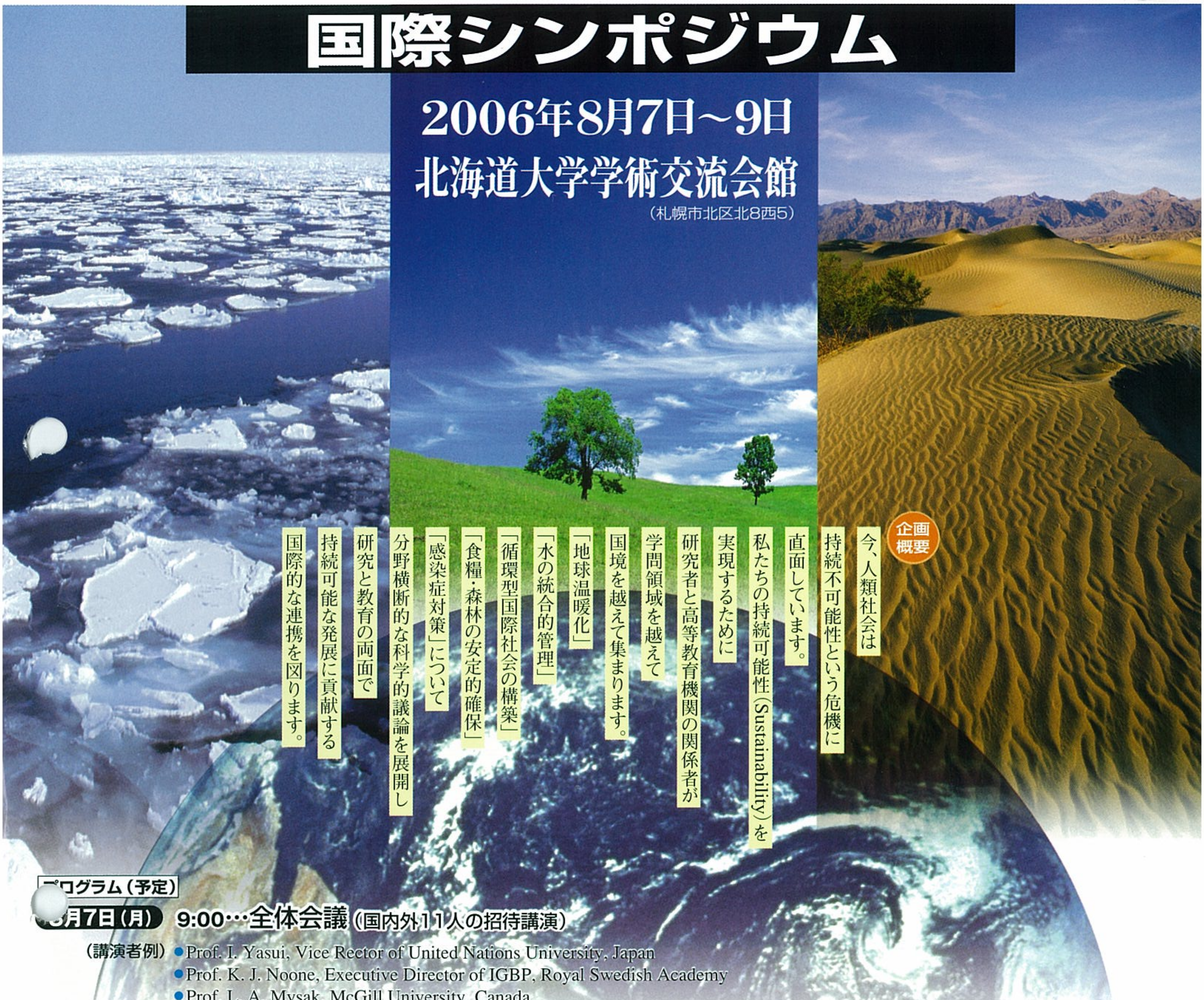
3. International Symposium on Sustainable Development

北 海 道 大 学

「持続可能な発展」国際シンポジウム

2006年8月7日～9日
北海道大学学術交流会館
（札幌市北区北8西5）



企画概要

今、人類社会は
持続不可能性という危機に
直面しています。
私たちの持続可能性（Sustainability）を
実現するために
研究者と高等教育機関の関係者が
学問領域を越えて
国境を越えて集まります。
「地球温暖化」
「水の統合的管理」
「循環型国際社会の構築」
「食糧・森林の安定的確保」
「感染症対策」について
分野横断的な科学的議論を展開し
研究と教育の両面で
持続可能な発展に貢献する
国際的な連携を図ります。

プログラム（予定）

8月7日（月）　9:00…全体会議（国内外11人の招待講演）

（講演者例）
- Prof. I. Yasui, Vice Rector of United Nations University, Japan
- Prof. K. J. Noone, Executive Director of IGBP, Royal Swedish Academy
- Prof. L. A. Mysak, McGill University, Canada
- Associate Prof. M. Schreurs, Maryland University, U.S.A.
- Prof. R.G. Webster, Director of WHO Collaborating Center for Studies on the Ecology of Influenza in Animals and Birds, U.S.A.
- Prof.T. Asano, University of California, Davis, U.S.A.
- Prof.N. El Bassam, President of the International Council of Sustainable Agriculture

8月8日（火）　9:00…分科会

分科会1: International Symposium- How to sustain Agrosphere, Biosphere and Geosphere in Asia
分科会2: Protection of Society from Infectious Threat
分科会3: Sustainable Metabolic Systems of Water & Waste for Area-based Society

8月9日（水）　9:00…全体会議とポスターセッション、まとめ

『持続可能性のための高等教育機関の役割』と『環境と開発に関する具体的な事例・警鐘と対策・提言』について講演、発表と議論

（講演者例）
- Dr. S. Shaeffer, Director UNESCO Bangkok
- Prof. P. Baklanov, Pacific Inst. Geography, Russia

【使用言語】英語　【参加料】無料　【申込方法】申込み用紙（下記HP上に掲載）に必要事項を記入し、下記のあて先までメールもしくはFAXで送って下さい。

主催：北海道大学「持続可能な発展」国際シンポジウム組織委員会

「持続可能な発展」国際シンポジウム実行委員会事務局（国際企画課内）
TEL 011-706-2916　FAX 011-706-2095
E-mail: kouryu@general.hokudai.ac.jp

8月9日の全体会議におけるポスターセッションの発表者を募集します

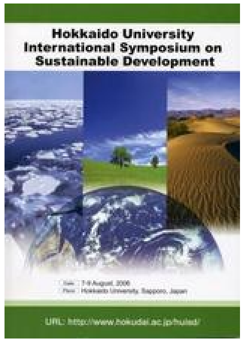
詳しくは漸次更新されるHPをご覧ください。 URL: http://www.hokudai.ac.jp/huisd/

Intrl' Sympo on SD (7-9 Aug. 2006)

Date Aug. 7-9, 2006 (Finished)

The Hokkaido University International Symposium on Sustainable Development was held on 7-9th August, 2006 in Sapporo, Hokkaidom, Japan.

It was the first multidisciplinary international meeting of its kind, bringing together educators of higher educational institutes and researchers to share their views of the sustainable development. About 950 educators and researchers from 19 countries and regions, representing fields as diverse as Earth Science, Ecology, Veterinary, Engineering, Political Science, Education and more, gathered for three days in Sapporo. All abstract and presentation data are available:



A major goal for the Symposium was to serve as a springboard for international collaboration toward the global sustainability among educators and researches beyond academic, national and regional boundaries. Many participants have told us about new insights and connections gained through the unique environment of the multidisciplinary meeting.

The Symposium finished with the proposals for creation of a network, named, "Hokudai Network for Global Sustainability". The Network is to accelerate education and research on Sustainable Development by sharing ideas and information through internet by increasing the visibility of the good practice and by enhance collaborative activities. The symposium also proposed the reunion, meeting at the next symposium held in 2009, with achievements of research and education.

The project team of Hokkaido University Initiative on Sustainable Development (HUISD) would take a central role of designing and operating the effective network activity. By doing so, Hokkaido University would accelerate further contributions to the global issue.

Picture Album: Hokkaido University International Symposium 2006

(Left side) Prof. K. Shetty speaches on "Sustainable Food Production:

Integration of Emerging Global Food, Health and Environmental Challenges"

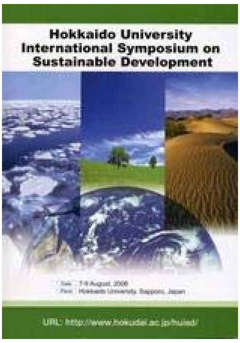
(Right side) Prof. K. J. Noone speaches "Creating an Applied Earth System Science:

Linking Global Environmental Change Science toSustainability Issues"

Hokkaido Uni. Int’l Symposium on SD in 2006

Date August 7-9, 2006 **(Finished)**

The Hokkaido University Symposium on Sustainable Development in 2006 had three different themes on each day. Its program with the theme led participants to have wide view and discuss for the future.
DAY1: Comprehensive View of Sustainable Development
DAY2: Sharing Recent Research Results
DAY3: Prospects for Means of Solution
Speech titles and speakers are as follows:



==

DAY One: 7 August, 2006

Plenary Sessions: Comprehensive View of Sustainable Development

——————————————————————————————

Opening

Keynote Speech
“Prospects of the 21st Century with Respect to Sustainability” by Itaru Yasui, United Nations University, Japan

Session 1. ” Sustainability of the Earth System”

Chaired by:
Motoyoshi Ikeda , Graduate School of Environmental Science Hokkaido University
1-1) “Creating an Applied Earth System Science: Linking Global Environmental Change Science to Sustainability Issues” by Kevin J. Noone, International Geosphere-Biosphere Programme (IGBP), The Royal Swedish Academy of Sciences, Sweden
1-2) “Glacial Inceptions: Past and Future” by Lawrence A. Mysak, Department of Atmospheric and Oceanic Sciences, McGill University, Canada
1-3) “Ecological Constrains on System Sustainability” by Takashi Kohyama, Faculty of Environmental Science, Hokkaido University
1-4) Summary by the Chairperson

Session 2. “Sustainable Society with Recycling System”

Chaired by:
Yoshimasa Watanabe, Graduate School of Engineering Hokkaido University
2-1) “Recovering Sustainable Water from Wastewater” by Takashi ASANO, Department of Civil and Environmental Engineering, University of California, Davis, U.S.A.
2-1) “Mottainai: A Comparative Study of the Politics of Innovation in Waste Management” by Miranda A. Schreurs, Department of Government and Politics, Maryland University, U.S.A.

2-3) “Sustainable and Cyclical Economy of Asia” by Fumikazu Yoshida, Graduate School of Public Policy, Hokkaido University
2-4) Summary by the Chairperson

Session 3. “Emerging Infections and Global Environment”

Chaired by:
Tsukasa Seya , Graduate School of Medicine Hokkaido University
3-1) “Ecology and Evolution of Influenza Viruses: Preparation for the Occurence of Highly Pathogenic Avian Influenza and the Possibility of a Human Pandemic of Influenza” by Robert G. WEBSTER, Division of Virology, Department of Infectious Diseases, St. Jude Children’s Research Hospital, U.S.A.
3-2) “Are We Prepared for Emerging Zoonoses?” by Hiroshi KIDA, Research Center for Zoonosis Control, Hokkaido University
3-4) Summary by the Chairperson

Session 4. “Sustainability Governance on Food and Bioresource”

Chaired by:
Yutaka Saito, Sustainability Governance Project(SGP), Hokkaido University
4-1) ” Understanding and Approach to ‘Sustainability’ Science of Fisheries”by Teisuke Miura, Graduate School of Fisheries Sciences, Hokkaido University
4-2) “Strategy towards Achievement of Sustainable Agriculture for Food, Energy and the Environment in the Age of the Globalization” by Nasir El Bassam, International Research Centre for Renewable Energy (IFEED), Germany
4-3) “The Sustainability of Bio-production Systems” by Mitsuru Osaki, Sustainability Governance Project (SGP), Hokkaido University
4-4) Summary by the Chairperson

===
DAY Two: 8 August, 2006
Parallel Sessions Theme: Sharing Recent Research Results
——————————————————————————————-

Session 1: International Symposium – How to sustain Agrosphere, Biosphere and Geosphere

Session 2: Protection of Society from Infectious Threat

Session 3: Sustainable Meatbolic System of Water and Waste for Area-Based Society

Group 1. Innovation of Membrane Technology for Water and Wastewater Treatment -IMTEC Sapporo
Group 2. Strategy for Sustainable Solid Waste Management

===
DAY Three: 9 August, 2006
Plenary Sessions: Prospects for Means of Solution

——————————————————————————————-

Session 1. Roles of Higher Education and International Collaboration for Sustainable Development

Chaired by:

* Takeshi Kishinami, Hokkaido University

* Midori Yamagishi

1-1) Keynote Speech: "Education for Sustainable Development: If Not the Solution, At Least a Start" by Sheldon Shaeffer, UNESCO Bangkok, Thailand

1-2) Panel Discussion

*Coodinator: Norihito Tambo, The University of the Air, Japan

* Panelist:

— John Cusick, Environmental Center, University of Hawai'i at Manoa, U.S.A.

— M. Harun-ur-Rashid, Bangladesh Agricultural Research Institute, Bangladesh

— Motoyoshi Ikeda, Graduate School of Environmental Science, Hokkaido University

— Stephen Lincoln, School of Chemistry and Physics, University of Adelaide, Australia

— Sheldon Shaeffer, UNESCO Bangkok, Thailand

Session 2. Poster Session

Session 3. Countermeasures for Sustainable Development

Chaired by:

*Oleg Shcheka , Department of International Programs and Projects Far Eastern Branch of the Russian Academy of Sciences, Russia

*Takayuki Shiraiwa , Research Institute for Humanity and Nature, Japan

3-1) Keynote Speech: "Interaction between the Amur River Watershed and the Sea of Okhotsk in a Model of a Sustainable Development" by Petr Y. BAKLANOV, Pacific Institute of Geography, Far Eastern Branch of the Russian Academy of Sciences, Russia

3-2) "Sustainable Food Production: Integration of Emerging Global Food, Health and Environmental Challenges" by Kalidas Shetty, Department of Food Science, University of Massachusetts, Amherst, U.S.A.

3-3) "The Land Use Change in Northeast of China Since 1980" by Bai Zhang, Northeast Institute of Geography and Agricultural Ecology, Chinese Academy of Sciences, China

3-4) "An Evaluation of Water Allocation Mechanisms: A Korean Case" by Dong-Geun Han, College of Economics and Finance, Yeungnam University, Korea

3-5) "Challenges and Strategies for the Planning of Sustainable Landscapes" by Jack Ahern, Department of Landscape Architecture and Regional Planning, University of Massachusetts, Amherst, U.S.A.

3-6) "Creating Effective International Regimes: New Approach of Political Science" by Toru Miyamoto, Graduate School of Public Policy, Hokkaido University, Japan

3-7) Summary by the Chairperson and the Co-Chairperson

Session 4. Summary of the Symposium

* Summary of Parallel Session 1

* Summary of Parallel Session 2

* Summary of Parallel Session 3

* Summary of the Symposium

Organization	Faculty of Environmental Earth Science, Graduate School of Engineering, Graduate School of Fisheries Sciences, Graduate School of Public Policy, HUISD (Hokkaido

Hokkaido University International Symposium on Sustainable Development

Date 7-9 August, 2006

Place Hokkaido University, Sapporo, Japan

URL: http://www.hokudai.ac.jp/huisd/

Hokkaido University International Symposium on Sustainable Development

Foreword

It is our great pleasure to host an International Symposium on Sustainable Development.

Human beings are currently facing a variety of crises, e.g. deterioration of the global environment, energy shortages, food shortages and global warming. All of these crises concern the survival of human beings and the sustainability of human society. The United Nations and a number of other international institutions have repeatedly presented various appeals concerning sustainability due to their anxieties about the issues.

In Japan, a myriad of actions have also been taken in response to these international demands. Also in academic circles, sustainability has been discussed in various fields, but a major trend has not yet been created.

Hokkaido University has abundant track record and accumulation of expertise to respond to international demands in extensive academic fields that constitute the foundation of sustainability. The typical academic fields are "global warming," "integrated water management," "establishment of a recycle-oriented international community," "stabilized securement of food and forest" and "measures against infectious diseases."

We are very much honored to have distinguished speakers and participants from around the world in an international symposium on "sustainable development" with the focus in these areas. We hope this symposium will promote international collaboration in both education and research by transcending academic, national and regional boundaries. And also we hope that the symposium will be one of the important steps towards the establishment of the sustainable society and that Sapporo will be a center of such activities.

Mutsuo Nakamura
President
Hokkaido University

Background of this Symposium

~The Internationalization Strategy on Sustainable Development at Hokkaido University~

Hokkaido University, aspiring to promote its activities in the fields of education, research and social contribution as an internationally characteristic university, is engaged in various activities.

Four major activities to promote internationalization are:

(1) Reinforcement of exchanges with universities worldwide

Hokkaido University has concluded the Exchange Agreements with 141 universities (as of 1 April, 2006), including the Departmental Exchange Agreements, thereby widening the scope of exchanges of faculty members and students. We have, at the same time, been actively holding university-wide bilateral symposiums with our partner universities, thereby strengthening the cooperative activities with the limited number of partners.

(2) Increase in the number of international students

Today over 800 foreign students have been studying on campus at Hokkaido University. We have formulated the "Strategic Plan for International Activities" and have been promoting exchanges with Northeast Asia, particularly China, South Korea and Taiwan, in order to increase the number of international students..

(3) Strengthening international public relations activities and overseas networks

We have newly published and widely distributed the Hokkaido University introductory pamphlet's in Chinese and Korean versions in addition to English. The quarterly-published English and Chinese Newsletter also introduce Hokkaido University's most recent activities in an easy-to-understand manner. We have established a liaison office in Beijing in April 2006 to provide more information and better services for Chinese researchers and students, as well as to support former international students in alumni associations' activities.

(4) Promotion of international cooperation

We concluded the Comprehensive Partnership Agreement with the Japan International Cooperation Agency (JICA) in April 2005, forging a stronger cooperative framework than ever. Furthermore, we have accepted trainees regarding the establishment of a waste disposal system in Inland China in collaboration with the Japan Bank for International Cooperation (JBIC).

In addition to the above mentioned activities, Hokkaido University has started new challenges in the field of Sustainable Development. The concept of sustainable development involves environmental perspectives, such as the responsible use and conservation of the earth's finite resources, as well as economic and social perspectives, such as continued life and prosperity of humanity. Thus, sustainable development contains three elements - environment, economy and society. Sustainable development has become a shared concept in the international community as evidenced by its reoccurrence at various United Nations conferences as well as throughout academia, such as the Science Council of Japan, which, for example, stated that a keyword running through all of its targeted missions is "sustainability, that is, the harmony between environment and economy" in the Principles of Strategic Science and Technology Policy, Japan, which were released in the spring of 2005.

The single phrase "internationalization of universities" actually involves extensive areas and diverse approaches. Our first target is internationalization in the area of sustainable development. We intend to implement strategies concerning research, education and social contribution, by focusing on enhancements of functions in the following four areas: (1) international research partnership; (2) international education partnership; (3) international cooperation, public relations and brand equity; and (4) comprehensive support (services) for international exchanges.

Hokkaido University Initiative for Sustainable Development, established in November 2005, has declared its objectives as follows:

- To make well known to the rest of the world the fact that Hokkaido University has practiced internationally competitive education and research;
- To make the university have a high affinity with the international community and abound in diversity;
- To make greater contributions to the international community through the spread of academic results and policy recommendations as well as the development of international cooperation activities

We at Hokkaido University have enough track record and accumulation of expertise to respond to international demands in extensive academic fields that constitute the foundation of sustainability. The representative academic fields are as follows:

- "Global warming"
- "Integrated water management"
- "Establishment of a recycle-oriented international community"
- "Stabilized supply of food and secured forest"
- "Measures against infections diseases"

I hope that plenty of fruitful discussion will be made during this international symposium, and your stay in Sapporo will be pleasant and memorable one.
Thank you.

Takeshi Kishinami
Vice President
Hokkaido University

Hokkaido University International Symposium on Sustainable Development - Program -

Sunday, August 6

Registration & Welcome Party

6:00pm - 7:30pm	*Registration at Hokkaido University Conference Hall*
	Welcome Party at Hokkaido University Centennial Hall

Day One: Monday, August 7

Plenary Sessions: Comprehensive View of Sustainable Development

at Hokkaido University Conference Hall - Auditorium A

8:00am -	*Registration*

Opening

8:30am - 9:00am	*Opening Address* **Mutsuo Nakamura**, Hokkaido University
	Congratulatory Speech by Guest of Honor **Daisuke Machida**, International Science and Technology Affairs Division, Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan
	Presentation: Background of This Symposium **Takeshi Kishinami**, Hokkaido Unviersity

Keynote Speech

9:00am - 9:45am	*Prospects of the 21st Century with Respect to Sustainability* **Itaru Yasui**, United Nations University, Japan ···P1-3
9:45am - 10:00am	*Break*

Session 1. Sustainability of the Earth System

Chairperson: **Motoyoshi Ikeda**, Faculty of Environmental Earth Science, Hokkaido University ···P4

10:00am - 10:40am	*Creating an Applied Earth System Science: Linking Global Environmental Change Science to Sustainability Issues* **Kevin J. Noone**, International Geosphere-Biosphere Programme (IGBP), The Royal Swedish Academy of Sciences, Sweden ···P5-6
10:40am - 11:20am	*Glacial Inceptions: Past and Future* **Lawrence A. Mysak**, Department of Atmospheric and Oceanic Sciences, McGill University, Canada ···P7-8
11:20am - 11:50am	*Ecological Constraints on System Sustainability* **Takashi Kohyama**, Faculty of Environmental Earth Science, Hokkaido University ···P9-10
11:50am - 1:00pm	*Lunch Break*

Session 2. Sustainable Society with Recycling System

Chairperson: **Yoshimasa Watanabe**, Graduate School of Engineering, Hokkaido University ···P12

1:00pm - 1:40pm	*Recovering Sustainable Water from Wastewater* **Takashi Asano**, Department of Civil and Environmental Engineering, University of California, Davis, U.S.A. ···P13-14
1:40pm - 2:20pm	*Mottainai: A Comparative Study of the Politics of Innovation in Waste Management* **Miranda Schreurs**, Department of Government and Politics, University of Maryland, U.S.A. ···P15-16
2:20pm - 2:50pm	*Sustainable and Cyclical Economy of Asia* **Fumikazu Yoshida**, Graduate School of Public Policy, Hokkaido University ···P17-18
2:50pm - 2:55pm	*Break*

Session 3. Emerging Infections and Global Environment

Chairperson: **Tsukasa Seya**, Graduate School of Medicine, Hokkaido University ···P20

2:55pm - 3:35pm	*Ecology and Evolution of Influenza Viruses: Preparation for the Occurrence of Highly Pathogenic Avian Influenza and the Possibility of a Human Pandemic of Influenza* **Robert G. Webster**, Department of Infectious Diseases, St. Jude Children's Research Hospital, U.S.A. ···P21-22
3:35pm - 4:05pm	*Are We Prepared for Emerging Zoonoses?* **Hiroshi Kida**, Research Center for Zoonosis Control, Hokkaido University···P23-24
4:05pm - 4:20pm	*Break*

Session 4. Sustainability Governance on Food and Bioresource

Chairperson: **Yutaka Saito**, Sustainability Governance Project (SGP), Hokkaido University ···P26

4:20pm - 4:50pm	*Understanding and Approach to "Sustainability" Science of Fisheries* **Teisuke Miura**, Graduate School of Fisheries Sciences, Hokkaido University ···P27-28
4:50pm - 5:30pm	*Strategy towards Achievement of Sustainable Agriculture for Food, Energy and the Environment in the Age of the Globalization* **Nasir El Bassam**, International Research Centre for Renewable Energy (IFEED), Germany ···P29-30
5:30pm - 6:00pm	*The Sustainability of the Bio-production Systems* **Mitsuru Osaki**, Sustainability Governance Project (SGP), Hokkaido University ···P31-32
6:00pm - 7:00pm	*Move to Hotel*

Reception hosted by Mutsuo Nakamura, President of Hokkaido University

7:00pm - 9:00pm	at Keio Plaza Hotel Sapporo: Kita 5 Nishi 7 Tel +81-(0)11-271-0111 Fax +81-(0)11-271-7943

Day Two: Tuesday, August 8

Parallel Session 1:
International Symposium - How to Sustain Agrosphere, Biosphere and Geosphere

at Hokkaido University Conference Hall - Auditorium A

8:00am -	*Registration*

Opening

8:30am - 9:00am	*Opening Remarks* **Yoshihito Osada**, Hokkaido University
	Mitsuru Osaki, Sustainability Governance Project (SGP), Hokkaido University
	Takashi Kohyama, Faculty of Environmental Earth Science, Hokkaido University

Morning Session:

Progressive Approach on the Sustainable Fisheries Management

9:00am - 9:20am	*Creating "Safe and Worry-Free" Salmon Products Using a HACCP System Form Fishing through Processing to Distribution* **Mamoru Yoshimizu**, Graduate School of Fisheries Science, Hokkaido Universtiy
9:20am - 9:40am	*Genetic Approach to Management and Sustainable Use of Marine Bio-Resources* **Syuichi Abe, Moongeum Yoon and Noriko Azuma**, Graduate School of Fisheries Science, Hokkaido University
9:40am - 10:00am	*The Shiretoko World Natural Heritage Including Marine and Land Ecosystems: Towards Coexistence with Marine Diversity and Fisheries* **Yasunori Sakurai and Masahide Kaeriyama**, Graduate School of Fisheries Science, Hokkaido University

Roles of the Coupled System of Biosphere and Geosphere

10:00am - 10:20am	*Development of an Integrated Ocean Model for Understanding Changes in Ecosystem in the Western North Pacific Associated with Global Warming* **Yasuhiro Yamanaka**, Graduate School of Environmental Science, Hokkaido University
10:20am - 11:00am	*Coffee Break and Poster Session*
11:00am - 11:20pm	*Material Transports from River to Ocean and Their Contribution to Marine Biological Productivity* **Takeshi Nakatsuka**, Institute of Low Temperature Science, Hokkaido Unviersity
11:20am - 11:40am	*Present and Future of Terrestrial Ecosystem Models: Modeling Atmosphere-Vegetation Interactions* **Toshihiko Hara**, Institute of Low Temperature Science, Hokkaido University
11:40am - 12:00pm	*21st Century Center of Excellence Program 'Prediction and Avoidance of an Abrupt Change in Bio-Geosphere System'* **Motoyoshi Ikeda**, Faculty of Environmental Earth Science, Hokkaido University
12:00pm - 1:00pm	*Lunch Break*

Afternoon Session

1:00pm - 1:20pm	*Sustainable Food, Water and Energy in Asia* **Kensuke Fukushi**, IR3S, University of Tokyo, Japan

3rd Biomicrocosmos Workshop: Sustainability and Security of Food Production

1:20pm - 1:35pm	*Importance of Rhizosphere Research for Sustainable and Safe Food Production* **Jun Wasaki**, Creative Research Initiative 'Sousei' (CRIS), Hokkaido University
1:35pm - 1:55pm	*Soil Quality Evaluation and Sustainable Agriculture Development in the Region of Southwest Yunnan, China* **Zhang Naiming**, Yunnan Agriculture University, China
1:55pm - 2:15pm	*Arsenic Contamination of Groundwater: Food Safety and Human Health Hazard in Bangladesh* **M. Harun-ur-Rashid**, Bangladesh Agricultural Research Institute, Bangladesh
2:15pm - 2:35pm	*Improvement of P Uptake from Acid Soil by Transgenic Plants with Modified Citrate Metabolism* **Hiroyuki Koyama**, Gifu University, Japan
2:35pm - 3:20pm	*Coffee Break and Poster Session*
3:20pm - 3:40pm	*Mycorrhizal Fungi in the Tropical Rain Forest of Indonesia and its Utilization for Reforestation* **Keitaro Tawaraya**, Yamagata University, Japan

Integrative Perspective on the Sustainable Earth

3:40pm - 4:00pm	*Latest Progress on Land System Studies in China* **He-Quing Huang**, Chinese Academy of Sciences, China
4:00pm - 4:20pm	*Prospects and Roles of Global Land Project* **Billie Turner**, Clerk University, U.S.A.
4:20pm - 4:30pm	*Break*
4:30pm - 5:30pm	*Concluding Discussion*
6:30pm - 8:00pm	*Welcoming Party at Restaurant ELM in the Faculty House ENREISO*

Day Two: Tuesday, August 8

Parallel Session 2:
Protection of Society from Infectious Threat

at Hokkaido University Conference Hall - Auditorium B

8:00am -	*Registration*

Morning Session

Opening

9:30am - 9:35am	*Welcoming Address* **Takashi Umemura**, Graduate School of Veterinary Medicine, Hokkaido University
9:35am - 9:40am	*Opening Remarks* **Hiroshi Kida**, Research Center for Zoonosis Control, Hokkaido University

Session 1

9:40am - 10:20am	*Ecology and Evolution of Influenza Viruses, Preparation for the Occurrence of Hightly Pathogenic Avian Influenza and the Possibility of a Human Pandemic of Influenza* **Robert G. Webster**, Department of Infectious Diseases, St. Jude Children's Research Hospital, U.S.A.
10:20am - 10:50am	*Computer Analysis for the Prediction of Structural Changes in Hemagglutinins of Future Antigenic Variants of Influenza Viruses* **Kimihiko Ito**, Research Center for Zoonosis Control, Hokkaido University
10:50am - 11:20am	*Coffee Break*

Session 2

11:20am - 12:00pm	*Deciphering Mechanisms of Prion Transmission Using Transgenic Mice* **Glenn C. Telling**, Department of Microbiology, Immunology and Molecular Genetics, University of Kentucky, U.S.A.
12:00pm - 12:30pm	*Tuberculosis: Research for Control Measures* **Yasuhiko Suzuki**, Research Center for Zoonosis Control, Hokkaido University
12:30pm - 2:00pm	*Lunch Break*

Afternoon Session

Session 3

2:00pm - 2:40pm	*Bats, Civets and Emergence of SARS* **Lin-Fa Wang**, CSIRO Livestock Industries, Australian Animal Health Laboratory, Australia
2:40pm - 3:20pm	*Japanese Encephalitis Molecular Epidemiology Implies Possible Rapid West Nil Virus Expansion: Development of West Nile Fever Vaccines* **Kouichi Morita**, Institute of Tropical Medicine, Nagasaki University, Japan
3:20pm - 3:50pm	*Epidemiology and Pathogenesis of Ebola Hemorrhagic Fever* **Ayato Takada**, Research Center for Zoonosis Control, Hokkaido University
3:50pm - 4:20pm	*Coffee Break*

Session 4

4:20pm - 5:00pm	*Control of Echinococcosis — the State of the Art* **Thomas Romig**, Dept. of Parasitology, University of Hohenheim, Germany
5:00pm - 5:30pm	*African Trypanosomiases* **Chihiro Sugimoto**, Research Center for Zoonosis Control, Hokkaido University
5:30pm - 5:35pm	*Closing Remarks* **Ikuo Takashima**, Graduate School of Veterinary Medicine, Hokkaido University

Day Two: Tuesday, August 8

Parallel Session 3:
Sustainable Metabolic System of Water and Waste for Area-Based Society

at Hotel Royton Sapporo

Group 1. Innovation of Membrane Technology for Water and Wastewater Treatment - IMTEC Sapporo -

8:30am -	*Registration*

Morning Session

Opening

9:00am -	*Opening Address and a Brief Report on the Current Status of Membrane Technology in Japan* Yoshimasa Watanabe, COE Program Leader, Hokkaido University
9:40am -	*Track for Wastewater* Moderator: Kazuo Yamamoto, Environmental Science Center, University of Tokyo, Japan
9:40am - 10:30pm	*Performance of Pre-denitrification Submerged Membrane Bioreactor (MBR) under Various Solid Retention Times* Speaker: Ong Say Leong, Center for Water Research, Division of Environmental Science & Engineering, National University of Singapore, Singapore *Effect of SRT on Membrane Fouling and Performance* Discusser: Hang-Sik Shin, Department of Civil and Environmental Engineering, KAIST, Korea
10:30am - 11:20am	*An Approach towards a Better Understanding of Fouling Phenomena in MBR* Speaker: Roger Ben Aim, Laboratory of Environmental Engineering (LIPE), INSA Toulouse, France *An Alternative Approach towards a Better Understanding of Fouling Phenomena in MBR* Discusser: Duu-Jong Lee, Department of Chemical Engineering, National Taiwan University, Taiwan
11:20am - 12:10pm	*Membrane Biofouling in the MBR Treating Domestic Wastewater: Identification of Key Players in Membrane Biofouling* Speaker: Satoshi Okabe, Graduate School of Engineering, Hokkaido University *Is Biofilm Formation The Key Player in MBR Biofouling?* Discusser: Guang-Hao Chen, Department of Civil Engineering, Hong Kong University of Science & Technology, China
12:10am - 1:30pm	*Lunch Break*

Afternoon Session

1:30pm -	*Track for Drinking Water I* Moderator: Shin-ichi Nakao, School of Engineering, University of Tokyo, Japan
1:30pm - 2:20pm	*Nanomaterials and Membranes for Water and Wastewater Treatment* Speaker: Mark R. Wiesner, Pratt School of Engineering, Duke University, U.S.A. *Nanosized Materials in Membrane Applications* Discusser: Yoshihiko Matsui, Graduate School of Engineering, Hokkaido University
2:20pm - 3:10pm	*Mechanism Involved in the Evolution of Irreversible Fouling in Microfiltration (MF) and Ultrafiltraion (UF) Membranes Used for Water Treatment* Speaker: Katsuiki Kimura, Graduate School of Engineering, Hokkaido University *Discussion of "Mechanism Involved in the Evolution of Irreversible Fouling in Microfiltration (MF) and Ultrafiltration (UF) Membranes Used for Water Treatment by Kimura et al. (2006)"* Discusser: Gary Amy, Institute for Water Education, UNESCO IHE, The Netherlands

3:10pm - 3:30pm	*Break*
3:30pm -	*Track for Drinking Water II* Moderator: **Yoshimasa Watanabe**, Graduate School of Engineering, Hokkaido University
3:30pm - 4:20pm	*Recovery of Spent Filter Backwash Water Using Coagulation-Assisted Membrane Filtration* Speaker: **Chihpin Huang**, Institute of Environmental Engineering, National Chiao Tung University, Taiwan *Discussion for "Recovery of Spent Backwash Water Using Coagulation-Assisted Membrane Filtration"* Discusser: **So-Ryong Chae**, Graduate School of Engineering, Hokkaido University
4:20pm - 5:10pm	*Low Pressure Membrane Filtration for Drinking Water Production in Germany : State of the Art and Future Developments* Speaker: **Stefan Panglisch**, Department of Water Technology, IWW Water Center, Germany *Comment on "Low Pressure Membrane Filtration for Drinking Water Production in Germany State of the Art and Future Developments"* Discusser: **Chung-Hak Lee**, School of Chemical and Biological Engineering, Seoul National University, Korea
5:10pm - 5:30pm	*Closing*
6:00pm -	*Party*

Day Two: Tuesday, August 8

Parallel Session 3:
Sustainable Metabolic System of Water and Waste for Area-Based Society

at Hotel Royton Sapporo

Group 2. Strategy for Sustainable Solid Waste Management

8:30am -	*Registration*

Opening

1:30pm -	*Opening* **Toshihiko Matsuto**, Graduate School of Engineering, Hokkaido University

Session

1:40pm - 2:40pm	*Waste Management, an Integrated Part of Sustainable Resource Management* **Paul H. Brunner**, Institute for Water Quality, Resource and Waste Management, Vienna University of Technology, Austria
2:40pm - 3:40pm	*Sustainable Land Disposal: Definitions and Possible Approaches* **Luis F. Diaz**, Calrecovery, Inc., U.S.A.
3:40pm - 4:00pm	*Coffee Break*
4:00pm - 5:00pm	*Integrated Strategy of Recycling in Korea* **Dong-Hoon Lee**, Department of Environmental Engineering, University of Seoul, Korea
5:00pm - 5:30pm	*Discussion*
5:30pm -	*Closing*

Day Three: Wednesday, August 9

Plenary Sessions: Prospects for Means of Solution

at Hokkaido University Conference Hall - Auditorium A

Session 1. Roles of Higher Education and International Collaboration for Sustainable Development

Chairperson: **Takeshi Kishinami**, Hokkaido University …P34

Keynote Speech

9:00am - 9:30am	*Education for Sustainable Development: If Not the Solution, At Least a Start* **Sheldon Shaeffer**, UNESCO Bangkok, Thailand …P35-36

Panel Discussion

Coordinator: **Norihito Tambo**, University of the Air, Japan …P37

9:30am - 11:30am	*Panelists:*
	John Cusick, Environmental Center, University of Hawai'i at Manoa, U.S.A. …P38
	Stephen Lincoln, School of Chemistry and Physics, University of Adelaide, Australia …P39
	M. Harun-ur-Rashid, Training & Communication Wing, Bangladesh Agricultural Research Institute (BARI), Bangladesh …P40
	Motoyoshi Ikeda, Faculty of Environmental Earth Science, Hokkaido University …P4
	Sheldon Shaeffer, UNESCO Bangkok, Thailand …P35

Session 2. Poster Session

Higher Education and Countermeasures for Sustainable Development

11:30am - 12:15pm	*Poster Session at Room 1*
12:15pm - 1:15pm	*Lunch Break*

Session 3. Countermeasures for Sustainable Development

Chairperson: **Oleg Shcheka**, Department of International Programs and Projects, Far Eastern Branch of the Russian Academy of Sciences, Russia …P41

Co-Chairperson: **Takayuki Shiraiwa**, Research Institute for Humanity and Nature, Japan …P42

Keynote Speech

1:15pm - 1:45pm	*Interaction between the Amur River Watershed and the Sea of Okhotsk in a Model of a Sustainable Development* **Petr Y. Baklanov**, Pacific Institute of Geography, Far Eastern Branch of the Russian Academy of Sciences, Russia …P43-44
1:45pm - 2:05pm	*Sustainable Food Production: Integration of Emerging Global Food, Health and Environmental Challenges* **Kalidas Shetty**, College of Natural Resources and the Environment, University of Massachusetts, Amherst, U.S.A. …P45-46
2:05pm - 2:25pm	*Land Use Change and Related Driving Factors in Northeast China from 1980 to 2000* **Bai Zhang**, Northeast Institute of Geography and Agricultural Ecology, Chinese Academy of Sciences, China …P47-48
2:25pm - 2:40pm	*Break*

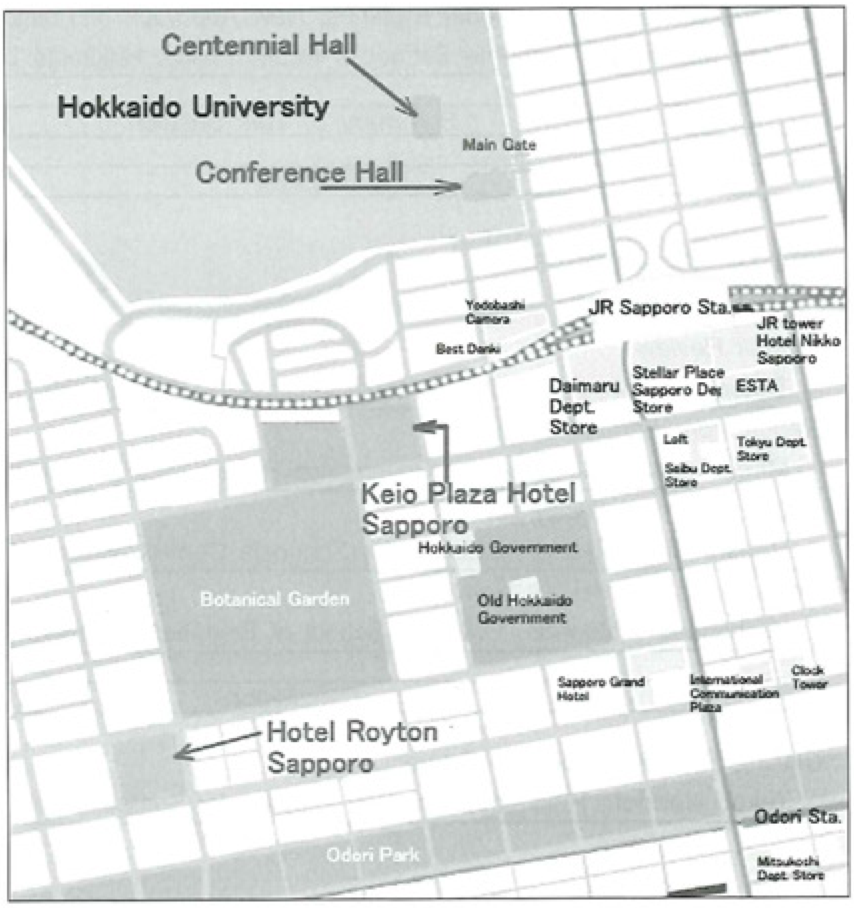
2:40pm - 3:00pm	*An Evaluation of Water Allocation Mechanisms: A Korean Case* **Dong-Geun Han**, College of Commerce and Economics, Yeungnam University, Korea …P49-50
3:00pm - 3:20pm	*Challenges and Strategies for the Planning of Sustainable Landscapes* **Jack Ahern**, Department of Landscape Architecture and Regional Planning, University of Massachusetts, Amherst, U.S.A. …P51-52
3:20pm - 3:40pm	*Creating Effective International Regimes: New Approach of Political Science* **Toru Miyamoto**, Graduate School of Public Policy, Hokkaido University …P53-54
3:40pm - 3:45pm	*Summary of This Session*
3:45pm - 4:00pm	*Break*

Session 4. Summary of the Symposium

Chairperson: **Takeo Hondoh**, Hokkaido University Initiative for Sustainable Development (HUISD) …P55

4:00pm - 4:05pm	*Overall Review* **Takeo Hondoh**, Hokkaido University Initiative for Sustainable Development (HUISD)
4:05pm - 4:15pm	*Report from Parallel Session 1* **Mitsuru Osaki**, Sustainability Governance Project (SGP), Hokkaido University …P31
4:15pm - 4:25pm	*Report from Parallel Session 2* **Hiroshi Kida**, Research Center for Zoonosis Control, Hokkaido University …P23
4:25pm - 4:35pm	*Report from Parallel Session 3* **Yoshimasa Watanabe**, Graduate School of Engineering, Hokkaido University …P12
4:35pm - 4:50pm	*Discussion*
4:50pm - 5:00pm	*Closing Remarks: For Our Future Direction* **Takeo Hondoh**, Hokkaido University Initiative for Sustainable Development (HUISD)

Map of Venue



Hokkaido University Conference Hall Secretariat Office

Kita 8 Nishi 5, Kitaku, Sapporo

TEL +81-(0)90-8637-0024 FAX +81-(0)11-706-2095 E-mail kouryu@general.hokudai.ac.jp

http://www.hokudai.ac.jp/huisd/en/index.html

Keio Plaza Hotel Sapporo

Kita 5 Nishi 7, Kitaku, Sapporo

TEL +81-(0)11-271-0111 FAX +81-(0)11-271-7943

http://www.keioplaza-sapporo.co.jp/

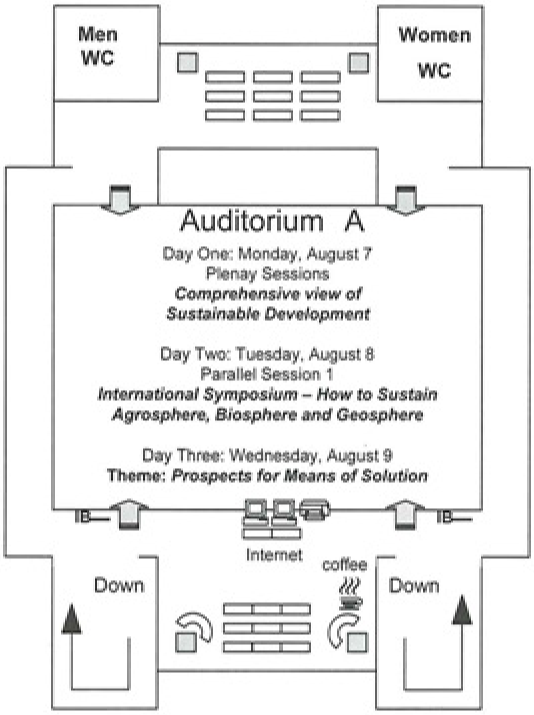
Hotel Royton Sapporo

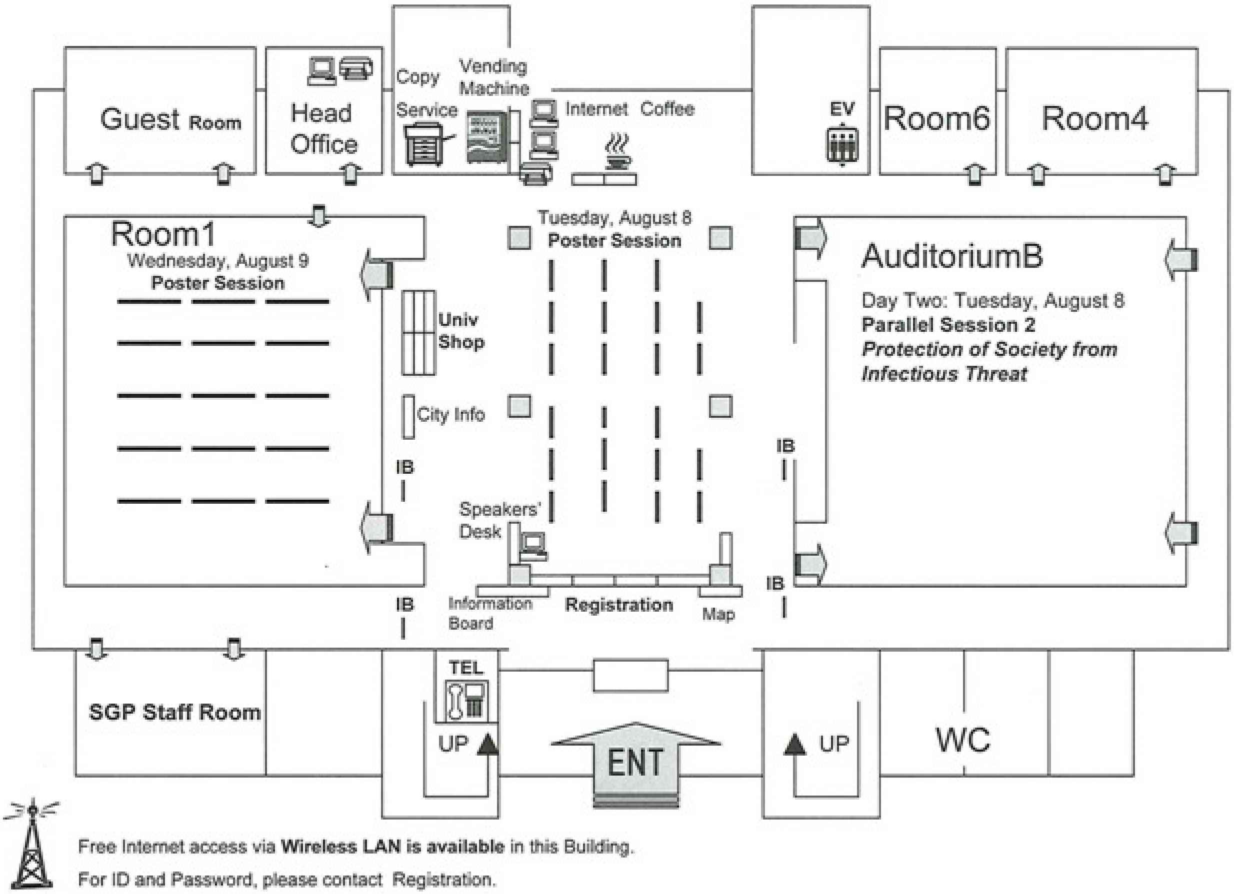
Kita 1 Nishi 11, Chuoku, Sapporo

TEL +81-(0)11-271-2711 FAX +81-(0)11-207-3344

http://www.daiwaresort.co.jp/royton/

Hokkaido University Conference Hall



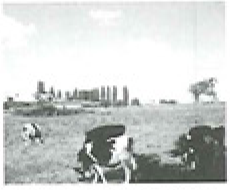


Free Internet access via **Wireless LAN is available** in this Building.
For ID and Password, please contact Registration.

SAPPORO CAMPUS MAP

Scenic Campus

51. Furukawa Hall

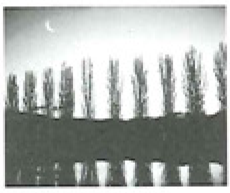


56. Experimental Farms

62. *Sakushukotoni* River

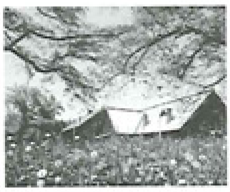
63. Bust of Dr. William S. Clark

64. Elm Grove

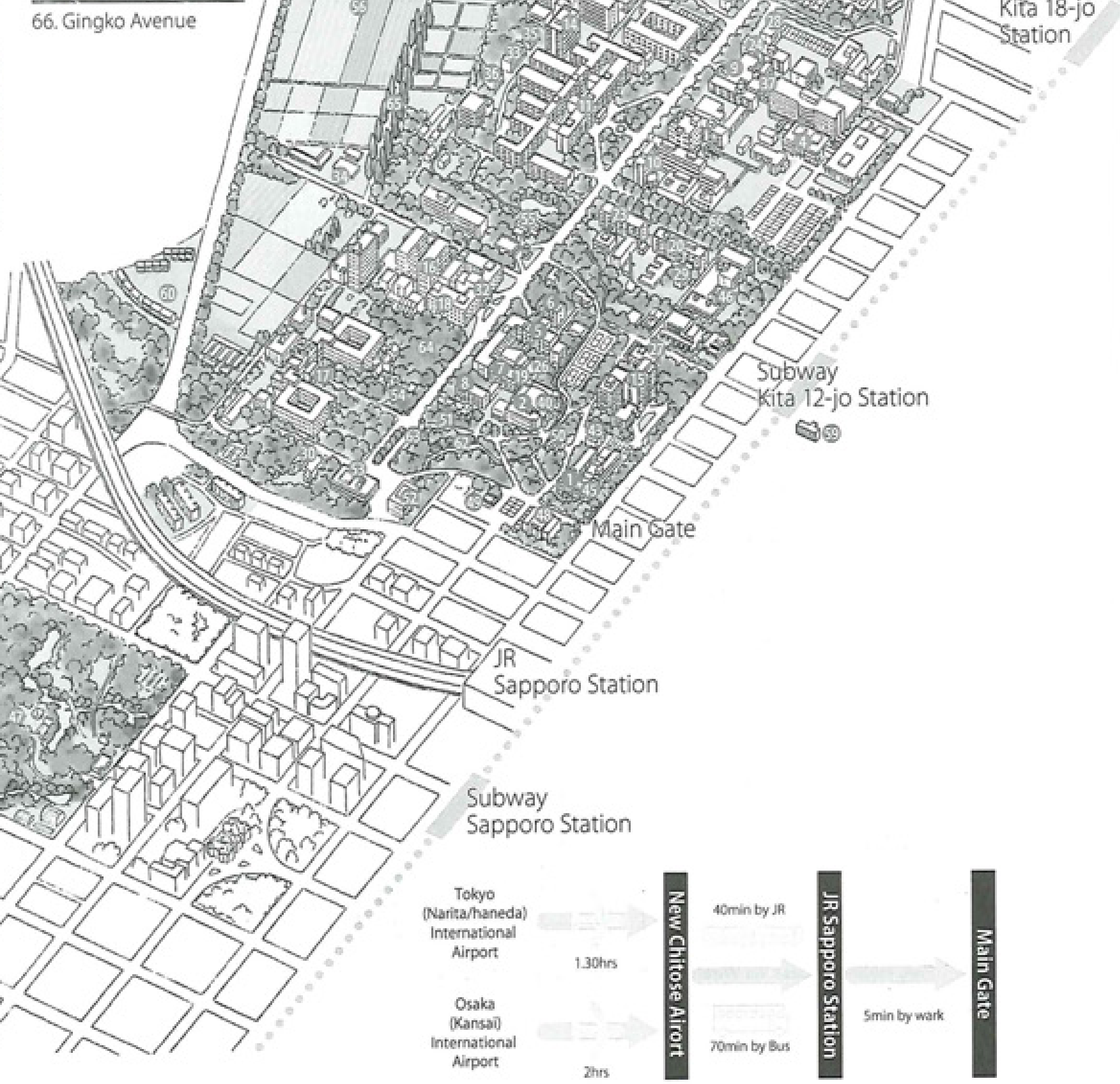


65. Poplar Avenue

66. Gingko Avenue



68. Model Barn



ADDRESSES

Sapporo Campus

	Graduate Schools, Faculties, etc.	Address	Zip	Tel	Fax
1	Administration Bureau	Kita 8, Nishi 5 Kita-ku, Sapporo	060-0808	+81-(0)11-716-2111	+81-(0)11-706-2095
2	Hokkaido University Library	Kita 8, Nishi 5 Kita-ku, Sapporo	060-0808		747-2855
3	North Library	Kita 17, Nishi 8 Kita-ku, Sapporo	060-0817		706-7851
4	University Hospital	Kita14, Nishi 5 Kita-ku, Sapporo	060-8648	+81-(0)11-716-1161	706-7627

Graduate Schools and Faculties

		Address	Zip	Tel	Fax
5	Graduate School / Faculty of Letters	Kita10, Nishi 7 Kita-ku, Sapporo	060-0810	+81-(0)11-716-2111	706-4803
6	Graduate School / School of Education	Kita11, Nishi 7 Kita-ku, Sapporo	060-0811		706-4951
7	Graduate School / School of Law	Kita 9, Nishi 7 Kita-ku, Sapporo	060-0809		706-4948
8	Graduate School / School of Economics and Business Administration	Kita 9, Nishi 7 Kita-ku, Sapporo	060-0809		706-4947
9	Graduate School / School of Medicine	Kita15, Nishi 7 Kita-ku, Sapporo	060-8638		717-5286
10	Graduate School / School of Dental Medicine	Kita13, Nishi 7 Kita-ku, Sapporo	060-8586		706-4919
11	Graduate School / Faculty of Engineering	Kita13, Nishi 8 Kita-ku, Sapporo	060-8628		706-7895
12	Graduate School / School of Veterinary Medicine	Kita18, Nishi 9 Kita-ku, Sapporo	060-0818		706-5190
13	Graduate School of International Media and Communication	Kita17, Nishi 8 Kita-ku, Sapporo	060-0817		706-7801
14	Graduate School of Information Science and Technology	Kita 14, Nishi 9 Kita-ku, Sapporo	060-0814		706-7890
15	Graduate School of Environmental Science / Faculty of Environmental Earth Science	Kita10, Nishi 5 Kita-ku, Sapporo	060-0810		706-4867
16	Graduate School / Faculty / School of Science	Kita10, Nishi 8 Kita-ku, Sapporo	060-0810		756-1244
17	Graduate School / Research Faculty/ Faculty of Agriculture	Kita 9, Nishi 9 Kita-ku, Sapporo	060-8589		716-0879
18	Graduate School of Life Science / Faculty of Advanced Life Science	Kita 10, Nishi 8 Kita-ku, Sapporo	060-0810		716-0879
19	Graduate School / Faculty of Public Policy	Kita 9, Nishi 7 Kita-ku, Sapporo	060-0809		706-4948
20	Faculty of Pharmaceutical Sciences / School of Pharmaceutical Sciences and Pharmacy	Kita12, Nishi 6 Kita-ku, Sapporo	060-0812		706-4989

Research Institutes and Research Centers

		Address	Zip	Tel	Fax
21	Institute of Language and Culture Studies	Kita17, Nishi 8 Kita-ku, Sapporo	060-0817	+81-(0)11-716-2111	706-7801
22	Institute of Low Temperature Science	Kita19, Nishi 8 Kita-ku, Sapporo	060-0819		706-7142
23	Research Institute for Electronic Science	Kita12, Nishi 6 Kita-ku, Sapporo	060-0812		706-4977
24	Institute for Genetic Medicine	Kita15, Nishi 7 Kita-ku, Sapporo	060-0815		706-7855
25	Catalysis Research Center	Kita21, Nishi10 Kita-ku, Sapporo	001-0021		706-9110
26	Slavic Research Center	Kita 9, Nishi 7 Kita-ku, Sapporo	060-0809		706-4952
27	Information Initiative Center	Kita11, Nishi 5 Kita-ku, Sapporo	060-0811		706-2936
28	Central Institute of Radioisotope Science	Kita 15, Nishi 7 Kita-ku, Sapporo	060-0815		706-7862
29	Center for Instrumental Analysis	Kita12, Nishi 6 Kita-ku, Sapporo	060-0812		706-4929
30	International Student Center	Kita 8, Nishi 8 Kita-ku, Sapporo	060-0808		706-4874
31	Center for Research and Development in Higher Education	Kita17, Nishi 8 Kita-ku, Sapporo	060-0817		737-5173
32	University Museum	Kita10, Nishi 8 Kita-ku, Sapporo	060-0810		706-2658
33	Research Center for Integrated Quantum Electronics	Kita13, Nishi 8 Kita-ku, Sapporo	060-8628		716-6004
34	Field Science Center for Northern Biosphere	Kita11, Nishi10 Kita-ku, Sapporo	060-0811		706-4930
35	Center for Advanced Research of Energy Conversion Materials	Kita13, Nishi 8 Kita-ku, Sapporo	060-8628		706-6655
36	Meme Media Laboratory	Kita 13, Nishi 8 Kita-ku, Sapporo	060-8628		706-7808
37	Research and Education Center for Brain Science	Kita 15, Nishi 7 Kita-ku, Sapporo	060-8638		706-7873
38	Creative Research Initiative "Sousei"	Kita 21, Nishi 10 Kita-ku, Sapporo	001-0021		706-9110
39	Research Center for Zoonosis Control	Kita18, Nishi 9 Kita-ku, Sapporo	060-0818		706-5190
40	Hokkaido University Archives	Kita 8, Nishi 5 Kita-ku, Sapporo	060-0808		706-4870
41	Admission Center	Kita 17, Nishi 8 Kita-ku, Sapporo	060-0817		706-7484
42	Center for Advaced Tourism Studies	Kita 17, Nishi 8 Kita-ku, Sapporo	060-0817		706-7801
43	Health Administration Center	Kita 8, Nishi 5 Kita-ku, Sapporo	060-0808		706-4872
44	Environmental Preservation Center	Kita 15, Nishi 9 Kita-ku, Sapporo	060-0815		706-7800
45	Management Center of Intellectual Property	Kita 8, Nishi 5 Kita-ku, Sapporo	060-0808		706-5310
46	College of Medical Technology	Kita12, Nishi 5 Kita-ku, Sapporo	060-0812		706-4916

		Address	Zip	Tel	Fax
47	Botanic Garden	Kita 3, Nishi 8, Chuo-ku, Sapporo	060-0003	+81-(0)11-221-0066	221-0664

Facilities

48 Conference Hall
49 Poplar Hall
50 Centennial Hall
51 Furukawa Hall*
52 Hokkaido University Co-op
53 Career Center
54 Visitor Center
55 Faculty House Trillium
56 Experimental Farms*
57 Gym
58 Keiteki-Ryo (Student Domitories)
59 Foreign Student's! House
60 Internationa Residence
61 Foreign Scholar's Accommodation

Touristic Attractions Spots

62 Sakushukotoni River*
63 Bust of Dr. William S. Clark*
64 Elm Grove*
65 Poplar Avenue*
66 Gingko Avenue*
67 Heisei Poplar Avenue
68 Model Barn*

Hakodate Campus

	Address	Zip	Tel	Fax
Graduate School / Faculty / School of Fisheries Sciences	3-1-1 Minato-cho, Hakodate	041-8611	+81-(0)138-40-5505	+81-(0)138-43-5015

Profiles and Abstracts

Keynote Speaker

Itaru Yasui

Vice Rector
United Nations University, Japan

> Monday August 7, 2006 / 9:00am-9:45am

ACADEMIC DEGREES:

B. A.	1968	The University of Tokyo (Faculty of Engineering)
Ph. D.	1973	The University of Tokyo (School of Engineering)

PROFESSIONAL APPOINTMENTS:

1973	Assistant, Faculty of Engineering, The University of Tokyo
1975	Lecturer, Institute of Industrial Science, The University of Tokyo
1975 - 1977	Postdoctoral Fellow, Rensselaer Polytechnic Institute, USA
1979	Associate Professor, Institute of Industrial Science, The University of Tokyo
1990	Professor, Institute of Industrial Science, The University of Tokyo
1996 - 1999	Director, Center for Collaborative Research, The University of Tokyo
1998 - 1999	Representative, National Conference for Centers for Industry - University Collaboration
2000	Head Investigator, Man - Earth Research Project of the Japan Ministry of Education, Culture, Sports and Technology
2003	Vice Rector, United Nations University
2003 - 2005	Affiliate Professor, The University of Tokyo
2007	Professor Emeritus, The University of Tokyo

RESEARCH INTERESTS:

Evaluation of Environmental Sustainability, Holistic Approach to Solve Sustainability Issues, Life Cycle Assessment, Advanced Science and Technology and Society

Prospects of the 21st Century with Respect to Sustainability

Itaru Yasui
Vice Rector
United Nations University
Jingumae, Shibuya, Tokyo 150-8925, Japan

The most important global issue for the 21st century is the sustainability of the human activities with relation to the limitation of the Earth. What is the sustainability? There are so many kinds of definitions of sustainability. Of course, the original one is the description found in the report of Brundtland committee in 1987, but currently there is no agreement on this issue.

United Nations determined eight millennium development goals in 2000, and these seem to be the UN's definition of sustainability up to the year of 2015, although it must be difficult to attain the goals by that time.

Eight millennium development goals are listed as follows;
1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development

Item 7 includes global warming, water supply, ecosystem conservation etc. The global warming is one of the most important issues for 21st century. If the prediction based on the simulation of global warming is correct and if two degree is really the limit to keep the global metabolism, we mankind have to discard the dependence on fossil fuel within twenty years.

In the plan of implementation for WSSD held in Johannesburg in 2002, changing unsustainable patterns of production and consumption was noted as the most important target to be attained by all advanced countries.

In order to discuss this kind of issue it is useful to utilize the concept of "Environmental Kuznets Curve". It seems true that improving processes start to work spontaneously after reaching the peak of pollutions, overexploitation of ecological resources, natural disasters and even the amount of final disposal of waste. But so far it is not clear the concept also fits to the case such as the reduction of carbon dioxide and/or energy consumption.

Technological innovations must be necessary to solve unsustainable way of lives in advanced countries, such as over-consumption of gasoline with big automobiles or electricity for air conditioners, but it seems not enough to solve the problem solely by means of technology. A habit of mind of people must be changed so as to reduce burdens on energy and other natural resources of the Earth.

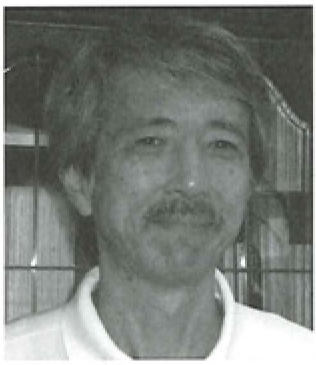
Population of the world is now believed to reach 9 billion in the year of 2050, but this value by United Nations seems to be overestimated. Population will reach the maximum at about 7.8 billion in the year of 2045, and will start to decrease since then.

It is quite likely that the 21st century is the first century for mankind to observe natural decrease in population not by pandemic disease. The only problematic region will be Africa. The millennium goals, especially items from 1 to 6, must be realized in Africa, because it is known in the other region that the birth rate goes down substantially after the improvement of such situations.

In addition, it is necessary to answer the question, "what is the development for human beings?" UNDP uses Human Development Index (HDI) as a metrics for the development. HDI includes longevity, education and income and these three are key factors to express the freedom to have options of human lives.

In some countries like Bhutan, the king proposed to use Gross National Happiness GNH as the metrics instead of GDP. This proposal must be considered seriously in most of advanced countries and countries in transition.

In this presentation, new concepts such as "Eco-Premium" for technologies and products, "The Third Revolution" for people's habit of mind and "A New Interpretation of CSR" in relation to realize true sustainability of the Earth.



Chairperson and Panelist

Motoyoshi Ikeda

Professor
Division of Environmental Science Development
Faculty of Environmental Earth Science
Hokkaido University

> 【Plenary Session 1】 Monday August 7, 2006 / 10:00am-11:50am
> 【Parallel Session 1】 Tuesday August 8, 2006 / 11:40am-12:00pm
> 【Panel Discussion】 Wednesday August 9, 2006 / 9:30am-11:30am

ACADEMIC DEGREES:

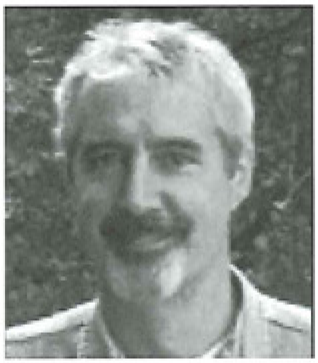
B.A. May 1969 Aeronautics, University of Tokyo
M.A. March 1971 Aeronautics, University of Tokyo
Ph.D. March 1974 Aeronautics, University of Tokyo

PROFESSIONAL APPOINTMENTS:

1979 - 1981	Research Associate, the U.S. National Research Council at NOAA/PMEL
1981 - 1983	Research Associate, the University of British Columbia
1983 - 1994	Research Scientist, Bedford Institute of Oceanography
1994 -	present Professor, Hokkaido University
1997 - 2002	Program Director for the IARC, Frontier Research System for Global Change
2002 -	present Dean, Graduate School of Environmental Science, Hokkaido University

RESEARCH INTERESTS:

(1) Modelling of current meanders and mesoscale eddies in the Gulf Stream, Kuroshio, California Current System, Labrador Current and Norwegian Coastal Current
(2) Modelling of oceanographic processes in the marginal ice zone and ice flow near the coast
(3) Sea ice simulation off the Labrador Coast and in the Sea of Okhotsk
(4) Data analysis of atmosphere, sea ice and ocean from the Arctic and Atlantic regions, showing decadal oscillations and global warming
(5) Analysis of SEASAT and GEOSAT altimeter data showing mesoscale variabilities off Labrador and in the Newfoundland Basin
(6) Modelling of paleoclimate in the Japan Sea
(7) Data assimilation for the Gulf Stream and Kuroshio
(8) Modelling of carbon dioxide flux in the northern North Pacific
(9) Coupling of natural system and societal system



Speaker

Kevin J. Noone

Professor
Executive Director
International Geosphere-Biosphere Programme (IGBP)
The Royal Swedish Academy of Sciences, Sweden

> 【Plenary Session 1】 Monday August 7, 2006 / 10:00am-10:40am

ACADEMIC DEGREES:

BSE.	1982	Washington University, Seattle, U.S.A. (Chemical Engineering)
MSE.	1985	Washington University, Seattle, U.S.A. (Civil and Environmental Engineering)
Ph.D.	1987	Washington University, Seattle, U.S.A. (Civil and Environmental Engineering)

PROFESSIONAL APPOINTMENTS:

1987 - 1991	Faculty at Stockholm University, Sweden
1992 - 1995	Research Scientist and Adjunct Professor of Oceanography, Center for Atmospheric Chemistry Studies, Graduate School of Oceanography, University of Rhode Island, U.S.A.
2000 - 2004	Professor of Meteorology and head of the Atmospheric Physics Division at the Department of Meteorology, Stockholm University, Sweden
2005	Moved to the Department of Applied Environmental Research at Stockholm University
2004 - 2005	Currently the Executive Director of the International Geosphere-Biosphere Program (IGBP), since the autumn of 2004

RESEARCH INTERESTS:

Early research work in Chemical Engineering focused on transparent semiconductors for use as solar cells in the generation of electricity. Primary research interests at present are in the area of atmospheric chemistry & physics, and the effects of aerosols and clouds on air quality and the Earth's climate. Advocate of an interdisciplinary approach to obtaining a solid scientific basis for decisions on environmental and climate issues. Author/coauthor of more than 110 scientific articles and book chapters, more than 70 of which are in refereed journals.

Creating an Applied Earth System Science:
Linking Global Environmental Change Science to Sustainability Issues

Kevin J. Noone

Executive Director

International Geosphere-Biosphere Programme (IGBP)

The Royal Swedish Academy of Sciences, Sweden

The UN Millennium Development Goals are an inspiring and formidable challenge for society: within the next decade we must aim to eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality and empower women; reduce child mortality; improve maternal health; combat deadly diseases; ensure environmental sustainability; and construct a global partnership for development. At the same time, society is faced with other challenges such as global climate change, air pollution, decreases in global biodiversity, food resources and how all of these issues tie into global security.

Some have argued that it is not feasible to address all of these issues at once, and that we should simply use a sort of cost-benefit analysis to choose one on which to concentrate. This view may be appealing, but it is fundamentally misguided. It would be a tragedy if, for instance, we were able to completely eradicate HIV/AIDS only to discover that by ignoring global environmental change issues, malaria had become even more widespread or fresh water resources even more scarce. We do not have the luxury of solving these problems one at a time; they need to be tackled together. Understanding how the natural Earth System works, and how we humans influence (and are influenced by) it is at the very heart of addressing these issues, and achieving the Millennium Development Goals.

We now know that human activities now match (and often exceed) the natural forces that regulate the Earth System. Recent ice core data show that current levels of carbon dioxide and methane are well outside the range of natural variability over the last 800,000 years. Roughly half of the world's ice-free land surface has been altered by human actions. Humans now fix more nitrogen than nature does. Particles emitted by human activities alter the energy balance of the planet, as well as have adverse effects on human health. These may seem to be unrelated issues; however, over the last decades, we have gained a deeper understanding of the degree to which all of these separate issues are linked. The Earth System is a very complex system with myriad feedbacks, and it has and presumably can still exhibit rapid, global-scale responses to changes in environmental conditions.

The global change research community faces an increasing challenge to present research results in more accessible and informative ways to stakeholders - particularly those concerned with sustainable development. We are frequently expected to answer questions on the effects of global change on regional- and even local scales: stakeholders seek strategies to deal with future environmental change.
The need to understand how the natural world works has not diminished, but in fact underpins the answers to questions of sustainable development. We still must concentrate on first class science involving the interactions and feedbacks between biological, chemical and physical processes and human systems. However, scientists, resource managers and policy makers require a common understanding in order for their interactions to be mutually beneficial.

In my presentation, I will attempt to give an overview of the current landscape of Earth *System* Science, give an example (or two) of planetary-scale feedback systems that may impact sustainable development strategies, discuss some the current structural challenges we have in addressing the interdisciplinary questions with which we are faced, and provide some ideas for creating an *Applied Earth System Science* linking global environmental change research to sustainable development.

Speaker

Lawrence A. Mysak

Professor
Department of Atmospheric and Oceanic Sciences
McGill University, Canada

> 【Plenary Session 1】 Monday August 7, 2006 / 10:40am-11:20am

ACADEMIC DEGREES:

B.Sc.	1961	University of Alberta, Canada (Applied Mathematics, Assoc Mus (performance in flute), both with first class honours)
M.Sc.	1963	University of Adelaide, S. Australia (Mathematics)
Ph.D.	1966	Harvard University, U.S.A. (Applied Mathematics)

PROFESSIONAL APPOINTMENTS:

1966 - 1967	Research Fellow in Geophysical Fluid Dynamics, Harvard University
1967 - 1970	Assistant Professor, Mathematics, University of British Columbia
1970 - 1976	Associate Professor, Mathematics and Oceanography, Uni. of British Columbia
1976 - 1986	Professor, Mathematics and Oceanography, University of British Columbia
1986 - 1996	AES/NSERC Industrial Chair Professor of Climate Research, McGill University
1986 - 1990	Director of Climate Research Group, Department of Meteorology (now Atmospheric and Oceanic Sciences), McGill University
1989 -	Pres.Canada Steamship Lines Professor of Meteorology, Dept. of Atmos. & Oceanic Sciences, McGill University
1990 - 1996	Founding Director of Centre for Climate and Global Change Research (C2GCR), McGill University
1993 - 1994	Sabbatic Leave (Montreal)
2000 - 2001	Sabbatic Leave (ETH, Zurich; INGV, Bologna)

RESEARCH INTERESTS:

Modelling and analysis of large and intermediate scale atmosphere-ice-ocean circulation and climate variability in the Arctic. Modelling century to millennial scale variability of the global ocean-ice-atmosphere-land climate system during the Quaternary period. Modelling geosphere-biosphere interactions and feedbacks using reduced complexity earth system models.

Glacial Inceptions: Past and Future

Lawrence A. Mysak
Professor
Department of Atmospheric and Oceanic Sciences
McGill University, Canada

Determining the causes and mechanisms of glacial inceptions during the past half million years has challenged scores of climate theoreticians and modellers. After introducing the basic Milankovitch theory of glaciation, I will review a number of earlier modelling studies on past glacial inceptions which have employed high-resolution GCMs or EMICs: Earth system Models of Intermediate Complexity. The latter class of climate models has been developed over the past two decades in order to investigate the many interactions and feedbacks among the geophysical and biospheric components of the Earth system over long time-scales.

Following an overview of various EMICs from Europe and North America, including the McGill Paleoclimate Model (MPM), I will present some recent simulations of the last glacial inception (LGI) in response to orbital (Milankovitch) and radiative (atmospheric CO2) forcing. Special attention will be given to determining the relative roles of the ocean thermohaline circulation, freshwater fluxes, orography, cryospheric processes and vegetation dynamics during the inception phase.

The lecture will conclude with a discussion on the (possible) occurrence of the next glacial period. To address this issue, which has been inspired by recent Berger-Loutre papers with titles like "An exceptionally long interglacial ahead?", I shall present EMIC simulations of the climate for the next 100 kyr which are forced by a various prescribed atmospheric CO2 levels, as well as insolation changes. The influence of a near-term global warming scenario on glacial inception will also be examined.

Finally, the recent simulations of glacial inceptions in the Potsdam (PIK) EMIC which includes an interactive carbon cycle will be described. It is not inconceivable that due to human activities, the current interglacial will last for at least another half million years.

Speaker

Takashi Kohyama

Professor
Section of Environmental Biology
Faculty of Environmental Earth Science
Hokkaido University

> 【Plenary Session 1】 Monday August 7, 2006 / 11:20am-11:50am
> 【Parallel Session 1】 Tuesday August 8, 2006 / 8:30am-9:00am

ACADEMIC DEGREES

B.A.	1978	Tokyo Metropolitan University (Biology)
M.A.	1980	Kyoto University (Botany)
Ph.D.	1983	Kyoto University (Botany)

PROFESSIONAL APPOINTMENTS

1983 - 1985	JSPS Post-Doctoral Fellow, Kyoto University
1985 - 1987	Lecturer, Faculty of Education, Kagoshima University
1987 - 1991	Associate Professor, Faculty of Education, Kagoshima University
1991 - 1994	Associate Professor, Center for Ecological Research, Kyoto University
1994 -	presentProfessor, Faculty of Environmental Earth Science, Hokkaido University
2000 -	presentSub-group leader, Ecosystem Change Research Program, Frontier Research Center for Global Change, JAMSTEC

RESEARCH INTERESTS

I have been interested in the complex architecture and tree species diversity of forest ecosystems. I have carried out research in temperate subalpine forests, warm-temperate rain forests and tropical rain forests in eastern Asia. Based on field census data, I developed simulation models and proposed 'the forest architecture hypothesis' (1993) to explain species coexistence by stratification. Undergoing change in forest ecosystems with global environmental change gives a unique opportunity to understand forest ecosystem properties. In 1997-2002, I organized a project of forest ecosystem monitoring and modeling named TEMA ('Global Change Impacts on Terrestrial Ecosystems in Monsoon Asia') as a core research of IGBP-GCTE.

Ecological Constraints on System Sustainability*

Takashi Kohyama
Professor
Section of Environmental Biology
Faculty of Environmental Earth Science, Hokkaido University

The anthropogenic biosphere is a complex adaptive system, constrained by a variety of processes, of which typical spatial-temporal scale is different from each other. In this lecture, I show the need of multi-scale analysis of system change, taking an example of forest ecosystems. I also propose that a similar approach is valid for socio-environmental systems.

We carried out a synthetic investigation of forest ecosystems in eastern Monsoon Asia. The target area is characterized by the continuous forested biomes from tropic to subarctic zones under prevailing humid climate. We made challenge to link physiological processes of foliage canopy to landscape-scale processes of tree-population demography and tree-community dynamics, and to integrate forest ecosystem processes into watershed-scale budget. So far, physiological screening and micrometeorological monitoring gave a fine-scale validation of land ecosystem processes. However, the prediction of the long-term response of forest systems to global change requires the coupling of ecosystem physiology and tree population demography. To interface the gap between them, we developed multi-scaled models and predicted such processes as the time delay in vegetation response to global change.

Ecosystem modeling uses such procedure to deal with biological units with naturally variable sizes such as biological individuals, species populations, etc. This situation is somewhat similar to social systems, where available statistic data is arranged with municipal/state/country basis with a variable size, and where, for instance, per capita demand of resources by human population is also largely variable. It is also obvious that the maintenance of human population is constrained by net primary productivity (NPP), as a measure of ecosystems. I show examples of relating NPP and vegetation/soil organic mass to the socio-economical statistics, at various scales, to elucidate emerging unit-scale-dependent components of socio-environmental systems, for the meaningful examination of the system sustainability.

* This paper has been prepared in collaboration with Akihiko Ito and Yoshiki Yamagata of National Institute for Environmental Studies, Tsukuba, Japan.

Chairperson and Speaker

Yoshimasa Watanabe

Professor
Division of Environmental Engineering
Graduate School of Engineering
Hokkaido University

> 【Plenary Session 2】 Monday August 7, 2006 / 1:00pm-2:50pm
> 【Parallel Session 3】 Tuesday August 8, 2006 / 9:00am-9:40am
> 3:00pm-5:10pm
> 【Plenary Session 4】 Wednesday August 9, 2006 / 4:25pm-4:35pm

ACADEMIC DEGREES:

B.A. 1967 Hokkaido University (Sanitary Engineering)
M.A. 1969 Hokkaido University (Sanitary Engineering)
Ph.D. 1972 Hokkaido University (Sanitary Engineering)

PROFESSIONAL APPOINTMENTS:

1972 Associate Professor, Miyazaki University, Japan
1975 Visiting Associate, California Institute of Technology, USA (- 1976)
1979 Associate Professor, Asian Institute of Technology, Thailand (- 1981)
1988 Professor, Miyazaki University
1993 Professor, Hokkaido University (- Present)

RESEARCH INTERESTS:

Development of water metabolic system of area-based society
Hybrid water and wastewater treatment technology using membrane
Phosphorous recovery from sludge

Speaker

Takashi Asano

Professor Emeritus
Department of Civil and Environmental Engineering
University of California, Davis
Davis, CA95616, U.S.A.

> 【Plenary Session 2】 Monday August 7, 2006 / 1:00pm-1:40pm

ACADEMIC DEGREES:

B.A.	1959	Hokkaido University (Agricultural Chemistry)
M.S.	1965	University of California, Berkeley (Civil and Environmental Engineering)
Ph.D.	1970	The University of Michigan, Ann Arbor (Environmental and Water Resources Engineering)

PROFESSIONAL APPOINTMENTS:

1971 - 1975	Assistant Professor, Department of Civil Engineering and Engineering Mechanics, Montana State University, Bozeman, MT.
1975 - 1978	Associate Professor, Department of Civil and Environmental Engineering, Washington State University, Pullman, WA.
1978 - 1992	Water Reclamation Specialist, State Water Resources Control Board, State of California, Sacramento, CA.
1981 - 2002	Adjunct Professor, Department of Civil and Environmental Engineering, University of California at Davis, Davis, CA.
1996	The Kubota Endowed Chair Visiting Professor of Environmental Engineering, Department of Urban Engineering, The University of Tokyo.
1997	The Nishihara Endowed Chair Visiting Professor of Environmental Engineering, International Center for Water Environment Engineering, Hokkaido University.
2002 -	Professor Emeritus, Department of Civil and Environmental Engineering, University of California at Davis, Davis, CA.

RESEARCH INTERESTS:

Planning and regulatory aspects of water resources development and water reuse, Microbial risk analysis in water reuse, Environmental and water resources engineering, Water reclamation and reuse, Indirect potable reuse, Advanced water and wastewater treatment, and Groundwater recharge.

Recovering Sustainable Water from Wastewater

Takashi Asano
Professor Emeritus
Department of Civil and Environmental Engineering
University of California, Davis
Davis, CA 95616, U.S.A.

The sustainability of water resources is of particular importance in light of projected increases in global population. It has been reported that the current world population of 6.2 billion is increasing at a rate of about 1.2 percent per year (United Nations, 2003) with the highest rates of population growth occurring in urban areas in mostly developing countries where supplies of freshwater tend to be limited or already exploited. Increasing urbanization has resulted in an uneven distribution of population and water, thus imposing unprecedented pressures on limited water supplies. These pressures are exacerbated during periods of drought.

For water supplies to be sustainable, the rate at which water is withdrawn from water sources needs to be in balance with the rate of renewal or replenishment of these water sources. In addition to a balance of water quantity, water quality must also be sustainable, recoverable or reusable. Water that is withdrawn for societal needs is also a source of water replenishment that should be considered in the sustainability equation.

Historically, after water has been used for societal needs, it has been labeled as "waste"water and treated to the extent deemed necessary for discharge into a receiving water or for land disposal. During most of the 20th century, the emphasis of wastewater treatment was on pollution abatement, protection of public health, and prevention of environmental degradation through removal of biodegradable material, nutrients, and pathogens. However, over the last few decades, the potential for recovering water from wastewater has been recognized. In fact, in many parts of the world, it is no longer practical or possible for water to be used only once. Thus, water reclamation, recycling and reuse are one element of water resources development and management that provides a viable option for traditional water supply. Water reclamation, recycling and reuse are multi-disciplined and require close examinations of infrastructure and facilities planning, wastewater treatment plant siting, treatment process reliability, energy considerations, public health, economic and financial analyses, and water utility management involving effective integration of water and reclaimed water functions.
In this presentation, the foundation of water reclamation, recycling and reuse will be discussed and the salient features of implementing water reuse projects including Orange County's Groundwater Replenishment System in California are summarized with considerations for future research needs.

REFERENCE
United Nations (UN Population Division) (2003) *World Population Prospects: The 2002 Revision - Highlights*, United Nations Population Division, Department of Economic and Social Affairs.
Accessed at: http://www.un.org/esa/population/unpop.htm

Speaker

Miranda Schreurs

Associate Professor
Department of Government and Politics
University of Maryland, U.S.A.

> 【Plenary Session 2】 Monday August 7, 2006 / 1:40pm-2:20pm

ACADEMIC DEGREES:

B. A.	1986	University of Washington
M. A.	1987	University of Washington
Ph. D.	1996	University of Michigan-Ann Arbor

PROFESSIONAL APPOINTMENTS:

Teaching courses on Japanese Politics, East Asian Politics, German Politics, European Politics, Comparative Environmental Politics and Law, and Research Methodology

RESEARCH INTERESTS:

Comparative and International Environmental Politics in Japan, China, East Asia, Germany, Europe, and the United States

Her books include *Environmental Policy in Japan* (co-edited with Hidefumi Imura, Edward Elgar, 2005), *The Environmental Dimensions of Asian Security: Cooperation and Conflict over Pollution, Energy, and Resources* (co-edited with In-taek Hyun, United States Institute of Peace Press, forthcoming), *Environmental Politics in Japan, Germany, and the United States* (Cambridge University Press, 2002), *The Internationalization of Environmental Protection* (co-edited with Elizabeth Economy, Cambridge University Press, 1997), and *Ecological Security in Northeast Asia* (co-edited with Dennis Pirages, Yonsei University Press, 1998).

Mottainai: A Comparative Study of the Politics of Innovation in Waste Management

Miranda Schreurs

Associate Professor
Department of Government and Politics
University of Maryland, U.S.A.

Consumer societies are being faced by increasingly difficult and pressing problems related to waste management. Household waste contains an increasingly large share of electronic products — computers, televisions, DVDs — that have added new challenges for municipalities that already have great difficulties in disposing of waste.

This paper examines innovative measures that are being developed to reduce waste at its source in the European Union, Japan, and the United States and considers how policy ideas are diffusing across borders.

Speaker

Fumikazu Yoshida

Professor
Graduate School of Public Policy
Hokkaido University

> 【Plenary Session 2】 Monday August 7, 2006 / 2:20pm-2:50pm

ACADEMIC DEGREES:

B. A.	1973	Tokyo Metropolitan University (Economics)
M. A.	1975	Kyoto University (Economics)
Ph. D.	1985	Kyoto University (Economics)

PROFESSIONAL APPOINTMENTS:

1978 - 1980	Lecturer, Faculty of Economics, Hokkaido University
1980 - 1992	Associate Professor, Graduate School of Economics, Hokkaido University
1992 -	Professor, Graduate School of Economics, Hokkaido University

RESEARCH INTERESTS:

Environmental Economics
Waste Management
Cyclical Economy

Sustainable and Cyclical Economy of Asia

Fumikazu Yoshida
Professor
Graduate School of Public Policy
Hokkaido University

Cross-Border Resource Cycling

Because of economic globalization, the material cycle has totally transcended national borders. In particular, imports and exports of scrap metal, post-consumer waste paper, waste plastic, and other reclaimed materials are booming due to heavy demand stemming from falling demand in Japan and to Asian economic growth.

Building a Cyclical Society Including All of East Asia

East Asia already has a large product and material cycle, making it impossible to create a cyclical society conceived for Japan alone. Therefore I would like to discuss the challenges for each actor in building a cyclical society system in East Asia, while taking into consideration the proposals mentioned thus far.

First, it is essential to assemble statistical data on the used consumer appliances/electronics and automobiles that are exported. This is impossible to determine from current Ministry of Finance customs statistics. We must also find out how resources are being recycled in importing countries. In view of the need for this information, the government must start by assembling statistics.

Second, information exchange and discussions on wide-area recycling should be carried out on the government level. Haste is needed especially on issues related to the Basel Convention. The EU practices wide-area waste management on the grounds that within the EU this does not constitute transboundary movement under the convention.

Third, in relation to manufacturers, the government should consider the application of EPR to used products and those produced overseas. Unless this is done, exporters cannot escape criticism that they are trying to avoid domestic environmental regulations.

And fourth, recyclers should run recycling businesses - not only in Japan, but in other Asian countries as well - that use their technology and expertise to advantage. Of course environmental friendliness and transparency will be crucial, and they should start with pilot projects.

Chairperson

Tsukasa Seya

Professor
Department of Microbiology and Immunology
Graduate School of Medicine
Hokkaido University

> 【Plenary Session 3】 Monday August 7, 2006 / 2:55pm-4:05pm

ACADEMIC DEGREES:

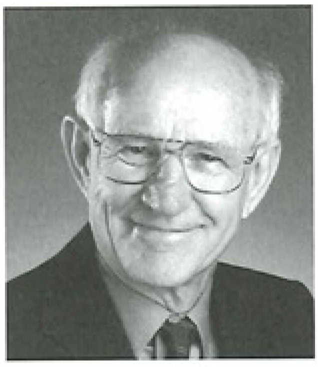
1984 Ph.D. degree (Hokkaido University)
1987 M.D. degree (Hokkaido University)

PROFESSIONAL APPOINTMENTS:

1987 - 1996	Associate Director, Department of Immunology, Center for Adult Diseases, Osaka. (Immunology)
1988 - 1992	Lecturer, Osaka University
1994 - 1997	Investigator, 'Inheritance and Variation' (Director, Dr. K. Toyoshima), PRESTO, JST (ex. JRDC)
1996 - 1998	Deputy Director, Department of Immunology, Osaka Medical Center for Cancer and Cardiovascular Diseases (ex. Center for Adult Diseases, Osaka)
1996 - 2001	Investigator, 'Swine to Human Xenotransplantation' (Director, Dr. R. Shirakura), PROBRAIN
1997 - 2002	Investigator, 'Cancer Immunotherapy' (Director, Dr. T. Masaoka), OPSR
1998 - 2004	Professor (concurrently), Nara Institute of Science and Technology
1998 - 2001	Director, Department of Immunology, Osaka Medical Center for Cancer and Cardiovascular Diseases
2001 - 2004	Director-in-Chief/Chairman, Research Institute of Osaka Medical Center for Cancer 2002- 2007 Team leader of CREST (Human diseases in association with innate immunity).
2002 - 2004	Professor (concurrently), Osaka University School of Medicine
2003 -	Subleader in the "Protein Factory project" in Koseisho
2003 - 2004	Core member, COE Osaka University (Dr. N. Taniguchi)
2004 -	Professor, Hokkaido University Graduate School of Medicine (Department of Microbiology and Immunology)
2005 - 2006	Professor, Institute for Virus Research, Kyoto University (Concurrently)
2005 -	Lecturer, University of Tokyo, Graduate School of Medicine (Concurrently)

RESEARCH INTERESTS:

Complement proteins and receptors
Innate immunity
Measles virus receptors
Anti-tumor immunotherapy
Xenotransplantation
Toll-like receptors
Cell adhesion molecules
Structure-function relationship of proteins
Abnormality of proteins and disease expression



Speaker

Robert G. Webster

Professor
Division of Virology, Department of Infectious Diseases
St. Jude Children's Research Hospital, U.S.A.

> 【Plenary Session 3】 Monday August 7, 2006 / 2:55pm-3:35pm
> 【Parallel Session 2】 Tuesday August 8, 2006 / 9:40am-10:20am

ACADEMIC DEGREES:

B.Sc. 1955 Otago University, New Zealand (Microbiology)
M.Sc. 1957 Otago University, New Zealand (Microbiology)
Ph.D. 1962 Australian National University, Australia (Microbiology)

PROFESSIONAL APPOINTMENTS:

1975 - Director, World Health Organization Collaborating Center for Studies on the Ecology of Influenza in Animals and Birds

1988 Rose Marie Thomas Chair, Division of Virology, Department of Infectious Diseases, St. Jude Children's Research Hospital

RESEARCH INTERESTS:

His interests include the emergence and control of influenza viruses, viral immunology, the structure and function of influenza virus proteins and the development of new vaccines and antivirals. The major focus of his research is the importance of influenza viruses in wild aquatic birds as a major reservoir of influenza viruses and their role in the evolution of new pandemic strains for humans and lower animals. His *curriculum vitae* contains over 500 original articles and reviews on influenza viruses. He has trained many scientists who now contribute to our understanding of the evolution and pathogenesis of influenza.

Memberships: American Society for Microbiology
American Society for Virology
Royal Society of Medicine
American Association for the Advancement of Science

Honors: Fellow of the Royal Society, London, 1989
Fellow of the Royal Society of New Zealand, 1990
National Academy of Sciences of the United States of America, 1998
Twelfth Annual Bristol-Myers Squibb Award for Distinguished Achievement in Infectious Diseases, 2002; New Zealand Biotech Distinguished Biotechnologist Award, 2006

Ecology and Evolution of Influenza Viruses: Preparation for the Occurrence of Highly Pathogenic Avian Influenza and the Possibility of a Human Pandemic of Influenza

Robert G. Webster
Professor
Division of Virology, Department of Infectious Diseases,
St. Jude Children's Research Hospital, Memphis, TN 38105 U.S.A.

Pandemic influenza is a zoonotic disease caused by the transfer of influenza A viruses or virus gene segments from aquatic bird reservoirs to humans and domestic animals. In wild aquatic birds - the natural hosts of all influenza viruses - these viruses exist in harmony with their natural host. After transfer to other species influenza viruses evolve rapidly.

In the past century there have been three pandemics in humans: 1918 Spanish, 1957 Asian, 1968 Hong Kong. These have emerged after reassortment between human influenza viruses and those in the aquatic birds of the world or directly from avian sources probably via intermediate hosts. The pandemics of the past century have been confined to the H1, H2 and H3 subtypes but there is no convincing evidence to exclude the others. The spread of H5N1 influenza viruses from Eastern Asia to Europe, Africa and India increases the geographical range and pandemic potential of this virus. Ducks are playing an important role in the continued evolution and spread of the H5N1 viruses including prolonged shedding and selection of antigenic variants. The H5N1 viruses from 2004-2006 are highly pathogenic in poultry, ferrets, felids and humans. The role of migrating birds in the spread of H5N1 and exchange of viruses between domestic and wild birds in Asia is of great concern. H5N1 viruses continue to break the ecological rules established for other highly pathogenic avian influenza viruses. What are the prospects for the H5N1/06 virus to become consistently transmitted from human to human and cause a global catastrophe? Options for control include increase biosecurity and the use of reverse genetics to produce standardized vaccines for human and veterinary use. The immediate control of the spread of H5N1 is through the use of the antiviral neuraminidase inhibitors. Continuing stockpiling of anti-neuraminidase drugs is prudent.

Speaker

Hiroshi Kida

Director, Research Center for Zoonosis Control
Professor, Graduate School of Veterinary Medicine
Hokkaido University

> 【Plenary Session 3】 Monday August 7, 2006 / 3:35pm-4:05pm
> 【Parallel Session 2】 Tuesday August 8, 2006 / 9:35am-9:40am
> 【Plenary Session 4】 Wednesday August 9, 2006 / 4:15pm-4:25pm

ACADEMIC DEGREES:

B.V.M.	1967	Hokkaido University (Veterinary Medicine)
D.V.M.	1967	The Ministry of Agriculture, Forestry and Fisheries
Ph.D.	1977	Hokkaido University (Veterinary Medicine)

PROFESSIONAL APPOINTMENTS:

1969 - 76	Research Officer for Vaccine Development, Takeda Chem Indst, Ltd
1976 - 78	Lecturer, Dept Veterinary Hyg & Microbiol., Hokkaido University
1978 - 94	Associate Professor, Dept Vet Hyg & Microbiol, Hokkaido Univ
1980 - 81	Visiting Scientist, Dept Virol, St. Jude Children's Research Hospital/WHO Collab Center for Ecology of Influenza Viruses, Memphis, Tennessee
1986 - 87	Visiting Professor, Dept Virol Mol Biol, St. Jude CRH/WHO CCEI
1989	Professor, University of Zambia School of Vet Med, Lusaka, Zambia
1994 - 95	Professor, Dept Vet Hyg and Microbiology, Hokkaido Univ
1995 - date	Professor, Dept Disease Control, Hokkaido Univ Grad Sch Vet Med
1995 - 05	Hokkaido University Senator
2001 - 05	Dean, Hokkaido Univ Sch and Grad Sch Vet Med
2004 - date	Head, OIE Reference Laboratory for Highly Pathogenic Avian Influenza
2005 - date	Director, Research Center for Zoonosis Control

RESEARCH INTERESTS:

Ecology and pathogenesis of influenza viruses, Zoonoses, Vaccinology

Are We Prepared for Emerging Zoonoses?

Hiroshi Kida
Director, Research Center for Zoonosis Control
Professor, Graduate School of Veterinary Medicine
Hokkaido University

Recent outbreaks of highly pathogenic avian influenza have spread worldwide. This H5N1 virus has jumped the species barrier and caused severe disease with high mortality in humans. A concern is that only the H5N1 virus is assumed to cause next pandemic in humans. Since each of the subtypes of influenza viruses perpetuates among migratory ducks and their nesting lake water in nature and avian viruses of any subtype can contribute genes in the generation of reassortants in pig, none of the 15 HA and 9 NA subtypes can be ruled out as potential candidates for future pandemic strains.

We have carried out global surveillance study of avian influenza and influenza virus isolates of 49 combinations of HA and NA subtypes have been isolated from fecal samples of ducks. So far, 76 other combinations have been generated by the genetic reassortment procedure in chicken embryos. Thus, avian influenza viruses of 125 combinations of HA and NA subtypes have been stocked for vaccine strain candidates and diagnostic use. Their pathogenicity, antigenicity, genetic information and yield in chicken embryo have been analyzed and registered in the database.

On the basis of the strategy for the control of influenza, Hokkaido University has established "Research Center for Zoonosis Control" in 2005. The long term goals of the center are the prevention and control of emerging zoonoses. To achieve the goals, the aims of the present program are; 1) to elucidate the ecology of zoonotic pathogens, 2) to detect the reservoir host and the route of transmission of each pathogen, 3) define the gene sequences that permit interspecies transmission of agents among animals including humans, 4) to clarify the molecular basis of pathogenisity of each agent for each of animal species, 5) to develop rapid methods for diagnosis of zoonoses and detection of the agents, 6) to establish international networks for global surveillance of zoonoses, 7) to scheme contingency plans for the prevention and control of zoonoses, 8) to provide training courses for personnel who conduct control management at the sites of disease outbreaks, 9) to exchange personnel between different laboratories in the world in order to develop new strategies for the control of zoonoses, and 10) to establish "International Collaboration Centers for Zoonosis Control" by 2008.

Chairperson

Yutaka Saito

Professor
Division of Environment and Resources,
Graduate School of of Agriculture, Hokkaido University
Deputy Director
Sustainability Governance Project (SGP), Hokkaido University
Hon. Prof. Fujian Academy of Agricultural Sciences

> 【Plenary Session 4】 Monday August 7, 2006 / 4:20pm-6:00pm

ACADEMIC DEGREES:

B.A.	1972	Hokkaido University (Agricultural Biology)
M.A.	1974	Hokkaido University (Agricultural Biology)
Ph.D.	1978	Hokkaido University (Agricultural Biology)

PROFESSIONAL APPOINTMENTS:

1981 - 1993	Assistant Professor, Faculty of Agriculture, Hokkaido University
1993 - 1996	Associate Professor, Faculty of Agriculture, Hokkaido University
1996 -	Professor, Graduate School of Agriculture, Hokkaido University

RESEARCH INTERESTS:

Biological pest management is still woefully insufficient in Japan, despite priority-level recommendations from more and more governments around the world. Implementation costs and the old-fashioned production systems used by small-scale farmers are the main reasons why such safe technology is proving difficult to introduce into Japanese agriculture. As such, I will try to idealize how to transform the status quo into systems that utilize safe biological pest management, natural fertilizers and the like, to achieve rational biomass production, and in turn develop new, sustainable agricultural systems applicable to Japan as well as to the rest of Asia. For such purposes, I have studied on utilizing fundamental ecology to develop new methods of controlling plant pests biologically, on permanent biological control systems in the Moso bamboo plantations of Fujian, China, and development of a simulation model of natural enemy-pest systems in agricultural fields.

I have also conducted basic researches on the behavioral ecology and sociobiology: By now, my major contributions are as follows: Discovery of mutual sociality in spider mites; Discovery of the importance of kin-selection in variation of male-to-male aggression;Development of an integrated game model explaining the conditions under which aggression, altruism and cooperation evolved.

Speaker

Teisuke Miura

Professor
Division of Marine Environment and Resource Sensing
Graduate School of Fisheries Sciences
Hokkaido University

> 【Plenary Session 4】 Monday August 7, 2006 / 4:20pm-4:50pm

ACADEMIC DEGREES:

B.A.	1970	Hokkaido University (Fisheries Sciences)
Ph.D.	1988	Hokkaido University (Fisheries Sciences)

PROFESSIONAL APPOINTMENTS:

1971 - 1989	Instructor, Faculty of Fisheries, Hokkaido University
1989 - 1994	Associate Professor, Faculty of Fisheries, Hokkaido University
1994 - 1995	Professor, Faculty of Fisheries, Hokkaido University
Present	Professor, Graduate School of Fisheries Sciences, Hokkaido University

RESEARCH INTERESTS:

System design of fisheries is the broad area of research interests. To develop sustainability of fisheries, the minimization of the environmental burden through appropriate management of resource utilization and energy consumption is the main focus of research activities. Some of the latest research topics are listed below:

1- Total Utilization of Squids (*Todarodes pacificus*) toward Zero Emissions
2- Measurements of Energy Consumption and the Environmental Burden in Squid Fisheries
3- LCA Methodology to the Evaluation of Japan Fisheries

Understanding and Approach to "Sustainability" Science of Fisheries

Teisuke Miura
Professor
Division of Marine Environment and Resource Sensing
Graduate School of Fisheries Sciences
Hokkaido University

According to FAO's reports, currently, approximately 44% of key fish species are being exploited at their maximum, 16% are overexploited with no room for expansion, and 6% have been depleted. These figures show that world's aquatic resources are unsustainably, not sustainably, used. Japan imports approximately 40% of fishery products consumed in the country. Now, demand for marine products in Japan cannot be met without imports. The international community has started to see that Japan, a major importer of marine products, for example prawns and shrimps, has been indirectly facilitating the destruction of the environment in developing countries.

In these circumstances, how should we consider sustainable fisheries? Considerations that we need to make in considering global sustainability of Japan's marine-product supply are: ①the establishment of global supply system; ②the securing of stable supply and safety of imported fishery products; and ③the establishment of partnership with importing countries. This paper, based on "Fisheries Research and Technical Development Strategy," a report that proposes new basic policies for fisheries of the 21st century, introduces the current status and problems of Japan's fisheries industry.

However, there is currently no clear definition of "sustainability of the fisheries industry." In this paper, I attempt to establish it logically. There are various ways to interpret the word "sustainability." Japan for Sustainability (JFS), for example, considers sustainability as from five basic compositions: ①Resource and Capacity, ②Fairness across Time, ③Fairness across Space, ④Diversity, and ⑤Human Will and Networking.

Based on this JFS's concept, the author fist discuses sustainability of the fisheries industry and then examines the "sustainability" science of fisheries-theme of this lecture-more specifically, ①new logic of the "sustainability" science of fisheries, ②educational philosophy of the "sustainability" science of fisheries, and ③problems of the "sustainability" science of fisheries. Also, a framework for practice is proposed using concepts of "backcasting" and "benchmarking."

Speaker

Nasir El Bassam

Director, International Research Centre for Renewable Energy (IFEED), Germany
President, International Council of Sustainable Agriculture (ICSA)

> 【Plenary Session 4】 Monday August 7, 2006 / 4:50pm-5:30pm

ACADEMIC DEGREES:

B.Sc., M.Sc. and Ph.D. University of Bonn, Germany (Professorship, Resource Managemnet)

PROFESSIONAL APPOINTMENTS:

- Director, International Research Centre for Renewable Energy e. V. (IFEED), Germany
- Chairman, Working Group, Biomass for Food, Energy and the Environment, Sustainable Rural Energy Network (SREN), FAO, United Nations
- President, International Council of Sustainable Agriculture and Resource Management (ICSA)
- Associate Professor, Federal Agriculture Research Centre, Braunschweig, Germany
- Promoting and supervising M.Sc. and Ph.D. students
- EU-Adviser in developing and evaluating of research programs
- Promoting academic and scientific research and co-operation between Germany and other countries at various levels and disciplines

RESEARCH INTERESTS:

The Centre IFEED undertakes the responsibility in the field of research, education, demonstration, transfer of technology and co-operation with national and international organizations. It also offers the agriculture, trade and industry to introduce and commercialize their products. The Centre has been recognized under his leadership recently as a "Centre of Excellence" in promoting renewable energy technologies for Food and Water Supply, especially in rural areas. Special emphasis is dedicated on optimization of energetic and food autonomy in decentralized living areas and to promote regional development and sustainable resource management.
ICSA is an international organization registered in Canada and aiming to discuss and promote worldwide research, strategies, dialogue and cooperation between scientists, researcher, institutions, universities, industry and communities to achieve sustainability in agriculture production systems and to protect the environment and climate.

Strategy towards Achievement of Sustainable Agriculture for Food, Energy and the Environment in the Age of the Globalization

Nasir El Bassam
Director
International Research Centre for Renewable Energy (IFEED), Germany
President
International Council of Sustainable Agriculture (ICSA)

Agriculture is the foundation of all cultures, economic advancement and human dignity. Also, Agenda 21 of the Rio de Janeiro Conference in 1992 put significant emphasis on agriculture as a key for intra-and intergenerational equity

Today we face immense pressure in the global environment resulting from industrial emissions of greenhouse gases, the continual growth of the world population and the depletion of natural resources. The recognition of the necessity for actions and the intention and the will are vital evolutionary steps towards sustainability,

Food security is often undermined by factors such as water availability, land distribution, poverty, and environmental degradation. Among the major food security threats on the horizon are climate change, the loss of diversity of plant and animal species and the rise of food borne illnesses

The key concept is to promote the conservation and the sustainable use of natural resources, which allows long term economic growth and enhancement of productive capacity, along with being equitable and environmentally acceptable.

In order to meet challenges, the future energy policies should put more emphasis on developing the potential of energy sources, which should form the foundation of future global energy structure. In this context, the FAO in support of the Sustainable Rural Environment and Energy Network (SREN) has developed the concept of the Integrated Energy Farms for the optimization, evaluation, and implementation of sustainable food, water and energy production systems in rural communities.

Speaker

Mitsuru Osaki

Executive Advisor, Hokkaido University

Director, Sustainability Governance Project (SGP), Hokkaido University

Professor, Division of Biological Resources and Production, Research Faculty of Agriculture, Hokkaido University

> 【Plenary Session 4】 Monday August 7, 2006 / 5:30pm-6:00pm
> 【Parallel Session 1】 Tuesday August 8, 2006 / 8:30am-9:00am
> 【Plenary Session 4】 Wednesday August 9, 2006 / 4:05pm-4:15pm

ACADEMIC DEGREES:

B. Sc. 1976	Hokkaido University (Agriculture)
M. Sc. 1978	Hokkaido University (Agriculture)
Ph. D. 1981	Hokkaido University (Agriculture)

PROFESSIONAL APPOINTMENTS:

1981 - 1982	Research Fellow, Laboratory of Plant Nutrition, Faculty of Agriculture, Hokkaido University
1982 - 1984	Associate Scientist at CIMMYT (Mexico)
1984 - 1997	Assistant Professor, Faculty of Agriculture, Hokkaido University
1997 - 1999	Associate Professor, Faculty of Agriculture, Hokkaido University
1999 - 2001	Associate Professor, Graduate School of Agriculture, Hokkaido University
2001 - 2006	Professor, Graduate School of Agriculture, Hokkaido University
2006 - now	Professor, Research Faculty of Agriculture, Hokkaido University

RESEARCH INTERESTS:

Rhizosphere regulation, plant-soil-microrganisms interaction,
Plant Productivity through carbon-nitrogen metabolisms
Al tolerance and phosphorus deficiency of plants grown low pH soil
Human-Dimension on ecological management
Global Land Project

The Sustainability of Bio-production Systems

Mitsuru Osaki
Executive Advisor, Hokkaido University
Director, Sustainability Governance Project, Hokkaido University
Professor, Research Faculty of Agriculture, Hokkaido University
E-mail: mosaki@chem.agr.hokudai.ac.jp

The present high productivity levels enjoyed by modern agronomy have largely been attained through intensive land management practices such as the vigorous application of fertilizers, fungicides, pesticides and herbicides, improved tillage and irrigation techniques, mono cropping, mechanization, and so on. However, these activities are becoming increasingly difficult to sustain due to 1) soil degradation and environmental pollution, 2) reduced oil production, and 3) climate changes. In this paper, I would like to discuss how to guarantee the sustainable development of human societies by proposing new biomass production fields, for which highly detailed models must be constructed via a systems simulation approach, and by developing sustainable cultivation methods as follows.

(a) <u>Development of integrated and detailed models for sustainable biomass production</u>: There are three compelling reasons why such detailed models are necessary for achieving sustainability. The first is to integrate the fragmented pieces of knowledge we have accumulated so far. The second is the process of establishing goals - namely, how the systems models may contribute heuristically. The third is using model simulations to evaluate levels of sustainability. Highly detailed models of food and biomass production systems must involve every activity related to the production and utilization of biomass, namely rhizosphere and phytosphere control, pest and disease management, ways of utilizing unavailable and/or wasted biomass, pollution monitoring, economic issues, and so on.

(b) <u>Development of monitoring and risk management systems for food production fields</u>: We are currently facing several important problems brought about by highly developed technology. Severe problems with residual chemicals and the flow of pesticides and chemical fertilizers exist in both agricultural and natural systems. For these reasons, we need to develop new monitoring systems and provide the governance to regulate them.

Chairperson

Takeshi Kishinami

Executive and Vice President
Hokkaido University

> 【Plenary Session 1】 Wednesday August 9, 2006 / 9:00am-11:30am

ACADEMIC DEGREES:

B. E. 1966 Hokkaido University (Engineering)

M. E. 1968 Hokkaido University (Engineering)

Ph. D. 1971 Hokkaido University (Engineering)

PROFESSIONAL APPOINTMENTS:

1972	Associate Professor, Faculty of Engineering, Hokkaido University
1988	Professor, Faculty of Engineering, Hokkaido University
1995	Professor, Graduate School of Engineering, Hokkaido University
2003	Dean, Graduate School of Engineering, Hokkaido University
2004 -	Executive and Vice President of Hokkaido University

RESEARCH INTERESTS:

The research activities of Prof. T. Kishinami includes the following topics:
-Digital Information Modeling and Technology,
-High Quality Information Modeling for Data Exchange between Design and Manufacturing
-High Level Data Modeling for Next Generation Computer Controlled Numerical Machine Tools,

Keynote Speaker and Panelist

Sheldon Shaeffer

Director
UNESCO Bangkok, Thailand

> 【Plenary Session 1】 Wednesday August 9, 2006 / 9:00am-9:30am
> 【Panel Discussion】 Wednesday August 9, 2006 / 9:30am-11:30am

ACADEMIC DEGREES:

B.A.	1967	Stanford University, U.S.A. (History)
M.A.	1974	Stanford University, U.S.A. (Anthropology)
Ph.D.	1979	Stanford University, U.S.A. (International Development Education)

PROFESSIONAL APPOINTMENTS:

1968 - 1969	Teacher, Saribas Government Secondary School in Sarawak, Malaysia
1970 - 1971	Lecturer, Faculty for Teacher Training at Pattimura University in Ambon, Indonesia
1972 - 1974	Teaching Assistant, graduate programme for South-East Asian educators and for courses in non-formal education at Stanford University
1975 - 1977	Programme officer, education and culture at the Ford Foundation in Jakarta
1980 - 1990	Associate Director, Social Sciences Division at the International Development Research Centre (IDRC) in Ottawa
1990 - 1993	Senior Research Fellow, International Institute for Educational Planning (IIEP) in Paris
1993	Senior Scientist, Social Science Division, International Development Research Centre
1994 - 1998	Regional Education Adviser in Bangkok, UNICEF
1998 - 2001	Chief, Education Section at UNICEF Headquarters in New York

RESEARCH INTERESTS:

Mr. Shaeffer has published and co-edited a number of books and journal articles in the field of education.

Education for Sustainable Development: If Not the Solution, At Least a Start

Sheldon Shaeffer

Director

UNESCO Bangkok, Thailand

Development which is sustainable is meant to "meet the needs of the present without compromising the ability of future generations to meet their own needs." Education for sustainable development (ESD) promotes the social, environmental, economic, and cultural awareness and action which can help make such a future achievable. This requires, however, a fundamental reform of the structure and nature of education, the development of public awareness about what sustainability means, and the building of capacity within education systems and across all other ESD partners. The United Nations Decade of Education for Sustainable Development, which UNESCO coordinates, is attempting to facilitate networking and exchanges among ESD partners, foster education reform fully incorporating ESD principles, and help countries make progress toward attaining the Millennium Development Goals which are essential for a sustainable future. Higher education institutions have a special role to playing in promoting ESD through their ability to promote inter-disciplinary work and re-orient their academic programmes toward sustainable development, enhance the ability of Ministries of Education to prepare curricula and train teachers along ESD principles, and strengthen inter-university research and action.

Coordinator

Norihito Tambo

Professor
President
University of the Air
(Japan Open University)

> 【Panel Discussion】 Wednesday August 9, 2006 / 9:30am-11:30am

ACADEMIC DEGREES:

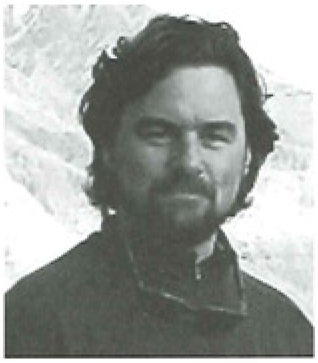
B.E.	1955	Hokkaido University (Civil Engineering)
M.E.	1957	Hokkaido University (Sanitary Engineering)
Ph.D.	1965	Hokkaido University (Sanitary Engineering)

PROFESSIONAL APPOINTMENTS:

1957 - 1958	Associate Professor,Sanitary Engineering, Hokkaido University
1969 - 1995	Professor,Environmental Engineering, Hokkaido University
1991 - 1993	Dean of the Bureau of Student Affairs, Hokkaido University
1993 - 1995	Dean of the Faculty of Engineering, Hokkaido University
1995 - 2001	President, Hokkaido University
2001 -	President,University of the Air

RESEARCH INTERESTS:

Aquatic Environmental Engineering
Urban Water and Wastewater Engineering



Panelist

John Cusick

Assistant Specialist
Environmental Center
University of Hawai'i at Manoa, U.S.A.

> 【Panel Discussion】 Wednesday August 9, 2006 / 9:30am-11:30am

ACADEMIC DEGREES:

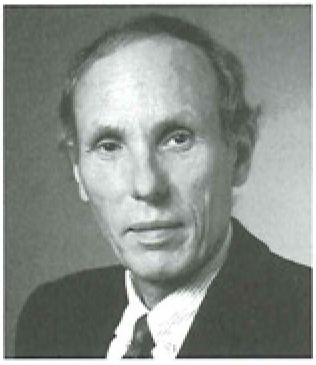
B.A.	1985	California State University, Chico (Geography, Latin American Studies, Spanish)
M.A.	1993	University of Hawai'i at Manoa (Geography)
Ph.D.	2003	University of Hawai'i at Manoa (Geography)

PROFESSIONAL APPOINTMENTS:

1996 - 2003	Lecturer, Geography, University of Hawai'i System
2003 -	Assistant Specialist, Environmental Center, University of Hawai'i at Manoa

RESEARCH INTERESTS:

My research focuses on tourism resources and activities in and adjacent to protected areas recognized as biological and cultural "hotspots." Of particular interest is the increase and expansion of ecotourism as an alternative to mass tourism and as a potential to mitigate negative impacts and improve the effectiveness of protected area management. The primary objective of current projects is to spatially identify ecotourism resources and activities toward establishing long-term monitoring programs in East Maui and the South Island, New Zealand. Current tourist visitation to project areas and the assessment of trends by public and private organizations suggests that ecological and social carrying capacities are concerns for protected area management and gateway community planners. Current strategic plans identify the need for monitoring programs of vital signs to improve resident and visitor relations. These projects will contribute information regarding current visitor activities and impacts to various stakeholder groups involved in environmental conservation and sustainable tourism development.



Panelist

Stephen Lincoln

Professor
Discipline of Chemistry
School of Chemistry and Physics
University of Adelaide, Australia

> 【Panel Discussion】 Wednesday August 9, 2006 / 9:30am-11:30am

ACADEMIC DEGREES:

B.Sc. (Hons). 1962 University of Manchester (Chemistry)
Ph.D. 1967 University of Adelaide (Chemistry)
D.Sc. 1984 University of Manchester (Chemistry)

PROFESSIONAL APPOINTMENTS:

1967 - 1968	Instructor, Department of Chemistry, Washington State University
1969 - 1972	Lecturer, Discipline of Chemistry, University of Adelaide
1972 - 1977	Senior Lecturer, Discipline of Chemistry, University of Adelaide
1977 - 1991	Reader, Discipline of Chemistry, University of Adelaide
1991 - 2006	Professor, Discipline of Chemistry, University of Adelaide

RESEARCH INTERESTS:

Stephen Lincoln's chemical research interests are centred on cyclodextrin chemistry, nanochemistry and molecular sensors. He has published three hundred refereed articles in chemical research journals which have been recognized through the award of medals. He is a Fellow of the Royal Australian Chemical Institute and the Royal Society of Chemistry. He has close research collaborations with Princeton University and the University of New Orleans in the United States.

During his career he has developed an increasing interest in the future of humanity and the habitability of Earth. This has given rise to his book "Challenged Earth: An Overview of Humanity's Stewardship of Earth" published by Imperial College Press in 2006. He is a board member of the Climate Change and Sustainability Research Centre at the University of Adelaide.

Panelist

M. Harun-ur-Rashid

Director
Training & Communication Wing
Bangladesh Agricultural Research Institute (BARI), Bangladesh

> 【Panel Discussion】 Wednesday August 9, 2006 / 9:30am-11:30am
> 【Parallel Session】 Tuesday August 8, 2006 / 1:55pm-2:15pm

ACADEMIC DEGREES:

B.Tech.	1976	Punjab Agricultural University, India
MS	1979	Colorado State University, U.S.A.

PROFESSIONAL APPOINTMENTS:

1976 - 1978	Scientific Officer, Agricultural Engineering Division, BARI
1978 - 1986	Senior Scientific Officer, Agricultural Engineering Division, BARI
1987 - 1998	Principal Scientific Officer, Irrigation & Water Management Division, BARI
1998 - 2002	Chief Scientific Officer, Farm Machinery and Process Engineering Division, BARI
2002 - 2004	Director, Wheat Research Centre, BARI
2004 - Till Date	Director, Training and Communication Wing, BARI
1992 - 1994	Consultant as Irrigation Agronomist, Canadian International Development Agency (CIDA)
1996 -	Deputy Project Manager, Landscape Project, Kuwait.
1990 - 2002	Adjunct Faculty in Bangabandhu Shake Mujibur Rahman Agricultural University & Bangladesh Open University.

RESEARCH INTERESTS:

1. Worked in Irrigation, Arsenic Problem, Agronomy, Farm Machinery, Landscape and Environment fields.
2. Have about 80 publications (Res. articles, books, booklets, workshop proceedings, popular articles, etc).
3. Worked as Teamleader, Research Coordinator/Leader, Principal Investigator, etc in over 10 Projects/Programs.
4. Members in many Professional societies

Chairperson

Oleg Shcheka

Head of Department
Department of International Programs and Projects
Far Eastern Branch of the Russian Academy of Sciences, Russia
Professor, Department of Physics, School of Physics and Information Technologies, Far Eastern State University, Russia

> 【Plenary Session 3】 Wednesday August 9, 2006 / 1:15pm-3:45pm

ACADEMIC DEGREES:

M.S.	1986	Far Eastern State University (Molecular Physics)
Ph.D.	1990	Institute of Chemistry, FEBRAS (Physical Chemistry)
D.Sc.	2000	Far Eastern State University (Condensed Matter Physics)

PROFESSIONAL APPOINTMENTS:

1989 - 1994	Researcher, Institute of Physics and Technology, Far Eastern State University
1994 - 1998	Director of Professional Programs Training, Administration of Nakhodka FEZ
1998 - 2000	Vice President, Academy for Regional Development
2000 - 2002	Associate Professor, Department of Physical Chemistry, Far Eastern State Technical University
2002 -	Assistant to Chairman, Head of Department of International Programs and Projects, Far Eastern Branch of the Russian Academy of Sciences
2000 -	Professor, Department of Physics, Far Eastern State University

RESEARCH INTERESTS:

Condensed matter physics, Heterogeneous catalysis, Electronic theory of adsorption processes, X-Ray photoelectron and emission spectroscopy, Quantum chemical simulation of pollutant transport and transformation in atmosphere.

Co-Chairperson

Takayuki Shiraiwa

Associate Professor
Research Institute for Humanity and Nature, Japan

> 【Plenary Session 3】 Wednesday August 9, 2006 / 1:15pm-3:45pm

ACADEMIC DEGREES:

B.A.	1987	Waseda University (Geography)
M.A.	1989	Hokkaido University (Environmental Sciences)
Ph.D.	1993	Hokkaido University (Environmental Sciences)

PROFESSIONAL APPOINTMENTS:

1991 - 2004	Assistant Professor, Institute of Low Temperature Science, Hokkaido University
2004 - 2005	Associate Professor, Institute of Low Temperature Science, Hokkaido University
2005 -	Associate Professor, Research Institute for Humanity and Nature

RESEARCH INTERESTS:

Palaeoclimate Reconstruction, Climate and Glacier relationship, Sustainable Development of Amur River Basin and the Sea of Okhotsk

Keynote Speaker

Petr Y. Baklanov

Director
Pacific Institute of Geography
Far Eastern Branch of the Russian Academy of Sciences, Russia

> 【Plenary Session 3】 Wednesday August 9, 2006 / 1:15pm-1:45pm

ACADEMIC DEGREES:

B.A.	1966	Geographical department of the Moscow State University after M.V.Lomonosov, Moscow
B.A.	1967	Economic department of the Moscow State University after M.V.Lomonosov, Moscow
M.A.	1971	Geographical department of the Moscow State University after M.V.Lomonosov, Moscow
M.A.	1972	Economic department of the Moscow State University after M.V.Lomonosov, Moscow
Ph.D	1974	Moscow State University after M.V.Lomonosov, Moscow
Doctor of Geography	1987	Moscow State University after M.V.Lomonosov, Moscow Academician of the Russian Academy of Sciences since 2002

PROFESSIONAL APPOINTMENTS:

1973 - 1987	Research worker, Head of the Laboratory, Deputy Director on sciences, Pacific Institute of Geography, Vladivostok, Russia,
1987 - 1991	Director of the Economic Research Institute of the USSR Academy of Sciences, Khabarovsk, Russia,
1991 -	Director of the Pacific Institute of Geography of the Far Eastern Branch of the Russian Academy of Sciences, Vladivostok, Russia

RESEARCH INTERESTS:

Expert in the field of industry distribution, territorial organization of economy, economic zoning, ecological-economic assessment of natural resources, regional development and management and geopolitics.

Interaction between the Amur River Watershed and the Sea of Okhotsk in a Model of a Sustainable Development

Petr Y. Baklanov

Director

Pacific Institute of Geography,

Far East Branch of the Russian Academy of Sciences, Vladivostok, Russia

The basic features of a model of a sustainable development of the region are identified and considered. The model must reflect a region as a complex natural-social and economic system. A balanced development of the region should be achieved in economic, social and ecological spheres. Indicators, criteria and restrictions of a sustainable development are used with this purpose. Such criteria as economic, social and ecological qualities of a regional development are introduced by us (Baklanov, 2001). Achievement of balanced national and geopolitical interests is important for trans- boundary regions.

The region *the Amur River watershed - the Sea of Okhotsk* is considered as a large regional structure, which consists of two links. The characteristic of the basic spheres of interaction between these links are given.

In natural-resource sphere - interactions in the use of water, fish, power and other resources.

In economic sphere - interactions in water transport, power, fish and food-processing industries, agriculture and forestry, and in other kinds of activity in the Amur River and Sea of Okhotsk watersheds.

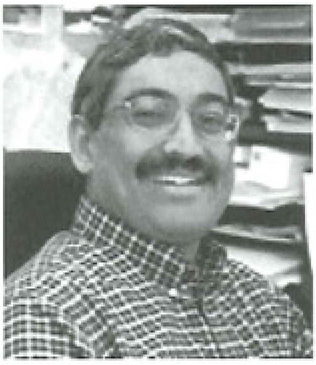
In social sphere - interactions in population migration, including international, in policy of preservation of indigenous people, etc.

In ecological - interrelations of the basic technogeneous threats connected with water and atmospheric pollution, with disturbance of forest ecosystems and wetlands. The basic trans-boundary ecological threats and problems are connected with water and atmospheric transfer of technogenious pollution. Variants of extreme situations with trans-boundary ecological problems are under consideration.

Zoning of the territory of the Amur River watershed, the territory and the water area of the Sea of Okhotsk watershed, which we carried out by combinations of natural resources and composed structures of nature use, is given. Such zoning and subsequent estimations of dynamics of natural resources are considered as a natural-resource basis of a sustainable development of the region.

Priorities of a regional development and their conformity to criteria and models of a sustainable development of the region are determined.

Proposals on the development of international programs of sustainable, balanced development of the Amur River and the Sea of Okhotsk watershed and also on the formation of the international monitoring system are put forward.



Speaker

Kalidas Shetty

Professor
Department of Food Science
College of Natural Resources and the Environment
University of Massachusetts, Amherst, U.S.A.

> 【Plenary Session 3】 Wednesday August 9, 2006 / 1:45pm-2:05pm

ACADEMIC DEGREES:

B.S.	1983	University of Agricultural Sciences, Bangalore, India (Agri Microbiology)
M.S.	1985	University of Idaho, USA (Microbiology)
Ph.D.	1989	University of Idaho, USA (Microbiology)
Post-Doctoral	1990 - 91	National Institute of AgroBiological Sciences (Tsukuba, Japan)
Post-Doctoral	1992 - 93	University of Guelph, Canada

PROFESSIONAL APPOINTMENTS:

1993 - 1999	Assistant Professor, Department of Food Science, University of Massachusetts
1999 - 2004	Associate Professor, Department of Food Science, University of Massachusetts
2004 -	Professor, Department of Food Science, University of Massachusetts
2004 - 2005	Jefferson Science Fellow, US Department of State, Washington, DC

RESEARCH INTERESTS:

Biotechnology and Metabolic Biology of Functional Foods and Phenolic Antimicrobials for Food Safety

Specific research interests focus on molecular and physiological regulation of phenolic metabolites and phenylpropanoid pathway by proline-linked pentose phosphate and redox pathways in food plants, food-associated bacteria, fungi and mammalian systems. This focus is contributing substantially to innovative research advances in the areas of Ingredient biosynthesis, Food Safety, Nutrition, Functional Foods and Environmental adaptation of biological systems.

Sustainable Food Production:
Integration of Emerging Global Food, Health and Environmental Challenges

Kalidas Shetty
Professor
Department of Food Science, University of Massachusetts,
Amherst, MA 01003, U.S.A.

Sustainable development requires us as a global community to capture the opportunities in Life Sciences to solve global problems. To achieve this the world needs a look at Biology as an integrated ecosystem. Therefore, Eco-Evolutionary pressures that drive Biological and Biochemical diversity (as genomes are plastic and adapt) are key to understanding individual Biological systems at the Cellular, Molecular and Biochemical levels. From this basic premise the challenges facing this world must be seen within the global human population trends that is projected to grow from the current 6 billion to 9 billion by 2050 with more people living longer. Another significant challenge that has emerged of late are the Food, Health and Wellness issues with more people excessively (excess calories) nourished than mal (under)-nourished. This has resulted in enhanced disease challenges from chronic obesity-linked diseases at a time many parts of the world are still facing the challenges of infectious diseases from mal-nutrition. Therefore, to understand and solve the sustainable development challenges facing humanity (and in particular food production and quality issues), we need to explore the opportunities and impact of Life Sciences. These opportunities have to be integrated with other technological changes emerging such as in the area of information technology and telecommunications in order enhance quality of life for all people within a sustainable ecosystem. These developments will have to be clearly linked to Environmental consequences of the above challenges and sustainability, with primary challenges coming for energy and water management. For all the above challenges we need an integrated approach (Systems Biology) for problem solving and especially in complex Biological Systems that are oxygen dependent (Redox Biology). These challenges and opportunities have to be seen within the perspective of a global economy and sustainable economic diversification that is bringing in new high growth countries such as India, China and Brazil.

Speaker

Bai Zhang

Professor
Director
Northeast Institute of Geography and Agricultural Ecology,
Chinese Academy of Sciences, China

> 【Plenary Session 3】 Wednesday August 9, 2006 / 2:05pm-2:25pm

ACADEMIC DEGREES:

B.A.	1983	Peking University (Physical Geography and Environment Science)
Ph.D.	2005	Graduate University of Chinese Academy of Sciences (GIS)

PROFESSIONAL APPOINTMENTS:

*NEIGAE-Northeast Institute of Geography and Agriculture Ecology, Chinese Academy of Sciences
*CCIG-Changchun Institute of Geography, Chinese Academy of Sciences

1983 - 1988	A.R., Dept.of RS & GIS Application, CCIG
1988 - 1993	Assi. Professor , Dept. of RS & GIS Application, CCIG
1993 - 1996	Asso. Professor, Depute Director, Center of RS & GIS Application, CCIG
1996 - 1997	Professor , Depute Director, Center of RS & GIS Application, CCIG
1997 - 1999	Professor, Chief, Research Project Office, CCIG
1999 - 2002	Professor , Director, Center of RS & GIS Application, CCIG
2002 - 2002	Professor , Director, Center of RS & GIS Application, NEIGAE
2002 - 2006	Professor , Assistant Director, NEIGAE
2006 -	Professor, Director, NEIGAE

RESEARCH INTERESTS:

Land use and cover change

Land Use Change and Related Driving Factors in Northeast China from 1980 to 2000

Bai Zhang
Director
Northeast Institute of Geography and Agricultural Ecology,
Chinese Academy of Sciences, China

Human-induced changes in land use/cover form an important component of sustainable development research. Therefore, it is important to study land use/cover and its change. Northeast China is one of the main agricultural regions in China, its yield of corn and soybean now accounting for more than 30% and 40% of the nation's total. In the past two decades, Northeast China has suffered dramatic land use change as a result of activities of human beings. These changes led to aggravating loss of water and soil, decrease in soil fertility in the black soil zone of the central part, wetland loss in Sanjiang Plain, desertification and grassland degradation in western part. There were many efforts to analyze climate change, landscape change, and effects of agricultural activities on local environment in Northeast China. Yet quantitative knowledge on changes in land use and in ecosystem services at regional level for the whole area is few. For this reason, three datasets of land use/-cover produced from 1980 and 2000 Landsat satellite images were overlaid in ArcInfo to reveal changes in land use/cover. In addition, this study aims to elucidate the interactive nature between changes in land use/cover caused by human activities and the environment (e.g., climate) in Northeast China in the past two decades.

From 1980 to 2000, according to study results obtained from Landsat images, widespread changes in land use/cover took place in Northeast China. Grassland, marsh, water body and woodland decreased by 9864, 3973, 1367 and 10052 km^2, respectively. By comparison, paddy field, dry famland, and built-up land expanded by 7339, 17193 and 700 km^2, respectively. These changes bore an interactive relationship with the environment, especially climate change. On the one hand, climate warming created a potential environment for grassland and marsh to be changed to farmland as more crops could thrive in the warmer climate, and for dry farmland to paddy field. On the other hand, the changed surface cover modified the local climate. These changes, in turn, have adversely influenced the local environment by accelerating land degradation in the agro-pastoral belt of western part of Songnen Plain, and exacerbating flooding in the drainage areas of the Songhua River and the Nenjiang River.

Speaker

Dong-Geun Han

Professor
School of Economics and Finance
College of Commerce and Economics
Yeungnam University, Korea

> 【Plenary Session 3】 Wednesday August 9, 2006 / 2:40pm-3:00pm

ACADEMIC DEGREES:

B.A.	1983	Yeungnam University (Economics)
M.A.	1987	Seoul National University (City Planning)
Ph.D.	1994	Purdue University (Economics)

PROFESSIONAL APPOINTMENTS:

1985 - 1988	Research Fellow, Korea Research Institute for Human Settlement
1995 - 1999	Assistant Professor, Yeungnam University
2000 - 2005	Associate Professor, Yeungnam University
2005 -	Professor, Yeungnam University

RESEARCH INTERESTS:

Water Demand Management Policy
Real Estate and Financial markets

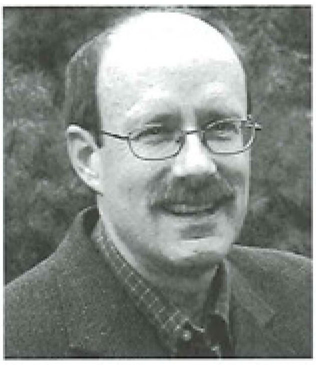
An Evaluation of Water Allocation Mechanisms: A Korean Case

Dong-Geun Han
Professor
School of Economics and Finance
Yeungnam University, Korea

According to a report by UN, Korea is classified as a water-shortage country. Annual total amount of rainfall in Korea may not seem insufficient, but the rainfall concentrates mostly in the monsoon season, and there are considerable deviations among different regions.

There is a big debate under way about how to deal with the problem. Some people assert that we need to build more dams to store up the rainwater. Others argue that water management needs to be more efficient and that dam construction is not a sustainable approach, only to destruct environment.

Supporting the demand management approach, my paper is about how to improve the efficiency in allocating scarce water among regions. The study offers two methods of water allocation between upstream and downstream regions; a proportional allocation method and a fixed-amount allocation method. The former method assigns each region with a proportion of the total water available in a river. The latter method allocates a fixed-amount of water to the downstream region, with the leftover being assigned to the upstream region. We apply those methods to Hwang River in Korea and evaluate the performances of each allocation method. This case study shows that, in general, the proportional allocation method is superior from an efficiency point of view, while the fixed-amount method dominates from a risk-equity point of view.



Speaker

Jack Ahern

Professor
Dept. of Landscape Architecture and Regional Planning
University of Massachusetts, Amherst, U.S.A.

> 【Plenary Session 3】 Wednesday August 9, 2006 / 3:00pm-3:20pm

ACADEMIC DEGREES:

B.S.	1974	University of Massachusetts (Environmental Design)
M.L.A.	1980	University of Pennsylvania (Landscape Architecture)
Ph.D.	2002	Wageningen University (Environmental Planning)

PROFESSIONAL APPOINTMENTS:

1986 - 1992	Assistant Professor, Dept. of Landscape Architecture and Regional Planning, University of Massachusetts
1992 - 1998	Associate Professor, Dept. of Landscape Architecture and Regional Planning, University of Massachusetts
1996.	Fellow, American Society of Landscape Architects
1997.	Fulbright Research and Teaching Fellowship, Portugal
1998 - present	Professor, Dept. of Landscape Architecture and Regional Planning, University of Massachusetts

RESEARCH INTERESTS:

Ecological Planning, Greenway Planning and Design, Applied Landscape Ecology, Green Infrastrucutre, Biodiversity in Planning and Design.

Challenges and Strategies for the Planning of Sustainable Landscapes

Jack Ahern
Professor
Dept. of Landscape Architecture and Regional Planning,
University of Massachusetts, Amherst, U.S.A.

Planning of sustainable environments is a complex process addressing the fundamental triad of economic, environmental and socially-equitable sustainability. This paper discusses challenges and strategies related to the environmental area of the sustainability triad, specifically for determining spatial configurations of landscapes that support physical, biological and cultural processes.

Because sustainable landscape planning addresses a great complexity of natural and cultural resources, a collaborative and interdisciplinary approach is needed. To meet this challenge, a transdisciplinary model of collaboration has been developed in which stakeholders are involved in the planning process with multiple scientific disciplines and professionals. A transdisciplinary approach emphasizes the connection between academic researchers and user groups/stakeholders - with all participants contributing tacit and explicit knowledge, sharing information, and jointly deciding policies and actions. Although this transdisciplinary approach appears obvious and logical, it has yet to be widely practiced in landscape planning.

Uncertainty is another major challenge to the understanding of complex landscapes and the testing of innovative policies and recommendations to address sustainability. An adaptive approach to planning defines uncertainty explicitly, minimizes risks, and then proposes actions to "learn by doing" through monitoring, analysis, and revision of plans. While the adaptive approach has been widely used in natural resource management in the USA, it remains a novel, but pro missing strategy for sustainable planning.

A major challenge to planning sustainable environments is the need to demonstrate through pilot projects what sustainability looks like, how it functions, what it costs, and how people respond to it. If sustainability remains only a subject of academic discourse, or abstract governmental policy, it will not change the course of human existence as boldly intended. Pilot projects, from regional plans, to neighborhood districts to individual buildings are all needed to make sustainability a real and tangible model that can be replicated and adapted widely.

Speaker

Toru Miyamoto

Associate Professor
Graduate School of Public Policy
Hokkaido University

> 【Plenary Session 3】 Wednesday August 9, 2006 / 3:20pm-3:40pm

ACADEMIC DEGREES:

B.A.	1990	Tokyo University (Law)
M. A.	1999	The Fletcher School of Law and Diplomacy, Tufts University (Law and Diplomacy)
(Since	2001	Ph. D. Candidate The Fletcher School of Law and Diplomacy, Tufts University)

PROFESSIONAL APPOINTMENTS:

1990 - 2000	Officer, Ministry of International Trade and Industry
1994 - 1996	Deputy Director, Global Environmental Affairs Division, Environmental Protection and Industry Location Bureau
1996 - 1997	Deputy Director, Price Policy Division, Industrial Policy Bureau
1999 - 2000	Deputy Director, Chemical Management Affairs Division,

Basic Industry Bureau

2002 - 2004	Research Fellow, Faculty of Law and Politics, Hokkaido University
2004 - 2005	Associate Professor, Faculty of Law and Politics, Hokkaido University
2005 -	Associate Professor, Graduate School of Public Policy, Hokkaido University

RESERCH INTERESTS:

International Political Economy
Global Environmental Governance
Decision Making Process on Foreign Policy
US/ Japan relations

Creating Effective International Regimes: New Approach of Political Science

Toru Miyamoto
Associate Professor
Graduate School of Public Policy
Hokkaido University

Although the international environmental problems are not new, the creation of regimes for them is relatively new phenomena. This is because we need new science to understand the problem enough to write prescriptions. Therefore scientists play vital roles. But the regime formation is one thing but its implementation is another. Even scientists convince diplomats to agree on multilateral environmental agreements (MEAs), economic activities within borders are difficult to control. Some MEAs are effective in solving the problems, but others are not. We need new approach to design the effective ones.

Political scientists have long defined the fundamental character of international relations as chaos. However, researches on the cases found the reality had been much less pessimistic. Scientists share many things such as respect in knowledge, political positions (i.e. in terms of research funding, or free from responsibility to their interest of domestic industries), despite the difference in nationalities. Therefore, networking among them is possible, which often extended to citizen's groups, environmental activists. This network of "enlightened people," often called the "epistemic community" contributes significantly in global/regional regime formation through framing the national interests in new ways.

However, now we have "congestion" of MEAs. Only some are effective. Activists advocate they should have "teeth" to harness economic activities within state borders. But this is not easy. Looking precisely at effective MEAs, most of them are originally designed, or later amended to be "self-implementable." Confrontational dialog between activists and practitioners rarely bear fruits. We need three new approaches to inquire the new diplomacy. First is the politics of ideas. National interests are not defined only by material interests. Bearing legitimacy is important resource for a country to be influential. The second is that we need to consider the domestic decision making process on foreign policy. The third is the politics of regulation. Regulations create costs as well as benefits. Their pay-off structure shapes the politics on their implementation.

The recognition for the conundrums in the (especially North) East Asia is quite new. But the cold latitudes are fragile. With learning experience, we need act now. Scientists should take the lead.

Chairperson

Takeo Hondoh

Global Manager, Hokkaido University Initiative for Sustainable Development (HUISD)
Professor, Institute of Low Temperature Science
Hokkaido University

> 【Plenary Session 4】 Wednesday August 9, 2006 / 4:00pm-5:00pm

ACADEMIC DEGREES:

B.A.	1969	Hokkaido University (Applied Physics)
M.A.	1974	Hokkaido University (Applied Physics)
D. Engineering	1985	Hokkaido University (Applied Physics)

PROFESSIONAL APPOINTMENTS:

1969 - 1971	Engineer, Hitachi Ltd.
1976 - 1984	Instructor, Faculty of Engineering, Hokkaido University
1984 - 1986	Lecturer, Faculty of Engineering, Hokkaido University
1986 - 1992	Associate Professor, Faculty of Engineering, Hokkaido University
1992 -	Professor, Institute of Low Temperature Science, Hokkaido University

RESEARCH INTERESTS:

Physical properties of ice and clathrate hydrates, physical processes in ice sheets, and physics of ice core records relating to paleoenvironmental reconstructions.

Poster Abstracts

P-1

Research Activities on Environmental Studies in the Pan-Okhotsk Research Center

Naoto Ebuchi, Yasushi Fujiyoshi, Toshihiko Hara, Sumito Matoba, Humio Mitsudera, Tomohiro Nakamura, Takeshi Nakatsuka, Kay I. Ohshima, Takayuki Shiraiwa, Kunio Shirasawa

Pan-Okhotsk Research Center, Institute of Low of Temperature Science, Hokkaido University,

This poster introduces research activities concerning environmental studies in the Pan-Okhotsk Research Center, Institute of Low Temperature Science, Hokkaido University.

The Sea of Okhotsk is one of the southernmost seasonal sea ice zone in the Northern Hemisphere.

Thus, it is expected that the generation of sea ice in the Sea of Okhotsk is very sensitive to the global environmental changes, such as global warming. Aiming to properly evaluate role of the Sea of Okhotsk in the global environment, the Pan-Okhotsk Research Center (PORC) was inaugurated in the Institute of Low Temperature Science, Hokkaido University in April 2004.

The Center covers physical, chemical and biological aspects of the environment in the Sea of Okhotsk and its surrounding areas. Field observations and monitoring have been conducted using various instruments, such as the dynamic monitoring system for sea ice areas, which enables simultaneous observations of the oceanic currents, sea ice drift and atmospheric circulation above the ice-covered sea, unmanned meteorological monitoring towers, and research vessels.

Moreover, researchers at the center have been developing numerical models of the Atmosphere- Ocean-Land-Biosphere-Cryosphere system to clarify physical, chemical, and biological mechanisms of the environmental variations in the Pan-Okhotsk area and to predict them.

Properly evaluating the impact of and predicting the future of climate change require conducting intensive observations and developing predictive models based on the collected data. Moreover, the establishment of observation and research networks is also indispensable for continuing long-term, extensive observations.

This Center has been proceeding with comprehensive monitoring and modeling efforts for the Pan-Okhotsk region in collaboration with universities and research institutions not only in Japan, but also in Russia, Canada, the U.S., China, Korea, and numerous other nations.

P-2, 3

International Antarctic Institute project in Hokkaido University

Takeo Hondoh [1], Shin Sugiyama [1], Shigeru Aoki [1], Masanobu Yamamoto [2], Testuo Sueyoshi [1], Sohey Nihashi [1], Hiromi Kimura [1],

1/Institute of Low of Temperature Science, Hokkaido University,

2/Faculty of Environmental Earth and Science, Hokkaido University

The international Antarctic Institute (IAI) is an international, multi-campus program of education in cryosphere science. The institute was firstly proposed by the University of Tasmania and now 16 universities and institutions from 11 countries are involved as international partners. IAI aims to offer international standard education programs at undergraduate and graduate level with a special emphasis on Antarctic and cryosphere sciences. The universities and institutions share their curriculums within the framework of IAI partnership so that the students are able to take lectures and courses internationally. For those students who completed an agreed portion of the curriculum, bachelor and master degrees will be offered by IAI in addition to the degrees given by their home institutions.

Hokkaido University is enrolled in the IAI program as one of the leading universities in the field of cryosphere science. Institute of Low Temperature Science and Faculty of Environmental Earth Science have initiated a project to tailor and newly establish lectures and field courses for the purpose of IAI program. To offer a curriculum with an international standard, we collaborate internationally with Swiss Federal Institute of Technology (ETH) and University of Tasmania, and domestically with National Institute of Polar Research and Tokyo University of Marine Science. In May 2006, a glacier field course in Switzerland has been conducted for the first time with 15 students from Graduate School of Environmental Science. Another field course studying sea ice is planed in February 2007 at lake Saroma, East Hokkaido. Two lectures are commonly offered in Hokkaido University and in ETH by using a text book jointly published by professors in the universities, and also by e-learning systems. The curriculum is specially prepared with an English environment to accept students from all over the world.

P-4

Environmental role of methane Hydrate formation near sea bottom offshore Sakhalin, Okhotsk Sea

Hitoshi Shoji, Nobuo Takahashi, Hirotsugu Minami, Akihiro Hachikubo, Hirotoshi Sakagami, Alexey Krylov, Masato Kida

Kitami Institute of Technology

Fluid venting from depths of sea sediment will transport a significant amount of methane gas into sea water, and eventually to the atmosphere, contributing to enhance greenhouse gas activity for global warming. Gas hydrate formation near sea bottom may act as negative factor for the global warming by fixing methane gas in a solid crystalline form as gas hydrates. However, the details of this gas seep and fixation processes near the bottom are not understood quite well at present.

Side-scan-sonar survey with high-resolution seismo-acoustic profiling was performed offshore Sakhalin, Okhotsk Sea by the members of CHAOS (hydro-Carbon Hydrate Accumulations in the Sea of Okhotsk) project by Japanese, Russian, German, Belgium and Korean scientists in 2003. The survey results revealed characteristic distributions of gas hydrate accumulations with unique images of gas seepage structures and vertical fluid channel at/near sea bottom. More than 40 seepage structures were found within a 10 x 20 km survey area. The maximum size of seepage structure observed is about 600 m in diameter. Methane gas released from the seepage structures into the above water was detected as flare images by hydro-acoustic profiling. Investigations for an understanding of methane hydrate formation mechanisms and monitoring of hydrate formation activities are required to understand the role of near-bottom hydrate formation for methane gas budget in the atmosphere and to discuss about future actions against long-term trend of increasing greenhouse gas contents.

P-5

Sustainable Farming System and Natural Resource Utilization: Evidence from the Rice-prawn Gher Fariming System of Bangladesh

Basanta Kumar Barmon, Takumi Kondo, Fumio Osanami

Laboratory of Development Economics Department of Agricultural Economics, Graduate School of Agriculture, Hokkaido University

This present study attempts to examine the economic evaluation and sustainability of rice-prawn gher farming system using indigenous natural resource use in Bangladesh. Experimental data and field survey data were used in the present study. Soils were collected after prawn production (before paddy production) and after paddy production (before prawn production) and tested in the Soil Resource Development Institute (SRDI) laboratory in Khulna, Bangladesh. The findings of the study indicated that the farmers used less chemical fertilizers in MV paddy production under the rice-prawn gher farming system compared to MV paddy production in Bangladesh and were statistically significant between the two agricultural systems. The main reason is that farmers apply various combinations of feed to gher plots during the prawn production and the leftover feeds make the land fertile for MV paddy production. Moreover, various types of algae and weeds grow on the bottom of the canal as well as the mid field of the gher farm, helping to make the land fertile for MV paddy production after prawn production. The cost of chemical fertilizers for MV paddy farming was about six times higher than MV paddy production under the rice-prawn gher farming system. However, per acre MV paddy production of MV paddy farming was almost same to MV paddy production under the rice-prawn gher farming system. The rice-prawn gher farming is a cost-saving technology for MV paddy production.

P-6

Problems in controlling invasive alien raccoons in Hokkaido, Japan

Tohru Ikeda, Go Abe, Yuji Masuyama, Shiro Tatsuzawa

Research Group of Regional Science, Division of Human Sciences, Graduate School of Letters, Hokkaido University

Irresponsible release and escape of pet raccoons (Procyon lotor) has caused their naturalization in Hokkaido, Japan. Raccoons had naturalized in cattle breeding area at first, where they could find food easily, then spread throughout Hokkaido.

Raccoons have opportunistic and omnivorous feeding habits, taking crops and fruit in agricultural areas and predating indigenous species such as the Japanese crayfish (Cambaroides japonicus) and the Ezo salamander (Hynobius retardatus) in

forests.
Nuisance control harvests of invasive alien raccoons were conducted in some areas in Hokkaido, but raccoons show high reproductive power and potentially rapid rate of population growth, thus it will be impossible to control invasive raccoons only by nuisance control harvesting. Intensive extermination under scientific control programs on the basis of adaptive management is indispensable to controlling invasive alien raccoons. As public awareness of invasive alien raccoon issues is low, except in some areas where agricultural damage is serious, educational efforts will be needed regarding invasive alien raccoon issues, especially irreversible impacts on native ecosystems.

P-7

Toward Sustainble Managemant in Japanese National Parks: Recreational impacts on natural resources and visitor experiences

Tetsuya Aikoh [1], Yasushi Shoji [1], Kazushige Yamaki [2], Kazuo Yamaguchi [3], Akihiro Kobayashi [4]
1/Hokkaido University, 2/Tohoku Research Center, Foresty and Forest Products Research Institute, 3/Consultant for Natural Resources Developments Inc., 4/Senshu University, Hokkaido College

Increasing number of visitors on outdoor recreational areas are threatening inherent conditions of such areas like national parks, national forest and world heritage registered sites in Japan. Soils are eroded, and alpine flowers are trampled by hikers on trails. Human waste and papers are found around shelters and campgrounds. Water contamination and disturbance of wildlife habitats are concerned. Also, quality of visitor experience are degraded. There are some conflicts among different type of visitors, such as hikers and bikers, kayakers and anglers, etc. Expected quiet atmosphere are loosing, because visitors are gathered at some summits, trailheads and accommodations, especially in some famous park like Mt. Fuji or Shiretoko.
To achieve sustainable management in natural recreational areas, some planning and management frameworks has been developing in North America, Recreational Opportunity Spectrum, Carrying Capacity, Limit of Acceptable Change, Visitor Experience and Resource Protection, etc. Those frameworks need to establish the management objectives which show the purposes and visions of such area, and the evaluation and monitoring of natural resource conditions and visitor experiences. On the other hand, Japanese National Park system seems to lack such type of planning and management framework. Lacks of reasonable planning and management framework is one of causes that park management are not effective. This series of posters describe the necessary of planning framework, the method to get exact recreational use statistics, and the importance of information about visitor choice behavior, toward sustainable management in Japanese National Parks.

P-8

Understanding Visitor Flows in Daisetsuzan National Park: Toward Sustainbale Management in Japanese Nationial Parks

Yasushi Shoji [1], Kazuo Yamaguchi [2], Kazushige Yamaki [3], Tetsuya Aikoh [1]
1/Hokkaido University, 2/Consultant for Natural Resources Developments Inc., 3/Tohoku Research Center, Foresty and Forest Products Research Institute

Visitor monitoring is fundamental to the sustainable management of recreation areas. Without this information, landowners or recreation managers cannot develop appropriate action plans to maintain natural resources and to manage quality of visitor experiences. In North American and European countries many studies have been conducted and a great deal of knowledge and techniques has been accumulated. In contrast to these countries, little attention has been given to the understanding of visitor monitoring in Japan.
Simple aggregation of self-registration books has been the main source of visitor counting in Japan. Most of mountain recreation areas, landowners or recreation managers request trekkers to write their information on self-registration books at trailheads, and it is said that not a few trekkers are willing to cooperate with it. Therefore, the official number of trekkers, which is reported by the Ministry of Environment, has also largely depended on simple aggregation of these self-registration data.
However, the number is fundamentally underestimation since there always exists some uncooperative trekkers, in addition a trend toward reluctance to cooperate with it against leaking of personal information has affected the registration rates. Thus, these ungraspable trekkers have evolved into an uncertainty on management of mountain recreation areas in Japan. Toward sustainable management, this paper examines closer annual visitor flows in the Omote-Daisetsu area, Daisetsuzan National Park, Japan, combining data from self-registration books and infrared trail traffic counters.

P-9

Understanding Hiker's choice behavior in Daisetsuzan National Park: Toward Sustainble Managemant in Japanese National Parks

Tetsuya Aikoh [1], Akihiro Kobayashi [2], Yasushi Shoji [1]
1/Hokkaido University, 2/Senshu University, Hokkaido College

The information about visitors' choice of the sites for hiking is useful to manage trails in recreational areas.
Based on such information, managers will be able to take effective management actions to achieve the sustainability of the park. Visitors' choice behavior are known as the composition of several attributes such as personal factors, information sources and site attributes, etc. Increasing number of visitors and the change of access has caused the concentration of visitors on some popular routes, therefore natural resource impacts and the change of wilderness experience has been reported in Daisetsuzan National Park. Managers and stakeholders are seeking some management strategy to modify such situation.
Hikers were asked to rate the importance of 21 attributes about the routes, the trailheads and the camp sites. We also asked the information sources, the motivation, their experience and their willingness to next visit. The result of factor analysis showed that visitors considered the convenience of camp site, the walkability of route, the convenience of trailhead, the condition of natural resource and the less visitors. Those factors had relationships with their motivation, information sources and their experience of hiking and Daisetsuzan National Park. We found the significant relationships among visitors' personalities and site attributes which they had considered. Those information will be helpful for managers to control visitor flows and to choose the information they offer.

P-10

The industrialization of agricultural villages and the employment structure in the Sunan area of China - A follow-up research of Kaixiangong village -

Hong Park
Graduate School of Agriculture, Hokkaido University

In China, reform of the ownership system of enterprises was promoted on a large scale in the late 1990's. Due to the increase of private enterprises, "Sunan model", which was owned by the town and village enterprises, has become a "Wenzhou model". This paper clarifies the real state and characteristics of farming village industrialization, centering on one of the villages in the Sunan area. In addition, by making clear the present status of progress of home-based industry, this presentation ascertains the change in the agricultural work structure in the economic development area, based on the existing study materials and actual condition survey.

P-11

Analysis of Indemnity for Community related to the World Natural Heritage Site — on Fisheries Management in Shiretoko —

Yayoi Hisasue
Graduate School of Law, Hokkaido University

On July 14, 2005, Shiretoko was finally registered as the World Natural Heritage Site.
Now, dynamic ecosystem of Shiretoko which contains both the land and sea become well known to the world.
On the other hand, Shiretoko shows through Japanese fisheries management that it is a difficult and delicate problem to balance up interests of communities in the Site.
This research tries to find the best way to indemnify for communities which suffer losses from ecosystem conservation policies which implemented in the World Natural Heritage Site.
The history of Japanese fishing rights began with the Fisheries Law of 1902(Meiji era) which licensed fishing rights for the first time. Since postwar amendment of 1949(Showa era) adopted a concept of "adjustments for fishing", Japanese fishing

rights have had natures both property right as legal and environmental right as essential. Shiretoko fisheries management raises the question of where shall we find the common ground when the nature of environmental right restricts the exercise of fishing rights.

In the context of a new conflict between fishing rights and environmental right, change in the substance of "environmental right" might exist which is influenced by the stream of International Environmental Law that regards ecosystem conservation as most important.

It is necessary to establish strict fishery resources management system developed from old concept of adjustment for fishing to reach both goals of "marine ecosystem conservation" and "sustainable development in the sea" that is to say on one hand to meet the IUCN(International Union for Conservation of Nature and Natural Resources) demand to regard ecosystem conservation as most important among diverse values which the World Heritage Convention(1972) brings and on the other to continue Shiretoko fishing based on fishing rights. Thereby it is appropriates to outline the way to indemnify for communities in Shiretoko World Natural Heritage Site in three phases as follows:

Ⅰ establish strict fishery resources management system,

Ⅱ adopt administrative fisheries controls as a part of above system,

Ⅲ and allow those whose fisheries rights are injured bringing actions(administrative/ civil) for their damages.

Actually, Shiretoko fisheries management raises our environmental awareness which shift from the amenity improvement stage to the Global Environment Facility stage.

P-12

Why could be small villages inside of dolines in China sustained for centuries?

Tadao Ando [1], Eriko Okada [1], Katsuhiko Demura [2], Toshiaki Tadano [3]

1/Hiroshima University, 2/Hokkaido University,

3/Tokyo University of Agriculture

Among the thousands dolines distributed in the limestone area in Western China, around one thousand of dolines have been inhabited for the past several hundreds years. The very steep limestone walls surrounding the village limited the villagers' activities to exchange materials with the outside of the dolines. There is no river above ground in the villages. Therefore, the villagers have been mostly dependent on the products inside of the dolines including basic life-supporting materials like water and foodstuff.

In order to elucidate the reasons why these life-supporting systems were sustainable for several centuries, we tried to analyze the material-cycling systems in the village in collaboration with the local scientists in China. The followings are the main findings obtained;

1) The solar energy was almost sole source of the energy to support the villagers' lives and activities. They obtained the essential energy from the food (mainly corn, beans and vegetables with occasional intake of meat) and the wood (for fuel and timbering) produced inside of the dolines.

2) Two types of mineral nutrient cycling routes were recognized in the system; the closed cycling route passing mainly fields and rather open cycling route passing through forest. The both route joined in the human life and the nutrients were incorporated in the fields as ash minerals.

3) Since almost all the materials including human bodies were incorporated in the recycling systems, there were not found any waste materials.

4) The people were very diligent and healthy, and passing constant daily life.

Though the way of living is not applicable to the industrialized countries, the fundamentals underlying those findings may be helpful for us to develop a sustainable society.

P-13

Wildflowers in Hokkaido as a natural resources - their conservation, creation, sustainable management, and use-

Tetsuya Kondo, Hajime Matsushima

Research Faculty of Agriculture, Division of Bioresources and Product Science

Although most parts of the mainland Japan have been developed, some areas in Hokkaido with several natural resources still remain. In particular, habitats of wildflower species with beautiful flowers are characteristic and important natural

features in Hokkaido. Some of these habitats have been conserved, and are used as sightseeing destinations or for recreation purposes, already.
In this study, personal interview surveys and field investigations were conducted at nine sites at which are wildflower habitats to determine the site characteristics, vegetation type, maintenance methods used, and utilization patterns.
Five sites were public domain land, two sites were on company-owned land, one site was in the precincts of a Shinto shrine, and one site was on the campus of a university. Most of the plant species that were conserved were spring ephemerals that are peculiar to the Northern region in Japan. Eight sites were managing pre-existing habitats, and one site was managing a habitat created by transplantation of individuals. All the sites were managed by mowing understory once or twice a year during summer or autumn. The duration of mowing ranged from 5-45 years. The site of each habitat of wildflower was used as a sightseeing location, for a stroll, or for nature observations.
We assume that, in Hokkaido, there are many promising wildflower habitats that are being suppressed by competitive species such as Sasa senanensis. We will be able to establish aesthetic wildflower habitats by suitable management of them, and also create new aesthetic wildflower habitats by transplantation of wildflower individuals. Aesthetic wildflower habitats that are maintained sustainably by appropriate maintenance strategies will be useful for a sightseeing location, for a stroll, or for nature observations.
The evaluation of such wildflower communities will be also necessary in the future.

P-14

Sustainable coastal management for recreational use and natural resource conservation: The case of Ishikari Coast, Hokkaido

Hajime Matsushima, Tetsuya Kondo
Graduate School of Agriculture, Hokkaido University

The purpose of this study is to consider and propose sustainable coastal area management method for their recreational use and natural resource conservation. Ishikari coast, 10km long at middle part of Hokkaido, was used by a lot of people for recreational use (e.g. swimming, barbeque, fishing, ATV, PWC) in summertime. Such a concentration of recreational use caused the impact of natural resources and the conflict between recreational users, especially motorized vehicle users and others. This poster resulted in the necessity of future vision and environmental education for sustainable coastal management, which Ishikari coast does not have established yet. Future vision means a framework of decision making for management planning. To establish the vision, application of natural park system were proposed.
Environmental education has great potential to enhance knowledge in the short run and to prompt attitude change in the long run. This research showed that the visitor landscape preferences were different according to their purpose. Such a "gap" may cause the conflict between visitors who have different purpose. This result showed that the effort to fill in the gap, called environmental education (share of the information, sign board, guides, etc.) is important. This poster was concluded that the application of natural park system is suitable to this area for the sustainable coastal management.

P-15

Design Viewed from the Perspective of Sustainalbe Development

Mirei Hagiwara, Nozomi Hokari, Kazuyuki Seino, Shun Niizuma, Masuyo Tokita
Hokkaido Universityy

Design is indispensable to achieve a society that promotes sustainable development. Products surrounding us affect our daily life physically, mentally, aesthetically, economically, and environmentally.
The way we design products reflects our approach to society. In other words, our daily actions and judgments in making and selecting products reflect our society's sense of values.
Therefore, we propose, as an extension of our freshman semiar course entitled "Power of Design", to reevaluate materials indigenous to Japan and re-examine traditional designs and techniques associated with these materials.
Among the various natural materials that will help us return to a "cradle to cradle" society, we will focus on bamboo and diatomaceous earth. We will first analyze their properties and current uses, and then present functional and beautiful designs suitable for these materials. Through the use of daily products made of such natural materials, we will learn to appreciate the beauty that nature bestows on us.

Such happy experiences will raise individual awareness of ecology and encourage responsible social behavior that does not overload our environment.

P-16

Effect and effectiveness of vaccination: pertussis in NZ as the case of sudy

Andrei Korobeinikov
RIES, Hokkaido University

In some cases vaccination is unreliable. For example vaccination against pertussis has comparatively high level of primary and secondary failures.
To evaluate efficiency of vaccination we introduce the idea of effective vaccination rate and suggest an approach to estimate it. We consider pertussis in New Zealand as a case study. The results indicate that the level of immunity failure for pertussis is considerably higher than was anticipated.

P-17

Research and Development of ubiquitous information services for sustainable fisheries operation and management in the offshore around Japan

Sei-ichi Saitoh [1,2], Fumihiro Takahashi [2], Daichi Tachikawa [2,3], Motoki Hiraki [2,4], Masami Yoshida [2,5], Teruaki Hiura [2,5], Hidetada Kiyofuji [6]
1/Laboratory of Marine Bioresource and Environment Sensing, Graduate School of Fisheries Sciences, Hokkaido University, 2/SpaceFish LLP, 3/Fujitsu Hokkaido Systems Limited, 4/GIS Hokkaido Limited, 5/Fujitsu Limited, 6/Joint Institute of Marine and Atmospheric Research University of Hawaii

This paper presents an overview of a newly developed ubiquitous fisheries information system using satellite remote sensing and geographical information system (RS/GIS). The system was developed to aim for providing high value-added fisheries oceanographic information in anytime and at anywhere. We also make this system to come into wide use for especially fishermen and managers in fisheries cooperation or fisheries experimental stations. All users can operate all products dynamically such as overlaying, measuring distance from nearest port or fishing grounds on the GIS. This system can help to support effective fishing activities such as economy with time for fishing ground destination or nearest landing port. This ubiquitous information services promise to promote sustainable fisheries operation and management in the offshore around Japan.

P-18

Organochlorine Pesticide Residues in the Pasture Environment, Meat and Milk of Philippine Buffaloes (Bubalus bubalis) from Angat, Bulacan

Elenanor S. Austria [1], Dr. Evangeline C. Santiago [2]
1/Faculty, Natural Science Department, Adamson University, Manila, Philippines
2/Head, Research and Anayltical Services Laboratory, Natural Science Research Institute, University of the Philipines, Diliman

The levels of OCP residues in environmental samples (soil, sediments, water and forage) as well as in meat and milk of Philippine Buffaloes from Angat and CLSU were determined. From Angat, Barangays Laog and Banaban were chosen because of its history of pesticide use and a preliminary study revealed the presence of several OCP residues. CLSU-PCC was chosen as the pseudocontrol area because although pesticide use was stopped more than a decade ago, contamination of the area cannot be ruled out.
Samples were collected from August 2002 to October 2003 and were taken to the Research and Analytical Services Laboratory of the Natural Science Research Institute (RASL-NSRI), University of the Philippines, for analysis. In the laboratory, soil, sediments and meat samples were extracted with DCM and hexane by Soxhlet apparatus for 8-16 hours. The extract was cleaned up using column packed with fully activated silica. Forage samples (grasses, legumes and feed concentrate) were extracted with acetone by sonication and cleaned up with silica and alumina. Milk samples were extracted with hexane and ethyl alcohol by sonication with reflux. Each sample was spiked with a surrogate standard (teterachloro-m-

xylene), OCP mix and internal standard mix (pyrene-d-10, phenanthrene-d-10) to assess performance of the method. A recovery of 60- 120% was considered acceptable. Method Detection Limits (MDL) was also determined for each compound and was computed based on US EPA method. Levels below MDL were reported as <MDL.

Analysis of water samples revealed residue levels below MDL indicating low levels of contamination. However almost all of the studied OCPs were detected in soil samples from Banaban and Laog with Banaban having the highest amount of contamination, 39.89 μg/kg. It is followed by Laog (37.97 μg/kg) and CLSU (6.48 μg/kg). It is possible that the longer use of OCP in Laog and Banaban than in CLSU resulted to higher level of contamination in soil from these areas.

The contaminants detected in soil samples were also the same contaminants detected in sediment samples. Laog contains the highest amount of contamination (104.20 μg/kg) followed by Banaban and CLSU (51.54 μg/kg and 1.72 μ g/kg, respectively). The higher amount of contamination in Laog sediments may be due to the more intensive use of irrigation in Laog than in Banaban and CLSU.

Analysis of OCP residues in forage samples revealed that endrin ketone was the predominant contaminant being present in all forage samples in high amounts. CLSU feed concentrate was also found to contain higher residue levels than grasses and legumes taken from the three areas. In meat, almost all of the studied OCP were present with the cyclodienes, heptachlor, dieldrin and endrin aldehyde as the predominant contaminants. But although many residues are found in the environment and meat of carabaos, only a few residues were present in milk samples. This may be because body burdens were not high enough to be incorporated in the milk. Comparison with the Codex EMRLs for meat and milk revealed that all of the detected residues were below their respective EMRLs suggesting that it is relatively safe to consume these animal products.

P-19

Determination of the presence of Organochlorine Pesticide Residues in the Einvironment of IPO Dam

Elenanor S. Austria

Faculty, Natural Science Department, Adamson University, Manila

The levels of OCP residues in environmental samples (soil, sediments, water) from Ipo Dam were determined. Samples were collected in September, 2005 and taken to the Research and Analytical Services Laboratory of the University of the Philippines, Diliman. Analysis of the water samples revealed that the levels of all of the studied OCP residues were below the Method Detection Limits (MDL), suggesting very low levels of contamination. In sediments, only residues of endrin aldehyde and endosulfan 2 were detected in Ipo Dam and comparison with the data from Laog , an agricultural community revealed Ipo Dam contained less OCP residues. This study also found out that the levels of OCP residues in sediments were higher in Laog, than in Ipo Dam (total OCP mean concentration: 6.0 ug/kg in Ipo Dam and 67.71 ug/kg in Laog). This may be due to the more intensive use of chemicals and irrigation in Laog. The analyzed soil samples revealed that only residues of endosulfan sulfate was present in soil samples from Ipo Dam. Comparison of the total OCP mean concentration in soil revealed that Laog has a higher amount of contamination than Ipo Dam (16.15 ug/kg in Ipo Dam and 4.24 ug/kg in Laog). Since pesticide use was not allowed in the watershed area, the presence of endosulfan sulfate residues may mean that Ipo Dam has received inputs of the persistent OCP residues from the surrounding agricultural areas.

P-20

21st Century Center of Excellence Program 'Prediction and avoidance of an abrupt change in bio-geoshpere system'

Motoyoshi Ikeda

Faculty of Environmental Earth Science, Hokkaido University

"Global warming by CO2", "ozone depletion", "forest destruction by exploitation" and "pollutants" are not influencing the environment independently. A possible feedback loop is that "Low absorption of CO2 caused by forest destruction" promotes "global warming", and then, "global warming" in turn enhances "forest destruction". They interact each other. Therefore, we need to understand these phenomena as a coupled system and to predict a future change. We are trying to understand and predict the phenomena by clarifying on the basis of bio-geoscience and intercomparison between the high latitude region and the low-to-mid latitude region. Our final objective is to avoid the abrupt change by not controlling nature but helping it from the cycle between natural ecosystem and material circulation.

P-21

The Land Use Changes and Modern Landscape Structure of the Russian-Chinese Transboundary Geosystem

Natalia Mishina
Research Institute of Humanity and Nature (RIHN)

Anthropogenic impacts on the adjacent territories of North-eastern China and the Russian Far East are considerably different. But a number of such territories have similar natural conditions and are the parts of integrated formations - transboundary natural geosystems. Both ecological and economical conditions of every transboundary territories depend on one another. Therefore transboundary territory's researches have large theoretical and practical value for the planning their sustainable development.

The territory of our research is the transboundary low mountain region with common geologic and geomorphologic structure, similar soils, vegetation and climate. The Ussuri River, on which the state boundary of Russia and China passes, divides this territory into two almost equal parts. The Chinese part of the transboundary geosystem is situated in Heilongjiang province, the Russian one is in Primorskii and Khabarovskii krais.

To conduct the ecologic-geographical analysis of the transboundary geosystem, the map of its modern landscapes was compiled, the main features of landscape structure were determined. Statistical economic data and tendencies of resource's use were also analyzed. It allowed us to define the main stages of economic and land use development of Russian and Chinese part of geosystem. Studying of land use changes from 1990 to 2000 showed the major trends of modern landscape transformation and the basic ecological problems in the different parts of the transboundary geosystem. Some measures on improvement of their ecological situation were offered. The obtained data were mapped.

In conditions of deficiency of the unified information about the Russian-Chinese geosystems, the received information is the important basis for further planning of the sustainable territorial development of the near-boundary administrative formations of both countries.

P-22

Global Warming

Lubowa Jafali, Ediriisa Balime, Abdul Ssebulime
Entebbe Environmental Conservators (EEC) Ltd.

Precipitation patterns are likely to change in many parts of the world and globally averaged annual precipitation is projected to increase during the next century, and some regions will experience a decline.

Precipitation changes could lead to further water shortages and affect water quality in some regions of the world. Soil moisture will also be affected. And a cause of an overall reduction in global food production potential due to lack of soil moisture. Effects on climate, rainfall availability hence droughts. So a need to find long term solutions for the uprising threats.

P-23

Germination and growth responses of some key plant species from Horqin sandy land of China to the simulated desertificated conditions

Lijun Chen
Institute of Applied Ecology, Chinese Academy of Sciences

There is little knowledge on the germination and growth response of key plant species in Horqin sandy land, to environmental stress conditions. This study aim to investigate the effects of different temperatures and light intensities on the germination of 7 key plant species, and the influence of interaction of varied nitrogen/phosphorus regimes simulated different degrees of degraded soil on the growth of 4 key plant species grown in desertificated area in Horqin sandy land.

P-24

Effect of Soil chemical and biological properties along a chronosequence of Caragana microphylla plantations in the Horqin Sandy Land, Northeast China

Yonh Jiang

Institute of Applied Ecology, Chinese Academy of Sciences

Soil chemical and biological properties along a chronosequence of Caragana microphylla plantations were studied in the Horqin Sandy Land, Northeast China. Results showed that shrub growth altered microclimate, increased litter input and hence improved soil water holding capacity, organic carbon, total N, microbial biomass C and N, electrical conductivity, soil enzyme activities, soil nematode diversity, and decreased soil bulk density.

P-25

STUDIES ON DYNAMIC CHANGES OF SOIL ORGANIC CARBON UNDER DIFFERENT LAND USE TYPES IN SANJIANG PLAIN

Yi Shi

Institute of Applied Ecology, Chinese Academy of Sciences

The vertical distribution of SOC and the relationships with pH and nitrogen in the marshy soil with different reclamation histories in Sanjiang Plain.

P-26

Decentralized Cooperation for Sustainable Development: Toward Paradigm Shift for International Cooperation Framework

Kumiko Seki

Graduate School of International Media and Communication, Hokkaio University

For many years, nation states have made significant efforts to resolve diversified and complicated global issues in cooperation with international organizations, NGOs and private companies. Despite these experiences, accumulated under existing international cooperation framework, global issues remain unsettled.

Then, what is an effective international cooperation framework to cope with global issues? One alternative framework, decentralized cooperation (cooperation decentralisee), sets out to give us an answer to this question.

Decentralized cooperation is a form of grass-roots international cooperation, institutionalized by French government in 1992, between French municipalities and their counterparts in developing countries. Under this framework, French municipalities offer techniques, knowledge and know-how to their partner cities in almost every field concerning public administration (environment, education, public health, urban and rural development, etc.).

Why have existing international cooperation frameworks failed? One of the main reasons has been insufficient effort aimed at strengthening the basis of democratic public administration systems in developing countries. In other words, without reinforcing self-resolving capacity against local problems, sustainable development of recipient communities can not be assured. In this meaning, decentralized cooperation seems useful for recipient communities, assuring transfer of public administration experience from French municipalities to their external counterparts.

Furthermore, we can remark other advantages of decentralized cooperation, compared with classical international cooperation frameworks: First of all, we can observe a less hierarchical relationship between supplier and recipient of decentralized cooperation. Because, in general, decentralized cooperation is concerned with the benefits of the vast existing sister city network established between French and foreign municipalities, respecting the reciprocal and equal partnership. Secondly, sister city relationships assure also long-term cooperation, one important element for sustainable development. Thirdly, long-term and equal partnership enables French municipalities to reply precisely to local needs, which is often needed by recipient municipalities.

Therefore, decentralized cooperation should be considered as a new paradigm for the international cooperation framework.

P-27

Life Cycle Assessment of Fishery Products - Case studies of Squid and Scallop production -

Kazuhito Watanabe [1], Teisuke Miura [2]

1/Miyagi Prefectual Government, 2/Graduate school of fisheries science, Hokkaido university

It is indispensable to incorporate environmental measures into fishery production process in addition to a resource and economic viewpoint to achieve sustainable fishery. Life Cycle Assessment (LCA) is an important and useful tool to evaluate the environmental effects and potential impacts associated with a product and a service throughout its life span. Up to date, however, few data have been reported concerning the environmental burden of fisheries. In this research, we quantitatively calculated the environmental burden of the entire squid and scallop fishing systems in Hokkaido and assessed the environmental impacts using LCA. Squid and scallop were chosen for this case study because they are important fishery products for the Japanese food supply. Moreover, we suggested the evaluation procedure, while applying LCA to the fishery. As to squid related fishery, squid jigging fishery exhibited the largest environmentally burden, followed by off-shore trawl fishery, and large scale set-net fishery. The results suggested the largest value of the squid jigging fishery was mainly due to the use of fuel oil by fish gathering lamps. As to the scallop cultivation industry, on the other hand, the value indicated the ground sowing method was superior to the hanging method. We demonstrated that LCA was applicable to fishery, and this new methodology was to be useful toward the improvement of the environmental aspects of fishery.

P-28

Rabies in Sri Lanka: Knowledge, attitudes, practices and beliefs among community-dwellers

Matibag GC [1], Kamigaki T [1], Kumarasiri PVR [2], Wijewardana TG [3], Kalupahana AW [3], Dissanayake DRA [3], De Silva DDN [3], Gunawardena GSP DeS [3], Obayashi Y [1], Taniguchi T [4], Sawa H [5], Umemura T [6], Tamashiro H [1]

1/Department of Global health and Epidemiology Division of Preventive Medicine, Graduate School of Medicine, Japan,
2/Faculty of Medicine, University of Peradeniya, Sri Lanka,
3/Faculty of Veterinary Medicine and Animal Science University of Peradeniya, Sri Lanka,
4/Ministry of Healthcare, Nutrition and Welfare, Sri Lanka Japan International Cooperation Agency,
5/Department of Molecular Pathobiology and 21st Century COE Program for Zoonosis Control Hokkaido University Research Center for Zoonosis Control, Sapporo, Japan
6/Department of Vetarinary Clinical Sciences, Graduate School of Veterinary Medicine, Hokkaido University, Japan

[Background]
Although Sri Lanka had adopted its national program for the elimination of rabies during the mid-1970s, this fatal disease still remains endemic in all provinces.
Objective
To assess the knowledge, attitudes, practices and beliefs of the study population about rabies.
[Materials and Methods]
This cross-sectional study, performed on 8-25 May 2006, utilized in-person interviews using structured and pre-tested questionnaires in the urban, rural and estate sectors of Kandy District, Central Province. After randomized selection, the sample consisted of 6,925 persons from 1,570 households of the 26 survey areas, which represented 0.5% of the population of Kandy District.
[Findings]
Most respondents knew that dogs are the most common reservoirs in Sri Lanka (90%) and that rabies is a fatal disease (79%). Eighty-eight percent knew that rabies could be prevented by regular animal vaccination while nearly half knew the universal pet registration law (55%). Majority preferred to seek treatment from physicians if bitten (95%) while the most common reason for not consulting was the distant location of health practitioners (49%). Although most pet dogs were vaccinated (76%), only 44% of immunization cards were shown during the interview. Ninety-three percent would send their pets for free immunization, however, 46% would send them immediately and 40% would send upon respondents' time availability. Although only 43% were aware that the head of the suspected animal should be sent to diagnostic laboratories for confirmation, 58% were willing to send the specimen. While 85% favored animal population control, common reasons against it were personal beliefs (44%) and religion (38%). Most pet dogs were fed more than 3 times per day (85%) and were free-roaming (33%).

[Discussion and Conclusion]
Public health education, awareness and advocacy are vital for disease eradication. Intensified animal welfare programs and responsible pet ownership, especially in inaccessible areas, would be most valuable to increase community participation.

P-29

Rabies in Sri Lanka: Assessing health-seeking behavior following animal bite injuries

Matibag GC [1], Kamigaki T [1], Kumarasiri PVR [2], Wijewardana TG [3], Kalupahana AW [3], Dissanayake DRA [3], De Silva DDN [3], Gunawardena GSP DeS [3], Obayashi Y [1], Taniguchi T [4], Sawa H [5], Umemura T [6], Tamashiro H [1]
1/Department of Global health and Epidemiology Division of Preventive Medicine, Graduate School of Medicine, Japan,
2/Faculty of Medicine, University of Peradeniya, Sri Lanka,
3/Faculty of Veterinary Medicine and Animal Science University of Peradeniya, Sri Lanka,
4/Ministry of Healthcare, Nutrition and Welfare, Sri Lanka Japan International Cooperation Agency,
5/Department of Molecular Pathobiology and 21st Century COE Program for Zoonosis Control Hokkaido University Research Center for Zoonosis Control, Sapporo, Japan
6/Department of Vetarinary Clinical Sciences, Graduate School of Veterinary Medicine, Hokkaido University, Japan

[Background]
Although Sri Lanka had adopted its national program for the elimination of rabies during the mid-1970s, this fatal disease still remains endemic in all provinces with an annual dog bite incidence of 2,000/100,000 and human deaths at 4/100,000. Data on health-seeking behavior after animal bites have not been properly studied at the community level.
Objective
To establish the benchmark data on medical care-seeking behavior and treatment compliance among animal bite victims in selected localities of the Central Province, Sri Lanka.
[Materials and Methods]
This cross-sectional study, performed on 8-25 May 2006, utilized in-person interviews using structured and pre-tested questionnaires in the urban, rural and estate sectors of Kandy District, Central Province. After randomized selection, the sample consisted of 6,925 persons from 1,570 households of the 26 survey areas, which represented 0.5% of the population of Kandy District.
[Findings]
A total of 357 animal bite cases (5,155/100,000) and 2 cases of rabies deaths (29/100,000) have been encountered 12 months prior to the survey. One was a documented case while the other died at home. Eighty-eight percent of injuries fell within 6 to 64 years of age (mean: 33.84 years; 95% CI: 31.73-35.95). Bites in males (54%) were more than in females (46%). Bites on the legs and feet were the most common (60%). Dogs were the most frequently attacking animals (93%) and were mostly pets (75%) that were previously vaccinated (53%). Half the cases occurred at home. Most patients have consulted physicians for treatment (96%). Most patients (86%) received post-exposure vaccine less than five times upon physicians' advice (50%) and upon observation that the animal remained healthy and with prior immunization history (9%).
[Discussion and Conclusion]
Our results showed that the incidence of annual animal bites and human rabies are well above the reported national average. It is of paramount importance to carefully examine the existing surveillance and reporting systems. We highlight the importance of universal registration and immunization coverage especially for owned pets to prevent potential rabies transmission.

P-30

Environmental Impact on Wildlife

Mayumi Ishizuka, Kentaro Sakamoto, Shoichi Fujita
Graduate School of Veterinary Medicine, Hokkaido University

Chlorinated / brominated persistent toxic substances (PTS), such as polychlorinated, -dibenzo-p-dioxins, -dibenzofurans, -biphenyls, -organochlorine pesticides, hexachlorobenzene, 2,2-bis(p-chlorophenyl)-1,1,1-trichloroethane (DDTs), hexachlorocyclohexane and -brominated diphenyl ethers, are ubiquitous contaminants in the environment. Due to the high lipophilicity / resistance to biological degradation, wildlife animals and humans accumulate notable levels of them through food chain. Our research subject is to elucidate the biological effects of these environmental pollutants on wildlife, such as crabs, fishes, birds and mammalians.

Especially, we detected the high level of PTS accumulation in top predators, e.g., seals, Steller's Sea Eagle and White-tailed Sea Eagle. The residues of PTS caused the suppression of thyroid hormone and induced xenobiotic metabolizing enzyme, which was biomarker enzyme for the contamination of planar compounds.

In the meantime, until to day, there is few document reported contamination of PTS in terricolous wild animals. Norway or Brown rats (Rattus norvegicus) inhabit over world especially close to human population. The Brown rats are useful indicator for the effects of environmental contamination on land-wildlife due to their position in food-chain. In recent study, we found the high concentration of PTS in liver of wild Brown rats, and the contaminants affected the gene expression profiles in testis and liver.

We concluded that our environment is polluted enough to find animals with altered hormone levels.

P-31

Sustainability cannot be realized without the Environmental Governance and the Participation of Indigenous Peoples

Yugo Ono

Graduate School of Environmental Science, Hokkaido University

Sustainability is a concept which postulates the environmental safety over the generations. If the environment is destroyed for the convenience of the present life, it is not sustainable. This corresponds to the idea of the Native American's saying that the Earth is not the heritage from the Ancestor, but we rent it from the future generation. Although the sustainability is a global concept, we have to act locally to realize it. Here I will take two cases in which we are acting in Hokkaido as environmental scientists to realize the sustainability of our planet.

1: Conservation of natural river ecosystem

The natural river is rare even in Hokkaido where the dam construction and all kinds of concrete works have destroyed the natural river ecosystem especially the migration of salmonids through the 20th century. Hokkaido Development Agency has planned the construction of a big dam (46m high, 300m wide) in the Sanru, a tributary of the Teshio, the second longest river in Hokkaido. The dam not only cuts the migration but breaks the spawning habitat of cherry salmon which is important fishing resources. Major purposes of dam construction are flood control, power generation and water supply. But they are satisfied by alternative ways which do not destroy the environments. Free and open discussion is needed to evaluate the alternatives, but it is not realized by the policy of Hokkaido Development Agency. Change of the decision making system is necessary for such environmental issues. Environmental governance is urgently introduced.

2: Participation of Indigenous Peoples

Sustainability cannot be realized in a society where the equality is not certified. The Ainu, the indigenous people in Japan, is still in the position not equal to the other Japanese people. They lost the rights of caching salmon, shooting brown bears and deer, and land rights. Public education of their language has never been done for a long time. Their land names of the Ainu language have been changed to the Japanese. Recovery of the Ainu's rights and culture should not be neglected when we talk of sustainability.

P-32

Amur-Okhotsk Project 2005-2009

Takayuki Shiraiwa

Research Institute for Humanity and Nature

Recent studies in the northern North Pacific have revealed that biological productivity was limited by iron availability there. Because iron can be hardly dissolved in water, phytoplankton largely relies on the iron supply from land via the atmosphere and/or rivers. In contrast to the central region of the northern North Pacific, the phytoplankton productivity is very high in the Sea of Okhotsk, probably due to the sufficient supply of iron from the Amur River. Riverine iron cannot keep dissolved in the seawater without being a complex with humic substances created in forest and wetland. Therefore, changes in land uses on the Amur basin such as deforestation, forest fire, cultivation, urbanization and/or reduction of wetland may reduce the biological productivity in the Sea of Okhotsk and the northwestern area of North Pacific Ocean.

In this project, we try to answer the following questions; 1) how large is the discharged flux of materials such as iron from the Amur River, how far the iron is transported offshore and to what extent the iron is contributing to the biological productivity in the Sea of Okhotsk; 2) what are the factors controlling the release of materials such as iron from the land to the Amur River in the natural and/or artificially altered land surface conditions in the Amur basin; 3) to what extent the economic and political systems around Northeast China and Far East Russia change the land uses in the Amur basin in the past, present and future; 4) how variable are the water and material cycles around the Amur basin and the Sea of Okhotsk in the natural conditions.

P-33

A Lower Trophic Ecosystem Model Including Iron Effect in the Okhotsk Sea

Takeshi Okunishi

Graduate School of Engineering, Hokkaido University

The Okhotsk Sea is one of the most biologically productive regions in the world, and it supports high fisheries production. The micronutrient iron plays a key role in limiting phytoplankton growth rates and structuring plankton communities over much of the world ocean. Recent studies have shown that iron is an important factor controlling phytoplankton in the western subarctic Pacific Nitrate is depleted after the spring phytoplankton bloom in the Okhotsk Sea. This fact suggests that iron supply is higher in the Okhotsk Sea than in the western subarctic Pacific and, that phytoplankton growth is not limited by iron availability in the Okhotsk Sea. However, it is not well known whether iron limits phytoplankton growth or not, or what is the main source of iron in the Okhotsk Sea. We applied a three dimensional ecosystem - physical coupled model including iron effect to the Okhotsk Sea. In order to clarify the sources of iron, four iron compartments were added to Kawamiya et al. (1995)'s model (KKYS) to create our ecosystem model (KKYS-Fe). We hypothesized that four processes supply iron to sea water: atmospheric loadings from Northeastern Asia, input from the Amur River, dissolution from sediments and regeneration by zooplankton and bacteria. We simulated 1year, from 1 January, 2001 to 31 December, 2001, using both KKYS-Fe and KKYS. KKYS could not reproduce the surface nitrate distribution after the spring bloom, whereas KKYS-Fe agreed well with observations in the western subarctic Pacific because it includes iron limitation of phytoplankton growth During spring bloom, the main source of iron at the sea surface is from the atmosphere. The contribution of riverine iron to total iron utilized for primary production is small in the Okhotsk Sea. Atmospheric deposition, iron flux from sediment and regeneration of iron in water column play an important role in maintenance of high primary production in the Okhotsk Sea.

Keywords: ecosystem model, Okhotsk Sea, phytoplankton, iron, primary production

P-34

Evaluation of the impact of water dilution within the eutrophic Lake Barato, Japan

Ryuichiro Shinohara

Graduate School of Engineering, Hokkaido University

Lake Barato is a eutrophic and subarctic 4.37 km2 lake in Hokkaido, Japan. This lake is an oxbow lake that was isolated from the Ishikari River following the development of flood-protection measures on the river. Although environmental criteria for water quality in Japan are defined as total nitrogen (TN) less than 71 ?mol L-1 and total phosphate (TP) less than 3.2 ?mol L-1, levels in Lake Barato exceed these standards by a factor of three (TN: 229 ?mol L-1; TP: 6.3 ?mol L-1). To dilute eutrophic water in Lake Barato, an Inlet Project was carried out during the summer of 2005 via a 1 m3 s-1 inlet from the Ishikari River. In this study, field data and three-dimensional numerical simulations are used to evaluate the impact of water dilution on eutrophication. River water was discharged from the margin of the upper section of the lake to dilute the water. We undertook a numerical simulation of total nitrogen (TN) and total phosphate (TP) distribution and its impact on the emergence of cyanobacteria considering five inlet cases. Model results suggest that the most effective and feasible way to achieve dilution is via a 5 m3 s-1 inlet and open the Shinko Gate, which connects the lake and Ishikari Bay through the channel. Following this scheme, TN and TP concentrations were reduced by 28% following 30 days of discharge according to the simulation results.

Keywords: Lake Barato, dilution of a eutrophic lake, numerical model

P-35

COMPARISION OF PERFORMANCE AND MEMBRANE FOULING CHARACTERISTICS BETWEEN PRESSURIZED AND SUBMERGED PVDF MICROFILTRATION MEMBRANES

So-Ryong Chae

Graduate School of Engineering, Hokkaido University

As a means of complying with current and anticipated regulations, membrane technologies have been widely adopted in the world. Especially, the low-pressure driven membrane techniques such as microfiltration (MF) and ultrafiltration (UF) have attracted a considerable amount of attention in drinking water treatment to remove particulate by size exclusion and usually produce a filtrate free of turbidity and bacteria from river, lake, and underground waters.

There are two different configurations (i.e. pressurized and submerged modules) of membrane filtration technology. Submerged module has become a major feature in wastewater application of membrane technology. Many researchers reported that this module remarkably reduced the power consumption of recirculation pumps used in a membrane bioreactor. However, there were no available reports comparing the pressurized and submerged membrane modules in water treatment. The goal of this study was to compare process performance and fouling characteristics between pressurized and submerged PVDF (polyvinylidene fluoride) hollow fiber membranes having 0.1? nominal pore size (MicrozaR, Asahikasei Chemical co., Japan) treating Chitose River water having relatively high turbidity and humic substances under the same operating conditions (permeate flux of 0.65 m/d, recovery rate of 92%, and physical cleaning using permeate and the compressed air for 90 s).

As a result, turbidity (100%), Al (> 84%), and Fe (> 95%) were removed very well by both membrane modules. However, humic substances and Mn were not effectively removed by the membranes. On the other hand, different fouling characteristics of the two membranes were observed during the experimental period.

In case of the submerged membrane, fouling could be effectively mitigated by backwashing and air scrubbing. In contrast, fouling of the pressurized membrane could not be easily recovered once it increased rapidly. Focused on this point, characteristics of foulants in both membranes were studied. As a result, it was found that relatively large amounts of organic matter (especially carbohydrates and humic substances) and Fe were extracted from the cake layer of the pressurized membrane than that of the submerged membrane.

In addition, from the surface analysis, it was observed that the cake layer formed on the pressurized membrane surface was intensely smoother and thicker than that formed on the submerged membrane surface. Finally, it was recognized that interaction between organic matters and Fe in the pressurized membrane improved significantly the cake compressibility and stability deteriorating membrane fouling.

Keywords: drinking water treatment, pressurized and submerged modules, PVDF, membrane fouling, surface analysis

P-36

Development of a super high-rate ANAMMOX reactor and in situ analysis of biofilm structure and function

Ikuo Tsushima

Graduate School of Engineering, Hokkaido University

The anaerobic ammonium oxidation (ANAMMOX) process is a new efficient and cost effective method of ammonium removal from wastewater. Under completely anoxic conditions ammonium is oxidized with nitrite as electron acceptor to dinitrogen gas and small amounts of nitrate. This process has many advantages as it demands no oxygen and no organic carbon source and produces small amount of sludge and could make the reactor footprint smaller than that of conventional systems. However, it is difficult to cultivate the ANAMMOX bacteria due to their low growth rate (the dabbling time is approximately 11 days). This indicates that rapid and certain start-up of ANAMMOX process is apparently the key to practical application. However, there is still little information on the efficient screening method of appropriate seeding sludges for ANAMMOX process. Therefore, in order to screen a good seeding sludge for the ANAMMOX process, we developed the real-time quantitative polymerase chain reaction (RTQ-PCR) assay with newly designed primers for the quantification of the ANAMMOX bacteria in the sludge. Thereafter, we successfully obtained a seeding sludge with high abundance of ANAMMOX bacteria and inoculated this sludge into an upflow anaerobic biofilter (UAB). The UAB was operated for more than one year, and the performance of ANAMMOX process was monitored. As a result, we successfully achieved the highest nitrogen removal rate of 26.0 kg-N/m3/day, which has never been reported. In addition, the

ecophysiology of ANAMMOX bacteria (spatial distribution and in situ activity) in biofilms was analyzed by combined use of a full-cycle 16S rRNA approach and microelectrodes to be improved and stabilize the performance. As a result, the microelectrode measurement clearly revealed that a successive vertical zonation of the partial nitrification (NH_4^+ to NO_2^-), ANAMMOX reaction, and denitrification was developed in the biofilm in the UAB. This result agreed with the spatial distribution of corresponding bacterial populations in the biofilm. The coexistence of ammonium oxidation bacteria (AOB), ANAMMOX bacteria, and denitrifiers gives mutual advantages, such as that AOB and Eubacteria give the ANAMMOX bacteria an advantage by consuming dissolved oxygen and organic matter derived from ANAMMOX reaction. We will link micro-scale information (i.e., single cell and/or biofilm levels) with meso-scale information (i.e., the reactor level) to understand the details of ANAMMOX reaction occurring in this UAB.

Keywords: ANAMMOX, RTQ-PCR assay, a full-cycle 16S rRNA approach, microelectrodes.

P-37

SUBCRITICAL CRACK GROWTH IN ROCK

Yoshitaka Nara
Graduate School of Engineering, Hokkaido University

Knowledge of the time-dependent properties of deformation and fracture behaviors in rocks is essential to ensure the long-term stability of structures in rock mass, such as underground power plants or sites for radioactive waste disposal. Subcritical crack growth is one of the main causes of the time-dependent behaviors in rocks. Under low homologous temperatures and atmospheric pressure, stress corrosion is the main mechanism of subcritical crack growth in rocks. In silicate rocks, stress corrosion is a weakening process due to a chemical reaction between the siloxane bond structure near the crack tip and water. The author has studied subcritical crack growth in rock and investigated the effects of surrounding environment and rock fabrics on subcritical crack growth.

The relation between the crack velocity and the stress intensity factor was determined by using a fracture mechanics testing method called "Double Torsion (DT) method" and effective agents on subcritical crack growth in rock were investigated. It was shown that subcritical crack growth in granite was anisotropic and affected by the preferred orientation of pre-existing micro-cracks. When the crack growth occurred in the direction parallel to the plane in which the density of pre-existing micro-cracks was the highest, the crack velocity at the same stress intensity factor was the highest in the same environmental condition. Dependence of the crack growth on the water vapor pressure was clarified in air. The crack velocity at the same stress intensity factor increased with increasing the water vapor pressure. It was also clarified that the crack velocity at the same stress intensity factor and temperature was higher in water than in air.

Preparing thin sections from the rock specimens used for DT test and observing the crack paths, the relation between the geometry of the crack path and the crack growth behavior was investigated by the fractal analysis. It was clarified that the density of pre-existing micro-cracks affected strongly the geometry of the crack path.

Subcritical crack growth was also observed for micro-cracks by raising the temperature and relative humidity of surrounding environment. By the measurement of P-wave velocity in granite with the change of temperature and humidity, the decrease of P-wave velocity was observed when the relative humidity increased under high temperatures. This result is due to the stress corrosion crack growth for micro-cracks.

From this study, the effects of environment and rock fabrics on subcritical crack growth have been clarified quantitatively.

Keywords: subcritical crack growth, stress corrosion, Double Torsion method, preferred orientation of micro-cracks, water vapor pressure, crack path.

P-38

MICROBIAL COMMUNITY ANALYSIS IN PILOT-SCALE MEMBRANE BIOREACTORS TREATING DOMESTIC WASTEWATER

Yuki Miura

Graduate School of Engineering, Hokkaido University

Membrane separation technology is increasingly becoming an important innovation in biological wastewater treatment. Membrane fouling particularly biofouling, is a major factor affecting the efficient and economic operation of membrane bioreactors (MBRs) and properties of biomass (sludge) in the MBR. We therefore, analyzed the microbial community structure of pilot-scale submerged membrane bioreactors treating municipal wastewater by applying a full cycle of 16S rRNA approach including clone library analysis and fluorescence in situ hybridization (FISH) and related to membrane fouling. FISH analysis revealed that the population Chloroflexi, belonging to subdivision 1 and 3, accounted for ca. 24% of total bacteria present in the mixed liquor, and they seem to be a key player in formation of microbial flocs and in degradation of soluble microbial products derived from biomass decay in the MBR. When the population of Chloroflexi decreased, soluble polysaccharide concentrations increased and trance membrane pressure (TMP) also accordingly increased. We further conducted the identification and characterization of this group of bacteria by using microautoradiography combined FISH (MAR-FISH) analysis. It was found that Chloroflexi was able to uptake N-acetyl-[1-14C] D-Glucose (NAG) as a major constituent of bacteria cell wall peptidoglycan and lipopolysaccharide. This implied that they were terminal organic degraders (scavengers) of dead biomass.

In addition, we observed the biofilm attachment and growth on the hollow fiber membrane surface by the SEM, Live/Dead staining and FISH anlysis. The number of active bacteria attached on the membrane surface increased with time, resulting in an increase in TMP. FISH analysis revealed that this biofilm was composed of mainly Betaproteobacteria, accounting for ca. 70% of total bacteria in the biofilm. Furthermore, we analyzed the microbial community structure in this biofilm by 16S rRNA gene clone libraly analysis followed by FISH. In the clone library, most of the clones belonged to only two bacterial lineages: Betaproteobacteria (detection rate; 32/47) and Gammaproteobacteria (detection rate; 8/47), which agreed with the result of FISH analysis. This biofilm microbial community structure was complete4ly different from that in the suspended mixed liquor sample. This indicate that bacteria belonging to the Betaproteobacteria have a special ability to attach to the membrane surface and form mature biofilms.

Keywords: Membrane Bioreactor (MBR) ; membrane fouling ; biofouling ; microbial community ; Chloroflexi ; Proteobacteria ; Fluorescence in situ hybridization (FISH).

P-39

Development of mathematical model for a landfill cell

Sang Yul Kim

Graduate School of Engineering, Hokkaido University

Many studies have been done in laboratory scale or even field scale experiments to obtain detailed information on the fate and transport of pollutants from municipal solid waste (MSW) landfills. However, such studies can only get a result for a specific set of parameters. In this regard, a numerical model can be a powerful tool to understand the behavior of pollutants according to various conditions: time scales, the type of waste, the dimensions of landfill, landfill structure as well as climatological conditions.

In past years, most landfill models were to simulate organic-rich landfills, so these models have addressed the fate of carbon compounds such as acetate, CO2, CH4. And solid calcium carbonate (CaCO3(S)) has been generally used as main buffer mineral in landfill. However, Japan has promoted the incineration of MSW over 30 years. Consequently, the quality of landfilled wastes has been changed from organic waste to inorganic wastes such as incineration residues.

Therefore, we developed a mathematical model of the fate and transport of pollutants from inorganic-rich MSW landfills as well as organic-rich MSW landfills. For this, we considers the precipitates of CaCO3(S), Ca(OH)2, and CaSO4(S) as main buffer mineral in landfills.

Our model is based on compartment model (or a box model), in which one compartment represents a unit cell of the landfill. This allows simulation of a landfill of various cells by using different parameters values in different landfill cells. In addition, the model is able to switch anaerobic conditions into aerobic conditions and vice versa, depending on the local

oxygen concentration. Furthermore, the influence of environmental factors, such as moisture content, pH, and temperature on reaction rates has been also incorporated.
Although the validation of model parameters is needed by applying to various field data, simulation results show a typical pattern of biogas and leachate composition as observed in actual landfill sites. In the near future, the model is scheduled to be improved by validating model parameters with field data, by including chemicals such as heavy metals and dioxins, and by expanding the one cell model to a multi-cell model to simulate actual landfilling operations and different structural designs.

Keywords: mathematical model, landfill, pollutant, simulation, municipal solid waste (MSW).

P-40

HUMAN DNA MICROARRAY ANALYSES FOR THE EVALUATION AND DIFFERENTIATION OF HEAVY METAL TOXICITY

Koji Kawata
Graduate School of Engineering, Hokkaido University

Current approaches to risk assessment of toxic chemicals focus on a single end point and are inadequate for the evaluation of environmental water including a large number of unspecified substances. DNA microarray technology, which makes it possible to analyse chemically induced alteration of gene expression, has become an important technique in toxicology and may provide new multiple bioassay method for detection of environmental chemicals. In this study, we evaluated and differentiated the toxicity of seven heavy metals on the basis of tentative elemental toxicity: oxidative stress, protein denaturation, and carcinogenesis through a comparison of the gene expression profiles in human hepatoma cell line, HpG2. Using 8795 gene array, gene expression changes following high-dose exposures (60-80% cell viability after 6 hr treatment) of arsenic, cadmium, mercury, chromium, nickel, antimony or manganese were examined along with those of model chemicals: hydrogen peroxide (oxidative stressor), phenol (protein denaturing agent), 12-O-tetradecanoylphorbol-13-acetate (TPA, tumor promoter), dimethylnitrosamine (DMN) or mitomycin C (MMC, tumor initiator). As the result of t-test with p<0,05, a total of 1230 genes with treatment : control ratios ? 2.0 or ?2.0 were identified. The hierarchical clustering analysis showed that gene expression profiles after exposure of five heavy metals (As, Cd, Hg, Cr, Mn) were closely related to that of H2O2, while the expression patterns induced by Ni and phenol were grouped together. These results suggested that high-dose exposure of five heavy metals and Ni induce oxidative stress and protein denaturation respectively. We further examined the dose-dependent toxicity of arsenic. The gene expression pattern induced by low-dose (78% cell viability after 48 hr exposure) arsenic was significantly different from high-dose exposure and closely related to three carcinogens (TPA, DMN, MMC). Thus, comparison of gene expression profiles, using DNA microarray allowed us to evaluate and differentiate heavy metal toxicity. This method has potential for predicting the major toxicities caused by chemicals in water environment and will provide information about toxic risks in humans.

Keywords: DNA microarray, heavy metal, oxidative stress, protein denaturation, carcinogenesis.

P-41

Recovery of nitrogen from source separated feces and urine in onsite wastewater differentiable treatment system

Shinya Hotta
Graduate School of Engineeing, Hokkaido University

Source separation of feces from urine has been studied to improve the present issues in Bio-toilet system that is the key technology in Onsite Wastewater Differentiable Treatment system (OWDTS). We need to apply urine diverting composting toilet system (UDCTS) to treat human waste in OWDTS. Source separated feces is treated in the sawdust matrix as conventional. Source separated urine is stored in urine storage and treatment unit (USTU). It is still not studied well in literatures how we recover the nitrogen from feces and urine in UDCTS. The aim of this study is to provide basic knowledge and to contribute the discussion for the nitrogen recovery from human waste in decentralized wastewater treatment system.
We have two topics in this study: Topic 1) we need to characterize feces nitrogen in the composting material for a control

of the recovery rate of nitrogen. Topic 2) the hydrolysis of urea in stored urine should be controlled for higher recovery rate of nitrogen. Urea hydrolysis proceeded by the activity of urease producing bacteria (UPB) from feces. We therefore focused on the fate of the UPB by feces contamination in the toilet bowel in UDCTS. The UPB in contaminated urine by feces (2g-feces/l-urine) was indirectly estimated: the UPB was described by ammonification rates. According to the theory for enzyme reaction, ammonification rate could be determined by three factors without inhibition factor: reaction temperature, concentration of urea and concentration of the UPB.

It was cleared that feces contained the 75% of NXS (biodegradable) and 25% of NXI (originally inert), and 9% of NXIB (inert produced by endogenous respiration) respectively. We therefore concluded that approximately 34% (sum up of NXI and NXIB) of feces nitrogen can be recovered from the composting toilet. We found that the urea hydrolysis depended on the UPB concentration and effect of inhibition factor. However it was not cleared nitrogen recovery rate from stored urine. We still need to study the inhibition factor by NH_3(aq) for the UPB to control the urea hydrolysis for stable condition in stored urine.

Keywords: nitrogen recovery, composting toilet, source separation, nitrogen transformation during the composting process, urea hydrolysis

P-42

Development of the prediction models of concrete structure for structural performance during service life

Kiyofumi Kurumisawa

Graduate School of Engineering, Hokkaido University

The objective is constructing the deterioration model of the concrete structure. Moreover, the durability of the concrete structure that will be constructed in the future is predicted, and an appropriate design and the repair time are clarified. It approaches from the materials level that composes concrete. The deterioration prediction model from the microstructure model with the cement-based materials is constructed, and it proposes the best material and the design for construction. Especially, the permeability and diffusion of the cement-based materials that greatly influences deterioration is examined, and the mechanism is clarified from microstructure.

For this purpose, the technique that the amount and the distribution of each phase in hardened cement paste is evaluated by using backscattered electron image and the element image measured by energy dispersive X-ray analysis, was developed. Moreover, it was also cleared the microstructure of cement paste mixed with fly ash and the blast furnace slag applying this technique. In addition, the technique for predicting the elastic modulus by using the phase distribution image was developed. And the technique that the amount and the distribution of pores in hardened cement paste are evaluated by using Gallium intrusion method with electron probe microanalysis, was developed. It is cleared that chloride penetration depth of hardened cement paste is evaluated by this method.

To evaluate the amount of chloride in a concrete structure existing by nondestructive because the deterioration diagnosis of an existing building is very important, we developed the prediction method of the difference of the amount of chloride contained in concrete by using the spectrum analysis of the received waveform of the electromagnetic radar.

Keywords: Concrete structure, Durability, Microstructure, Hydration, Transport, Elastic behavior

P-43

Development of analytical model for predicting deterioration process coupled with heat, moisture and substances transfers and chemical reactions of various concretes

Yoshihiko Kishimoto

Graduate School of Engineering, Hokkaido University

Neutralization of concrete occurs as a result of CO_2 gas from the air dissolving in the absorbed water, which contains alkaline substances such as $Ca(OH)_2$. Therefore, the ad- or absorbed water is essential to neutralization, and the rate of the neutralization strongly depends upon the moisture regime. When a concrete wall is exposed to rain, it is generally believed that the neutralization is slow because CO_2 gas cannot diffuse into concrete. Although rain is assumed to be pure water, rain in Japan is usually acid with a pH of less than 5.6. In this situation, neutralization may proceed faster because CO_2

has already dissolved in the atmosphere, and the acid substances can move due to advection of the solution.
From this point of view, permeability is one of the most important parameters in discussing the neutralization of a concrete wall. Furthermore, if the permeability varies depending upon the position in the wall, the neutralization rate may also differ from place to place.
In this study, the permeability of concrete was measured at atmospheric pressure in order to clarify the vertical distribution. The measured result in a test piece with 20 cm height showed clearly a non-uniform vertical distribution of the permeability. The water permeability in the upper part was about two times larger than that in the center part.
Next, a neutralization process in a small-scale concrete wall was simulated under cyclic infiltration of rain and drying, with an assumed vertical distribution of water permeability. The results showed that neutralization was accelerated due to acid rain in regions with a high permeability and retarded in regions with a low permeability. Thus, it can be concluded that the influence of acid rain on neutralization process may differ depending on the position in concrete structure.
After this, proposed analytical model will be extended for application to concrete treated with silane agent, and recycled concrete.

Keywords: concrete, durability, water permeability, advection, chemical reaction

P-44

Feasibility Study of a Low Energy System Utilizing Urban Exhaust Heat With Ground Water as Medium of Thermal Transport

Takao Katsura
Graduate School of Engineering, Hokkaido University

In order to recreate utilizable water resource and maintain area based society, it is necessary to establish small-sized sewage-disposal plants, which can release treated sewage into closed-hand area. In addition, it is possible to utilize exhaust heat from black water by construction of the sewage-disposal plants. As the method, for example, a system utilizing ground water as medium of thermal transport, which cultivates treated sewage into the ground and recovers the exhaust heat in the downstream, is suggested. Since there are a lot of heat demand for heating and hot water supply, to construct such a system is effective from the viewpoint of energy saving, especially cities in the cold region like Sapporo.
In this paper, in order to evaluate the system, a method to calculate ground temperature with ground water flow s shown based on comparing the thermal response for cylindrical heat source calculated by numerical calculation with one for line heat source calculated by the moving line heat source theory.
Next, the outline of the system is proposed and the feasibility study is carried out with the tool including developed method.

Keywords: Urban Exhaust Heat, Ground Thermal Energy System, Feasibility Study, Design Method, Ground Water Flow

P-45

OPTIMAL SPEED LIMIT BY COST ANALYSIS

Suthipun Thanesuen
Graduate School of Engineering, Hokkaido University

This study is aimed at determining the optimal speed limit for dry summer conditions on Hokkaido roads by using cost analysis including the effects from traffic signal intensity and traffic congestion. In the cost analysis, the components that were involved include time cost, vehicle operating cost, pollution cost, and accidental cost. The unit here was in yen per kilometer per day. Initially, traffic volumes on Hokkaido roads were determined. Then, the relationships between average speed and each cost component was calculated. After that, the summations of overall costs of each average speed were verified so that the optimal average speeds were obtained from the minimum total costs. Then, the effects from traffic signal intensity and traffic congestion were required to calculate the optimal speed limit from the optimal average speed. Finally, the optimal speed limits were obtained, i.e. 60 km/h on urban national highways, 70 km/h on rural national highways, and 90 km/h on urban and rural expressways. This is in contrast to the current existing speed limits of 50 km/h on urban national highways, 60 km/h on rural national highways, and 80 km/h on urban expressways and 100 km/h on rural

expressways. In conclusion, it was shown that traffic congestion had less of an effect on average speed due to the low traffic volume of Hokkaido roads. From the cost analysis, time costs and accidental costs had major effects on the results. As the cost analysis included all major components for determining optimal speed limit, these new speed limits can contribute towards improved road safety, increased energy efficiency and a healthier roadside environment. Eventually, as a practical measure, public hearings are necessary to support the new speed limits which are also included in the further study.

Keywords: optimal speed limit, cost analysis, traffic signal intensity, traffic congestion

P-46

Characteristics of irreversible membrane foulant in Ultrafiltration of surface water

Hiroshi Yamamura
Graduate School of Engineering, Hokkaido University

Water treatment using microfiltration (MF)/ultrafiltration (UF) membranes are gaining in popularity all over the world. Although use of membranes in drinking water treatment has various advantages, a major drawback associated with this technology, membrane fouling, has not been addressed yet. Membrane fouling can be divided into two types: reversible fouling and irreversible one. The former can be defined as the fouling that can be cancelled by physical membrane cleaning, whereas the latter needs chemical membrane cleaning to be canceled. Currently, there is still a lack of information as to which constituents contained in feed water would cause irreversible fouling and therefore it is not possible to establish an efficient way to prevent it. In this study, to obtain the information about the constituents that would cause irreversible fouling in/on Polyacrylnitrile membrane (molecular weight cut-off: 100,000 Da), pilot studies were conducted for 30 days from the beginning of October, 2005. As expected, the development of irreversible fouling was observed in increase in trans-membrane pressure in spite of conducting the physical cleaning routinely. After 30 days of continuous operation, to elucidate what constituents caused the irreversible fouling, membrane specimens were taken out from the pilot unit and various types of chemical cleaning were examined. A series of chemical cleaning demonstrated that acid or chelate worked better in flux recovery, whereas sodium hydrate was not effective. This result implied that irreversible fouling might mainly induced by inorganic matter. Based on the chemical analysis, HCl extracts contained a large amount of iron. Consequently, it was found that one of the major foulant that caused irreversible fouling in this study was iron. Also interestingly, not only iron but also a large amount of organic matter was desorbed by HCl solution. The FTIR spectra of the foulants contained in HCl solution exhibited a large carbohydrate peaks around 1080 cm-1, which indicated that carbohydrate could be pointed out to be one of the major foulant as well. Therefore, it could be considered as fouling mechanisms that (1) complexes of iron and carbohydrate plug the macropores or (2) iron and carbohydrate accumulated on/in the membrane, respectively.

Keywords: Ultrafiltration, Irreversible membrane fouling, iron, carbohydrate

P-47

LIFE PREDICTION FOR CONCRETE UNDER FATIGUE LOADS AND FREEZING-THAWING CYCLES

Koji Matsumoto
Graduate School of Engineering, Hokkaido University

Background

In order to develop sustainable infrastructure system, rational design method for structures against long-term deterioration is required. Hence, we should know when and how structures are damaged and improvement of current life-prediction methods is required. This study focuses on fatigue and frost damage, which are typical deterioration of concrete structure. The aim of this study is to develop new design method, which can consider deformation, damage distribution and combined effect of fatigue and freezing-thawing action during structural service life.

Research plan

This study is composed of five stages. As the first step, macroscopic constitutive model of concrete under fatigue loading is developed. Secondly, mesoscopic fatigue analysis system using Rigid Body Spring Model (RBSM) will be developed. Here, time-dependent mesoscopic constitutive law is proposed. Thirdly, freezing-thawing analysis system using RBSM with truss network will be developed. Here, mesoscopic damage is related to water and temperature change in concrete based on microscopic structure. At the fourth step, both the analytical systems will be combined, and then deterioration of concrete under combined action of fatigue and freezing-thawing can be simulated. Lastly, fatigue life prediction formula, which can take frost damage into account, will be developed for design purposes.

Macroscopic deformational model under fatigue loads (STEP1)

Fatigue loading tests were carried out and they were analyzed with previous experimental data. This activity corresponds to the first step. As a result of summarizing and organizing the experimental data, it was found that concrete under fatigue loading has non-damaging strain as well as damaging strain. Besides, stress-strain model was developed, and then deformation of concrete under fatigue loading could be numerically expressed. However, remaining issue was found, which is, amount of time-dependent plastic strain has not been quantitatively expressed under macroscopic level.

Time-dependent analysis of mortar by RBSM (STEP2)

Time-dependent analyses of mortars by RBSM were carried out as a basic study of fatigue analysis. In general, there are two visco-elastic models, which are Maxwell and Voigt model. In this study, characteristic of each model on results of RBSM analysis were examined through mortar analyses. Consequently, differences of strength and stiffness change from static case between Maxwell and Voigt model were found.

Keywords: concrete structures, life-prediction, fatigue, freezing-thawing, combined action, mesoscopic analysis

P-48

Fate of Pharmaceuticals in Human Excrement During the Composting Process of Feces

Takashi Kakimoto

Graduate School of Engineering, Hokkaido University

We have proposed the Onsite Wastewater Differentiable Treatment System. In this system, household wastewater is separated into three fractions (blackwater, higher load graywater, and lower load graywater), and each is treated separately. The blackwater that may contain pharmaceuticals (PhACs) is treated by a composting toilet using sawdust as a matrix. Our objective in this study is to understand the fate of PhACs in the composting process varying the feces loading ratio on the toilet reactor. The variation of oxygen utilization rate (OUR) indicated the degradation rate of feces in the composting process, and the OUR profiles showed that feces were almost treated in early stage of this process. We also observed the decay of the selected PhACs in this process. The reduction profiles imply that the degradation of PhACs has small relation to the treatment of feces. The degradation rates of all PhACs were almost the same if the feces loading ratio was 5%, and the degradation rates of acidic PhACs were almost the same regardless of the increasing of the feces loading ratio. But the higher feces loading ratio gave higher degradation rates of basic PhACs. During the process higher feces loading ratio gave the higher ammonia concentration in the sawdust matrices and this resulted in higher pH value. In this experiment, the pH ranged from pH7 to pH9 and in this pH range, acidic PhACs are present as an ionic form. At pH 7, the basic PhACs exists as an ionic form, but at pH 8.5 and 8.8, where we observed the rapid degradation of the basic PhACs, about 10% of the basic PhACs exists as non-ionic form. Therefore we infer that the degradation of the selected PhACs is affected by the dissociation condition. To conclude this study, we obtained following knowledge; (1)Easily biodegradable organic matter (like feces) does not interfere the degradation of the PhACs; (2)The structural difference among the selected PhACs in this study gives insignificant effect on the degradation rate; (3)The dissociation condition may have a significant effect on the degradation rates in the composting process.

Keywords: Composting process, Degradation of Pharmaceuticals, Treatment at source

P-49

Simultaneous Power Production and Wastewater Treatment Using a Microbial Fuel Cell

Kyung mi Chung

Graduate School of Engineering, Hokkaido University

A microbial fuel cell (MFC) converts chemical energy, available in a bio-convertible substrate, directly into electricity. To achieve this, bacterial are used as a catalyst to convert substrate into electrons. Electrons are transferred through an external circuit while the protons diffuse through the solution to the cathode, where electrons combine with protons and oxygen to form water. The objective of this study is to optimize the operation conditions of MFC for simultaneous power production and wastewater treatment.

In this work, the MFC comprised anode and cathode chambers. Between the compartments, a Nafion proton exchange membrane was installed. Glucose (5 mM) was used as carbon source and loading rate was 2.0 ml/min. Electrodes of anode and cathode were consisted of woven graphite. The anode was continuously purged with nitrogen gas to maintain anaerobic condition, while the cathode was sparged with air. Current (I) was calculated at a resistance (R) from the voltage (V) as I=V/R. Power was calculated as P=IV.

Power generation was measured using a series of resistors (1-100000 Ω) to determine the maximum power output as a function of current. The highest power density of 5.0 mW/m2 was achieved at the current density of 23.5-26.0 mA/m2, which was obtained with the resistance of 900 and 800 Ω, respectively. The maximum coulombic efficiency was 11.6 % with a resistance of 500 Ω. The DOC removal rate was 30%. These results suggested the possibility of using MFC to generate electricity and simultaneously treat wastewater, but further progresses in the design and operation of MFC are required in order to accomplish greater overall MFC performance.

Keywords: microbial fuel cell, power density, current density, coulombic efficiency

P-50

Complexation Reactions of Anions on Hydrotalcite Surface

Kazuya Morimoto
Graduate School of Engineering, Hokkaido University

Hydrotalcite is one of the naturally occurring minerals with a formula of [Mg1-xAlx(OH)2] [An-x/n·yH2O]. An- denotes an anion of which the valence is n. It comprises positively charged brucite-like octahedral layers and interlayers filled with anions and water molecules. The positive charge in the octahedral layers is formed by partial substitution of Al3+ for Mg2+. Stacking of the layers occurs and the balancing interlayer anions can be exchanged.

Recently, hydrotalcite has received considerable attention in a variety of fields because of their considerable anion-exchange capacity. It has been used as a sorbent in the removal of various pollutants in aqueous solutions. The mechanism involved has not yet been elucidated specifically surface complexation reactions. This study focuses on anion sorption mechanism in hydrotalcite with a specific regard on surface complexation reactions.

Chloride, nitrate, carbonate, sulfate, phosphate and silicate ions are the sorbates considered in the experiments. Zeta potential and pH measurements were used to monitor the sorption reactions with these ions.

The change in zeta potential of hydrotalcite in distilled water is similarly observed in chloride and nitrate-sorbed hydrotalcite in this study. It indicates that chloride and nitrate ions inspired simply sorption by anion-exchange reaction onto hydrotalcite because that reaction has little influence on zeta potential.

On the other hand, the zeta potential trends for carbonate, sulfate, phosphate and silicate-sorbed hydrotalcite are in contrast. These exhibited lower zeta potential values which would suggest that the point of zero charge (PZC) also shifted to lower pH compared to a pHpzc of more than 11 for hydrotalcite in distilled water. These results suggest that the ions considered in this study formed inner-sphere surface complexes on hydrotalcite surface probably via ligand-substitution reaction. Such reactions are expected to change the physico-chemical properties of hydrotalcite (i.e. increased or decreased stability).

Hydrotalcite has two possible sorption sites indicating that sorption mechanism would vary for different anion species.

Keywords: Hydrotalcite; Sorbent; Zeta potential; Complexation reactions

P-51

Weathering resistivity interpreted from the textures of plutonic rocks

Kouki Kashiwaya
Graduate School of Engineering, Hokkaido University

Void structures observed in weathered Inada granite and Kuroishiyama gabbro were examined using quantitative methods such as multifractal analysis, pore size distribution measurement, and effective porosity measurement. And values characterizing the void structures were correlated with uniaxial compressive strengths (UCS) to reveal the weathering resistivity of the plutonic rocks.
Slope of q-Dq-UCS curved surface showing a relationship of generalized dimension spectra and UCSs is steeper in the granite. It means that the UCS of the granite decreases more drastically than the gabbro when their heterogeneities increase similarly.
The granite has granular texture. Continuous and linear void structures occur through weathering, and their fracture density is relatively small. That is why the void structures in the granite largely contribute to the decrease in UCS but influence on the heterogeneity of the void structure is not so strong. On the one hand, the gabbro is characterized by poikilitic texture. Intra-granular fractures in plagioclase are densely distributed and contribute to the increase in the heterogeneity of the void structure. However, the skeleton of amphibole is not so affected by weathering and thus the strength of the gabbro is maintained.
The results show that the UCS of the granite decreases more easily by weathering than the gabbro when the two plutonic rocks are compared based on their void structures. This indicates that the gabbro has higher weathering resistivity than the granite even though the granite is composed of minerals which have relatively high weathering resistivity such as quartz, and it is attributed to their microscopic void structures.

Keywords: weathering, void structure, multifractal analysis, plutonic rock

P-52

Chloride ion diffusion coefficient of stressed fiber reinforced concrete under loading conditions

Yuki Sakoi
Graduate School of Engineering, Hokkaido University

To examine the chloride penetration into concrete is one of the most important to assess the durability of concrete structures. The concrete structures are always subjected to various loads, prestressing as well as traffic, earthquake and so on. Many cracks exist in the stressed concrete, and it is considered that these cracks accelerate the deterioration caused by chloride ion or other substance penetration. However, only few attempts have been made so far for the chloride penetration into concrete under loading condition. Therefore, it is needed for the durability of concrete structures to examine the effect of loading for the chloride penetration into concrete.
In addition, admixing short fibers into concrete can improve the properties of concrete. As a result of admixing fibers, the concrete can alter development of crack that was caused by loading or environmental effects. Therefore, it is considered that the chloride penetration into concrete can be reduced due to the mix of short fibers into concrete.
In this study, the chloride penetration into short fiber reinforced concrete under several loading condition was examined. From the results, it was found that the chloride diffusion coefficient (Dnssm) reduced at low stress level under static compressive loading condition, and the Dnssm at around 50% stress level changed to increase, and then the Dnssm increased with the increase of static compressive loading level after that. On the other hand, the change of Dnssm under tensile loading was differed from that under compressive loading level. The Dnssm subjected to tensile stress showed the increase with the increase of tensile stress level after subjected to low tensile stress.
The change of Dnssm for short fiber reinforced concrete showed almost same behavior under both loading conditions, however, the change ratio of Dnssm with the change of stress level differed from that of non- fiber concrete. And it was found that mixing short fibers into concrete could lead to the improvement of chloride penetration resistance under loading conditions.
From these findings, it was confirmed that loading affects the chloride penetration into concrete. And it was suggested that mixing short fibers into concrete could improve the durability of concrete structures due to the increase in resistance of chloride penetration.

Keywords: Short Fiber Reinforced Concrete, Chloride Ion, Diffusion Coefficient, under Loading

P-53

THE CONTRIBUTION OF RPOS TO FORMATION OF ESCHERICHIA COLI BIOFILMS

Akinobu Ito
Graduate School of Engineering, Hokkaido University

It is now apparent that microorganisms undergo significant changes during the transition from planktonic to biofilm growth that possess enhanced resistance to various stresses such as chlorine treatments and antimicrobial agents. It has been suggested that the creation of starved, stationary phase zones in biofilms seems to be a significant factor for biofilm formation. In this study, the role of rpoS gene in Escherichia coli biofilms was investigated which is known to be expressed during entry into stationary phase and stress conditions. To assess the importance of rpoS gene for biofilm formation, we used E. coli MG1655 rpoS mutant strain to perform flow chamber experiment. We found that the rpoS mutant can only form thin biofilms. To further assess the role of the rpoS gene in E. coli, we performed DNA microarray analysis, and it revealed that gene expression pattern of rpoS mutant was different from that of wild type strain. In stationary phase, 193 genes were significantly down-regulated in rpoS mutant, which included genes induced in starvation conditions, genes encoding heat shock proteins, genes induced at high temperature, and osmotically inducible genes. These results suggest that the rpoS mutant is less capable of response and adaptation to stresses than the wild type strain in stationary phase, which might be the reason for the formation of only thin biofilms. In addition, they also suggest that the rpoS mutant shows too much motility even in the stationary phase. It could explain the presence of the actively moving and rotating cells in the early stages of biofilm formation, which might be the reason for E. coli rpoS mutant to be incapable of establishing mature biofilms. Based on these results, we concluded that rpoS gene which is induced in the stationary phase and stress conditions is important for formation of mature biofilms.

Keywords: biofilms, gene expression, rpoS, Escherichia coli, stress response

P-54

Evaluation of char derived from solid waste for fuel recovery and final disposal in landfill

In-Hee Hwang
Graduate School of Engineering, Hokkaido University

Carbonization is a kind of thermal treatment process to produce carbonaceous materials, so-called char, under inert atmosphere. In this work, chars derived from various municipal and industrial solid wastes were evaluated from the standpoint of fuel recovery and thermal pretreatment before landfilling.

The quality of char as a fuel definitely depends on the composition of input wastes. The higher the ratio of woody biomass in raw wastes, the better the quality of the char produced. The estimation equation of char heating value by using its weight fraction of fixed carbon (FC) and volatile matter (VM) was derived; estimated heating values showed a good correlation with measured ones (R2=0.957). Regarding quality improvement of char, the pulverization and sieving method effective in separation of incombustibles rather than ash. From the application of coal cleaning or separation techniques (ex: sink-floatation, froath floatation, and oil agglomeration in liquid) for ash removal from char, char particles existed as compounds of combustibles and ash. Moreover, char particles have a tendency to coagulate in water. These characteristics indicate that wet separation using an aqueous solution likely reduces efficiency due to particle coagulation. Further ash separation should be studied for improving char quality. On the other hand, most char met a 0.5 wt% chlorine criterion allowing it to be utilized as shaft blast furnace fuel after water washing.

Carbonization has an excellent effect on reduction of organic matter disposed in landfills. Releasing of heavy metals such as chrome, cadmium, and lead decreased remarkably by carbonization regardless of the type of raw waste at JLT-13 leaching test. However, it was found that metal leaching from carbonization residue could be changed somewhat by landfill environment such as aerobic or anaerobic condition through column tests.

From these results, carbonization might be considered as a feasible option for pre-treatment before landfills, as well as for fuel recovery.

Keywords: Carbonization, char, quality improvement, pre-treatment for landfilling

P-55

Advanced Application of Jig Separator for Plastic Material Recycling

Kunihiro Hori
Graduate School of Engineering, Hokkaido University

Development of mechanical separation of different plastics is essential in planning and constructing a recycling plant that processes scrapped electric appliances or automobiles. The authors have improved TACUB jig as a plastic separator. Jig separation for plastics of smaller sizes (0.5-3 mm) but similar specific gravities was performed using polyvinyl chloride (PVC), polyethylene (PE), acrylonitrile butadiene styrene (ABS), and acrylicplastics from scrapped plastic rods and electric wires. At the minimum difference in the specific gravities of 0.03, a higher grade product over 99% was still obtained. The pulsation of frequency and amplitude for smaller size plastics is lesser than that for coarser plastics. Based on the results, jig separator was applied to the following process.

For the plastics from scrapped copy machines containing polystyrene (PS),ABS, and polyethylene terephthalate (PET), high grade (>99%) of each plastic was recovered in the two cells of the jig, where PET is recovered from the first cell as bottom product, and ABS and PS from the second cell as bottom and upper layer products, respectively. Their sizes ranged from 3.5-10mmand their specific gravities were 1.03, 1.22 and 1.71 for PS, ABS, and PET respectively. Based on the results a recycling plant for processing scrap office and home appliances had been constructed.

Keywords: Jig, Gravity Concentration, PVC, Waste Plastics, Recycling

P-56

Value material collection by wet process sorting method from various shredder dusts

Yutaka Kuwayama
Graduate School of Engineering, Hokkaido University

----no abstruct

P-57

Sustainable Development

Stephen Lincoln
School of Chemistry and Physics, University of Adelaide

A flow chart is presented which shows a model of the interdependencies in sustainable development which may be used in education. The model is centered on population. Current projections suggest that population will level out about 10 billion a little before 2100 and that a decline will occur thereafter. In seeking to sustainably support the present population and its anticipated growth many interdependent factors must be considered [1]. These factors are collected into four major components for convenience: water, food, energy and disease. The interdependence of these components occurs through a wide range of factors exemplified by deforestation, climate change, biodiversity, zoonolysis, biotechnology, fertilizer use, fossil fuel use and alternative energy sources. These considerations are presented in a pattern useful for giving an overview of sustainable development to students at universities.

[1] S.F. Lincoln, Challenged Earth: An Overview of Humanity's Stewardship of Earth, Imperial College Press, London, 2006.

P-58

Point and Non-point Source Pollution of Dahuofang Reservoir Catchment Based on a GIS Model and Its Integrated Water Management

Tao Hua
College of Environmental Science and Engineering, Nankai University

As a strategic and critical surface water resource for the Liao River basin, Dahuofang Reservoir is also an important water resource for Shenyang in Liaoning Province.China. However, in recent years, eutrophication has been reported in its water due to both point and non-point source pollution.
This research was performed to identify the main factors influencing its water quality. In this research, an ArcView hydrology extension script was employed to construct a point and non-point source pollution model based on basic information that has been collected.
The current situation and the future tendency of water pollution in the catchment were identified and suggestions were proposed to enhance the integrated water management which aims to improve the water quality for Dahuofang Reservoir.

P-59

Soil organic carbon, nitrogen and microbial biomass under Larix gmelinii forest in different latitude of Northeast China

Fuchen Shi
College of Life Sciences, Nankai University

Larix gmelinii forest plays a very important role in both environmental protection and economic development in northern China. We compared soil organic carbon (SOC), nitrogen (N), and microbial biomass in L.gmelinii forest along the latitude in northeast China. Surface SOC, total N and microbial biomass of soil samples collected from L. gmelinii forest along the latitude grads ascending decreased significantly. Surface SOC content decreased from 10.56% to 5.30% along the latitude, and N decreased from 0.88% to 0.29%. In surface soil, the highest microbial biomass carbon (MBC) was 4805.16 mg/kg which located in N44° 22′ , and the lowest MBC was 161.49 mg/kg which located in N53° 33′ . Surface soil microbial biomass nitrogen (MBN) also varied from 1038.54 mg/kg to 99.55 mg/kg with latitude ascent. The ratios of microbial biomass to SOC and N In the southern study sites were significantly higher, when compared to the northern study sites' ones. Differences among sites became less pronounced in subsoil. There were positive and significant correlations between SOC, total N and microbial biomass. The study showed that the tested soil characteristics, both abiotic and biological, significantly liner correlated with the latitude.

Keywords: Larix gmelinii; Latitude; Soil organic carbon and nitrogen; Microbial biomass

P-60

Sustainable production in aquaculture: innovation of closed recirculation aquaculture system and its ripple effects

Rie Goto-Kazeto [1], Etsuro Yamaya [1], Yasuaki Takagi [2]
1/Nanae Fresh-Water Lab, Field Science Center for Northern Biosphere, Hokkaido University,
2/Graduate School of Fisheries Sciences, Hokkaido University

The present human industrial activities have great impacts on our environment through emissions of carbon dioxide and other chemical pollutants. Such 'environmentally high-cost' human activities now threaten sustainability of our food production. This general undesirable formula is also applicable to the present fishery production.
In 2003, total fishery production was reported to be 132.2 million tones, of which 41.9 million tones from aquaculture practices and 90.3 million tones from capture. Because of decreasing and/or conservation of fishery resources, aquaculture production has been extremely growing compared to capture, about 67 % growth in volume from 1990 to 2003. However, present aquaculture operations (open water system) have serious environmental impacts, such as water pollution by wasted feeds and feces. Although aquaculture production in the last decade has given it increased importance in the modern food supply, there are growing needs to introduce environmentally low-impact system for sustainable food production.
Recently, closed recirculation aquaculture system is concerned as most desired technology for future aquaculture. There are

a lot of benefit of environmental preservation, cost saving and prevention of fish diseases. Further more, in spite of global climate change or regional weather change, stable production is engaged in this system. However, a lot of issues appear to be resolved to practically introduce this system. For one, closed recirculation system are much more expensive to construct, install, and maintain than the open water system.
In this study, the issues of introducing closed recirculation system will be raised and discussed from the aspect of fisheries, environmental sociology and international economics.

P-61

Science, participatory research and sustainable land use

William Smith
The University of Auckland

Illustrating on-going research to integrate science into decision-making by farmers on sustainable land use.

P-62

A Study on the Wetland Dynamic and Its Relation with Cropland Reclamation in Sanjiang Plain, China

Kaishan Song, Dianwei Liu, Bai Zhang, Zong Ming Wang, Cui Jin, Yuedong Guo
Northeast Institute of Geography and Agricultural Ecology, Chinese Academy of Sciences,

Using remote sensing interpretation, we obtained four periods of land use data sets from 1976 to 2005. Based on these data sets, this study analyzed the dynamics of the wetland land cover and the conversion between wetland and other land use types of Sanjiang Plain in the past 30 years with GIS spatial analysis. It shows that the wetland in Sanjiang Plain has been severely damaged; the wetland area decreased by 37.72% from 1976 to 1986, by 15.54% from 1986 to 1995, and by 30.97% from 1995 to 2005, which shows that the situation of wetland loss had much slowed down in1986 to 1995, but in recent years, the reclamation speed still very high. It was showed by conversation matrix that most wetland losing was the result of reclamation, and only small part of lost wetland was converted into grassland and forest. Still, it found that cropland contributed the main part for wetland area increasing for aimless reclaimed cropland was converted into wetland during flood inundation. Both demographic and resource management policies reason were analyzed for the wetland reduction. The result showed that population increasing was the main reason for wetland reduction in the past decades since P.R. of China foundation. Though the speed of wetland loss decreased during the later period, the reclamation of wetland still happened, so the practicable protection measurement of the wetland in Sanjiang Plain should be reinforced further.

Keywords: Wetland, Sanjiang Plain, remote sensing, GIS

P-63

Salinized wasteland monitoring in Daan County, Northeast China, Using GIS and remote sensing

Zong Ming Wang, Bai Zhang, Kaishan Song, Xiaoyan Li, Ming Chen, Jianping Li, Fang Li, Hongtao Duan
Department of RS and GIS, Northeast Institute of Geography and Agricultural Ecology, Chinese Academy of Sciences

Western part of Northeast China has suffered substantial land degradation during past decades, due to human impact under climatic variations. We presents an integrated study of expansion process of salinized wasteland in Daan County, a typical salt-affected area in Northeast China, by using Geographical Information System (GIS) and remote sensing. Our study explored that, from 1954 to 2004, the salinized wastland in study area have increased by 135995 ha, and now cover 32.31% of the total area, in the meantime grassland has decreased by 104697 ha and covers only 13.15% of land area. Grasslands, croplands and swamplands were found the three main land use types converted into salinized wasteland. Land use/cover changes show that between 1954 and 2004, 48.6% of grasslands, 42.5% of swamplands, and 14.1% of croplands were transformed to salinized wasteland, respectively. Lastly, the major factors influencing salinized wasteland expansion and land use/cover changes are also explored. In general, climatic factors supplied a potential environment for soil saliniztion. Human-related factors, such as policy, population, overgrazing, and intensified and irrational utilization of land and water resources are the main causes of salinized wasteland expansion.

Key words: Salinized wasteland expansion; Land use change; GIS; Remote sensing; Daan County, Northeast China

P-64

International trade of Recyclable Resources in Thailand

So Sasaki
Japan Society for the Promotion of Science

Recently, in Asian Regions there has been active trade of Recyclable Resources. Several Studies have been made on International trade of Recyclable Resources from Japan to China, but little is known about that other Asian countries. This paper is intended as an investigation into International trade of Recyclable Resources in Thailand and the efforts of the Thai government. As a result, it has been understood as follow. First, Thailand was received the influence of the demand for Recyclable Resources in China. Second, there are some second-hand goods import limitations in Thailand. However, third, Thai government is doing flexible correspondence to International trade of Recyclable Resources under certain conditions. To put it briefly the concept of International trade of Recyclable Resources in the future, Thailand shows some suggestive cases.

P-65

Today's Development of a sustainable agro system in dry areas of Mongolia

Eldevochir Sukhee
Khash Tsagaan Arslan Co., Ltd.

How to use this restored pasture that was completely barren 5 years ago will be one of the problems to be solved.

P-66

Biotechnology Innovations and Patent Protection

Dae Hwan Koo
College of Law, Seoul National University, Korea

Is patenting biotechnology desirable to encourage biotechnology innovations in the light of economic perspective? To answer to this question, it is necessary to consider both the characteristics of biotechnology innovations and the impact of patenting biotechnology (e.g. DNA, gene fragments, etc) to the biotechnology industry as well as the international relationship between developed and developing countries.

P-67

Temporal Variability of the Volume Transport through the Korea Strait and the Tsugaru Strait and the Tsugaru Strait

Hanna Na [1], Kuh Kim [1], Shoshiro Minobe [2]
1/School of Earth and Environmental Sciences, Seoul National University,
2/Division of Earth and Planetary Sciences, Graduate School of Science, Hokkaido University

The volume transports (VT) through the Korea Strait and Tsugaru Strait are estimated from linear regressions between transport data and the sea level difference (SLD) across the straits. As the sea level data along the Korean and Japanese coasts have been measured for several decades, the VTs can be estimated for a long period during which the sea level data are available. For the Korea Strait the SLD was calculated between Pusan and Moji. The transport data by the submarine cable was used to get the conversion equation from the SLD to the VT (Lyu and Kim, 2003). The atmospheric pressure effect and the baroclinic part of SLD were removed before computing the conversion equation. For the Tsugaru Strait Tappi and Yoshioka were selected to calculate the SLD. The conversion equation for the Tsugaru Strait was obtained by using the transport data from the vessel mounted ADCP (Ito et al., 2003). The mean value of the VT from 1984 through 2004 is 2.5 Sv for the Korea Strait and 1.5 Sv for the Tsugaru Strait is 1.5 Sv. It is found that variance of the VT through the

Korea Strait during this period is partitioned 33 %, 23 % and 44 % for seasonal, interannual and intraseasonal time scales respectively. Partition for the Tsugaru Strait is 59 %, 16 % and 25 % for the same temporal scales. Forcing for these temporal variation is under investigation by examining statistical relations between transports and various atmospheric and oceanic parameters.

P-68

Argo for long-term ocean variability and climate research

Kuh Kim, Jong Jin Park
School of Earth and Environmental Sciences, Seoul National University

Argo is a global array of 3,000 free-drifting profiling floats that measures the temperature and salinity of the upper 2000 m of the ocean. This allows, for the first time, continuous monitoring of the temperature, salinity, and velocity of the upper ocean, with all data being relayed and made publicly available within hours after collection.
We are increasingly concerned about global change and its regional impacts. Sea level is rising at an accelerating rate of 3 mm/year, Arctic sea ice cover is shrinking and high latitude areas are warming rapidly. Extreme weather events cause loss of life and enormous burdens on the insurance industry. Globally, 8 of the 10 warmest years since 1860, when instrumental records began, were in the past decade. These effects are caused by a mixture of long-term climate change and natural variability. Their impacts are in some cases beneficial (lengthened growing seasons, opening of Arctic shipping routes) and in others adverse (increased coastal flooding, severe droughts, more extreme and frequent heat waves and weather events such as severe tropical cyclones).
Understanding (and eventually predicting) changes in both the atmosphere and ocean are needed to guide international actions, to optimize governments' policies and to shape industrial strategies. To make those predictions we need improved models of climate and of the entire earth system (including socio-economic factors). Lack of sustained observations of the atmosphere, oceans and land have hindered the development and validation of climate models. An example comes from a recent analysis which concluded that the currents transporting heat northwards in the Atlantic and influencing western European climate had weakened by 30% in the past decade. This result had to be based on just five research measurements spread over 40 years. Was this change part of a trend that might lead to a major change in the Atlantic circulation, or due to natural variability that will reverse in the future, or is it an artifact of the limited observations? In 1999, to combat this lack of data, an innovative step was taken by scientists to greatly improve the collection of observations inside the ocean through increased sampling of old and new quantities and increased coverage in terms of time and area. (from www.argo.ucsd.edu)

P-69

Issues and opportunities in sustainable management of water through the community based organizations in South Asian Countries - A case study in Sri Lanka -

Kandula Pathma Kumara
Faculty of Agriculture, Dept. of Agricultural Engineering, University of Peradeniya

In developing countries there are lots of problems in managing the water supply schemes. The Community based organization (CBO) has came into consideration as a solution for problems. But there are enough experiences for identifying issues and opportunities that can be used as a lesion to have sustainable water management schemes in the region. This study was based on the evaluation on the CBO's.

Hokkaido University International Symposium on Sustainable Development

Organizing Committee

Chairperson	Mutsuo Nakamura	President, Hokkaido University
Co-Chairperson	Takeshi Kishinami	Executive and Vice President, Hokkaido University
Committee Members	Hiroshi Saeki	Executive and Vice President, Hokkaido University
	Yoshihito Osada	Executive and Vice President, Hokkaido University
	Masaaki Hemmi	Executive and Vice President, Hokkaido University
	Tadayuki Hayashi	Executive and Vice President, Hokkaido University
	Kenichi Iyama	Executive, Hokkaido University
	Hajime Endoh	Executive and Director General, Hokkaido University

Program Committee

Chairperson	Takeo Hondoh	Global Manager, Hokkaido University Initiative for Sustainable Development (HUISD) Professor, Institute of Low Temperature, Hokkaido University
Committee Members	Motoyoshi Ikeda	Professor, Faculty of Environmental Earth Science, Hokkaido University
	Hiroshi Kida	Director, Research Center for Zoonosis Control, Hokkaido UniversityProfessor, Graduate School of Veterinary Medicine, Hokkaido University
	Mamoru Kobayakawa	Adviser to the Executives of International Affairs Professor, Graduate School of International Media and Communication, Hokkaido University
	Mitsuru Osaki	Director, Sustainability Governance Project (SGP), Hokkaido University Professor, Research Faculty of Agriculture, Hokkaido University
	Yoshimasa Watanabe	Professor, Graduate School of Engineering, Hokkaido University
	Fumikazu Yoshida	Professor, Graduate School of Public Policy, Hokkaido University

Secretariat Office

Hokkaido University International Symposium on Sustainable Development

Hokkaido University Initiative for Sustainable Development (HUISD)
International Affairs Division, Hokkaido University

Kita 8, Nishi 5, Kitaku, Sapporo 060-0808
Tel +81-(0)11-706-2093   Fax +81-(0)11-706-2095
E-mail: kouryu@general.hokudai.ac.jp
http://www.hokudai.ac.jp/huisd/

Hokkaido University International Symposium on Sustainable Development

Date 7-9 August, 2006
Place Hokkaido University, Sapporo, Japan

URL: http://www.hokudai.ac.jp/huisd/

Hokkaido University International Symposium on Sustainable Development

Preface

It was a great honor for Hokkaido University to host the International Symposium on Sustainable Development on 7-9 August, 2006.

First of all, I would like to express my deep appreciation to all persons who contributed themselves in making the symposium successful. We are delighted to see that we had over 900 participations from 19 countries and regions at the symposium, and that the symposium has provided an opportunity to promote international collaboration in both education and research on sustainable development by transcending academic, national and regional boundaries. As was agreed at the end of the symposium, we have begun the process to create new collaboration network named "Hokudai Network for Global Sustainability". We will present the framework of the network to you in the near future. In the symposium, speakers provided thoughtful presentations and participants created meaningful discussions, therefore, we decided to keep a record of their summary here in the booklet. It will be our great pleasure if the booklet will be a medium for further fruitful discussion on sustainable development.

Hokkaido University has committed to continue the activities on sustainable development with an emphasis on five representative academic fields, such as "Global Warming, "Integrated Water Management", "Establishment of a Recycle-Oriented International Community", "Stabilized Securement of Food and Forest", and "Measures against Infectious Diseases". In order to achieve effective and productive collaboration, we are longing for your continuous support and active cooperation.

Finally, we would like to inform you that we have a plan to host second international symposium on sustainable development in 2009. We will be looking forward to meeting many of you again in Sapporo for further discussion on sustainable development.

Thank you again for your strong support and contributions to our activities.

Mutsuo Nakamura
President
Hokkaido University

Hokkaido University International Symposium on Sustainable Development - Program -

Sunday, August 6

Registration & Welcome Party

6:00pm - 7:30pm	*Registration at Hokkaido University Conference Hall*
	Welcome Party at Hokkaido University Centennial Hall

Day One: Monday, August 7

Plenary Sessions: Comprehensive View of Sustainable Development

at Hokkaido University Conference Hall - Auditorium A

8:00am -	*Registration*

Opening

8:30am - 9:00am	*Opening Address* **Mutsuo Nakamura**, Hokkaido University
	Congratulatory Speech by Guest of Honor **Daisuke Machida**, International Science and Technology Affairs Division, Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan ···P1-2
	Presentation: Background of This Symposium-Hokkaido University International Symposium on Sustainable Development- **Takeshi Kishinami**, Hokkaido Unviersity ···P3-6

Keynote Speech

9:00am - 9:45am	*Prospects of the 21st Century with Respect to Sustainability* **Itaru Yasui**, United Nations University, Japan ···P7-20
9:45am - 10:00am	*Break*

Session 1. Sustainability of the Earth System

Chairperson: **Motoyoshi Ikeda**, Faculty of Environmental Earth Science, Hokkaido University ···P38

10:00am - 10:40am	*Creating an Applied Earth System Science: Linking Global Environmental Change Science to Sustainability Issues* **Kevin J. Noone**, International Geosphere-Biosphere Programme (IGBP), The Royal Swedish Academy of Sciences, Sweden ···P21-26
10:40am - 11:20am	*Glacial Inceptions: Past and Future* **Lawrence A. Mysak**, Department of Atmospheric and Oceanic Sciences, McGill University, Canada ···P27-33
11:20am - 11:50am	*Ecological Constraints on System Sustainability* **Takashi Kohyama**, Faculty of Environmental Earth Science, Hokkaido University ···P34-37
11:50am - 1:00pm	*Lunch Break*

Session 2. Sustainable Society with Recycling System

Chairperson: **Yoshimasa Watanabe**, Graduate School of Engineering, Hokkaido University ···P61

1:00pm - 1:40pm	*Recovering Sustainable Water from Wastewater* **Takashi Asano**, Department of Civil and Environmental Engineering, University of California, Davis, U.S.A. ···P39-48
1:40pm - 2:20pm	*Mottainai : A Comparative Study of the Politics of Innovation in Waste Management* **Miranda Schreurs**, Department of Government and Politics, University of Maryland, U.S.A. ···P49-56
2:20pm - 2:50pm	*Sustainable and Cyclical Economy of Asia: Overview* **Fumikazu Yoshida**, Graduate School of Public Policy, Hokkaido University ···P57-60
2:50pm - 2:55pm	*Break*

Session 3. Emerging Infections and Global Environment

Chairperson: **Tsukasa Seya**, Graduate School of Medicine, Hokkaido University ···P73

2:55pm - 3:35pm	*Origin and Evolution of Influenza Virus* **Robert G. Webster**, Department of Infectious Diseases, St. Jude Children's Research Hospital, U.S.A. ···P62-67
3:35pm - 4:05pm	*Are We Prepared for Emerging Zoonoses?* **Hiroshi Kida**, Research Center for Zoonosis Control, Hokkaido University···P68-72
4:05pm - 4:20pm	*Break*

Session 4. Sustainability Governance on Food and Bioresource

Chairperson: **Yutaka Saito**, Sustainability Governance Project (SGP), Hokkaido University ···P97-98

4:20pm - 4:50pm	*Understanding and Approach to "Sustainability" Science of Fisheries* **Teisuke Miura**, Graduate School of Fisheries Sciences, Hokkaido University ···P74-77
4:50pm - 5:30pm	*Strategy towards Achievement of Sustainable Agriculture for Food, Energy and the Environment in the Age of the Globalization* **Nasir El Bassam**, International Research Centre for Renewable Energy (IFEED), Germany ···P78-91
5:30pm - 6:00pm	*The Sustainability of the Bio-production Systems* **Mitsuru Osaki**, Sustainability Governance Project (SGP), Hokkaido University ···P92-96
6:00pm - 7:00pm	*Move to Hotel*

Reception hosted by Mutsuo Nakamura, President of Hokkaido University

7:00pm - 9:00pm	at Keio Plaza Hotel Sapporo: Kita 5 Nishi 7 Tel +81-(0)11-271-0111 Fax +81-(0)11-271-7943

Day Two: Tuesday, August 8

Parallel Session 1:
International Symposium - How to Sustain Agrosphere, Biosphere and Geosphere

at Hokkaido University Conference Hall - Auditorium A

8:00am -	*Registration*

Opening

8:30am - 9:00am	*Opening Remarks* **Yoshihito Osada**, Hokkaido University **Mitsuru Osaki**, Sustainability Governance Project (SGP), Hokkaido University ···P170-173 **Takashi Kohyama**, Faculty of Environmental Earth Science, Hokkaido University

Morning Session:

Progressive Approach on the Sustainable Fisheries Management

9:00am - 9:20am	*Creating "Safe and Worry-Free" Salmon Products Using a HACCP System Form Fishing through Processing to Distribution* **Mamoru Yoshimizu**, Graduate School of Fisheries Science, Hokkaido Universtiy
9:20am - 9:40am	*Genetic Approach to Management and Sustainable Use of Marine Bio-Resources* **Syuichi Abe, Moongeum Yoon and Noriko Azuma**, Graduate School of Fisheries Science, Hokkaido University
9:40am - 10:00am	*The Shiretoko World Natural Heritage Including Marine and Land Ecosystems: Towards Coexistence with Marine Diversity and Fisheries* **Yasunori Sakurai and Masahide Kaeriyama**, Graduate School of Fisheries Science, Hokkaido University

Roles of the Coupled System of Biosphere and Geosphere

10:00am - 10:20am	*Development of an Integrated Ocean Model for Understanding Changes in Ecosystem in the Western North Pacific Associated with Global Warming* **Yasuhiro Yamanaka**, Graduate School of Environmental Science, Hokkaido University
10:20am - 11:00am	*Coffee Break and Poster Session*
11:00am - 11:20pm	*Material Transports from River to Ocean and Their Contribution to Marine Biological Productivity* **Takeshi Nakatsuka**, Institute of Low Temperature Science, Hokkaido Unviersity
11:20am - 11:40am	*Present and Future of Terrestrial Ecosystem Models: Modeling Atmosphere-Vegetation Interactions* **Toshihiko Hara**, Institute of Low Temperature Science, Hokkaido University
11:40am - 12:00pm	*21st Century Center of Excellence Program 'Prediction and Avoidance of an Abrupt Change in Bio-Geosphere System'* **Motoyoshi Ikeda**, Faculty of Environmental Earth Science, Hokkaido University
12:00pm - 1:00pm	*Lunch Break*

Afternoon Session

1:00pm - 1:20pm	*Sustainable Food, Water and Energy in Asia* **Kensuke Fukushi**, IR3S, University of Tokyo, Japan

3rd Biomicrocosmos Workshop: Sustainability and Security of Food Production

1:20pm - 1:35pm	*Importance of Rhizosphere Research for Sustainable and Safe Food Production* **Jun Wasaki**, Creative Research Initiative 'Sousei' (CRIS), Hokkaido University
1:35pm - 1:55pm	*Soil Quality Evaluation and Sustainable Agriculture Development in the Region of Southwest Yunnan, China* **Zhang Naiming**, Yunnan Agriculture University, China
1:55pm - 2:15pm	*Arsenic Contamination of Groundwater: Food Safety and Human Health Hazard in Bangladesh* **M. Harun-ur-Rashid**, Bangladesh Agricultural Research Institute, Bangladesh
2:15pm - 2:35pm	*Improvement of P Uptake from Acid Soil by Transgenic Plants with Modified Citrate Metabolism* **Hiroyuki Koyama**, Gifu University, Japan
2:35pm - 3:20pm	*Coffee Break and Poster Session*
3:20pm - 3:40pm	*Mycorrhizal Fungi in the Tropical Rain Forest of Indonesia and its Utilization for Reforestation* **Keitaro Tawaraya**, Yamagata University, Japan

Integrative Perspective on the Sustainable Earth

3:40pm - 4:00pm	*Latest Progress on Land System Studies in China* **He-Quing Huang**, Chinese Academy of Sciences, China
4:00pm - 4:20pm	*Prospects and Roles of Global Land Project* **Billie Turner**, Clerk University, U.S.A.
4:20pm - 4:30pm	*Break*
4:30pm - 5:30pm	*Concluding Discussion*
6:30pm - 8:00pm	*Welcoming Party at Restaurant ELM in the Faculty House ENREISO*

Day Two: Tuesday, August 8

Parallel Session 2:
Protection of Society from Infectious Threat

at Hokkaido University Conference Hall - Auditorium B

8:00am -	*Registration*

Morning Session

Opening

9:30am - 9:35am	*Welcoming Address* **Takashi Umemura**, Graduate School of Veterinary Medicine, Hokkaido University
9:35am - 9:40am	*Opening Remarks* **Hiroshi Kida**, Research Center for Zoonosis Control, Hokkaido University…P174-176

Session 1

9:40am - 10:20am	*Ecology and Evolution of Influenza Viruses, Preparation for the Occurrence of Hightly Pathogenic Avian Influenza and the Possibility of a Human Pandemic of Influenza* **Robert G. Webster**, Department of Infectious Diseases, St. Jude Children's Research Hospital, U.S.A.
10:20am - 10:50am	*Computer Analysis for the Prediction of Structural Changes in Hemagglutinins of Future Antigenic Variants of Influenza Viruses* **Kimihiko Ito**, Research Center for Zoonosis Control, Hokkaido University
10:50am - 11:20am	*Coffee Break*

Session 2

11:20am - 12:00pm	*Deciphering Mechanisms of Prion Transmission Using Transgenic Mice* **Glenn C. Telling**, Department of Microbiology, Immunology and Molecular Genetics, University of Kentucky, U.S.A.
12:00pm - 12:30pm	*Tuberculosis: Research for Control Measures* **Yasuhiko Suzuki**, Research Center for Zoonosis Control, Hokkaido University
12:30pm - 2:00pm	*Lunch Break*

Afternoon Session

Session 3

2:00pm - 2:40pm	*Bats, Civets and Emergence of SARS* **Lin-Fa Wang**, CSIRO Livestock Industries, Australian Animal Health Laboratory, Australia
2:40pm - 3:20pm	*Japanese Encephalitis Molecular Epidemiology Implies Possible Rapid West Nil Virus Expansion: Development of West Nile Fever Vaccines* **Kouichi Morita**, Institute of Tropical Medicine, Nagasaki University, Japan
3:20pm - 3:50pm	*Epidemiology and Pathogenesis of Ebola Hemorrhagic Fever* **Ayato Takada**, Research Center for Zoonosis Control, Hokkaido University
3:50pm - 4:20pm	*Coffee Break*

Session 4

4:20pm - 5:00pm	*Control of Echinococcosis — the State of the Art* **Thomas Romig**, Dept. of Parasitology, University of Hohenheim, Germany
5:00pm - 5:30pm	*African Trypanosomiases* **Chihiro Sugimoto**, Research Center for Zoonosis Control, Hokkaido University
5:30pm - 5:35pm	*Closing Remarks* **Ikuo Takashima**, Graduate School of Veterinary Medicine, Hokkaido University

Day Two: Tuesday, August 8

Parallel Session 3: Sustainable Metabolic System of Water and Waste for Area-Based Society

at Hotel Royton Sapporo

Group 1. Innovation of Membrane Technology for Water and Wastewater Treatment - IMTEC Sapporo -

8:30am -	*Registration*

Morning Session

Opening

9:00am -	*Opening Address and a Brief Report on the Current Status of Membrane Technology in Japan* **Yoshimasa Watanabe**, COE Program Leader, Hokkaido University ···P177-179
9:40am -	*Track for Wastewater* Moderator: **Kazuo Yamamoto**, Environmental Science Center, University of Tokyo, Japan
9:40am - 10:30pm	*Performance of Pre-denitrification Submerged Membrane Bioreactor (MBR) under Various Solid Retention Times* Speaker: **Ong Say Leong**, Center for Water Research, Division of Environmental Science & Engineering, National University of Singapore, Singapore *Effect of SRT on Membrane Fouling and Performance* Discusser: **Hang-Sik Shin**, Department of Civil and Environmental Engineering, KAIST, Korea
10:30am - 11:20am	*An Approach towards a Better Understanding of Fouling Phenomena in MBR* Speaker: **Roger Ben Aim**, Laboratory of Environmental Engineering (LIPE), INSA Toulouse, France *An Alternative Approach towards a Better Understanding of Fouling Phenomena in MBR* Discusser: **Duu-Jong Lee**, Department of Chemical Engineering, National Taiwan University, Taiwan
11:20am - 12:10pm	*Membrane Biofouling in the MBR Treating Domestic Wastewater: Identification of Key Players in Membrane Biofouling* Speaker: **Satoshi Okabe**, Graduate School of Engineering, Hokkaido University *Is Biofilm Formation The Key Player in MBR Biofouling?* Discusser: **Guang-Hao Chen**, Department of Civil Engineering, Hong Kong University of Science & Technology, China
12:10am - 1:30pm	*Lunch Break*

Afternoon Session

1:30pm -	*Track for Drinking Water I* Moderator: **Shin-ichi Nakao**, School of Engineering, University of Tokyo, Japan
1:30pm - 2:20pm	*Nanomaterials and Membranes for Water and Wastewater Treatment* Speaker: **Mark R. Wiesner**, Pratt School of Engineering, Duke University, U.S.A. *Nanosized Materials in Membrane Applications* Discusser: **Yoshihiko Matsui**, Graduate School of Engineering, Hokkaido University
2:20pm - 3:10pm	*Mechanism Involved in the Evolution of Irreversible Fouling in Microfiltration (MF) and Ultrafiltraion (UF) Membranes Used for Water Treatment* Speaker: **Katsuiki Kimura**, Graduate School of Engineering, Hokkaido University *Discussion of "Mechanism Involved in the Evolution of Irreversible Fouling in Microfiltration (MF) and Ultrafiltration (UF) Membranes Used for Water Treatment by Kimura et al. (2006)"* Discusser: **Gary Amy**, Institute for Water Education, UNESCO IHE, The Netherlands

3:10pm - 3:30pm	*Break*
3:30pm -	*Track for Drinking Water II* Moderator: **Yoshimasa Watanabe**, Graduate School of Engineering, Hokkaido University
3:30pm - 4:20pm	*Recovery of Spent Filter Backwash Water Using Coagulation-Assisted Membrane Filtration* Speaker: **Chihpin Huang**, Institute of Environmental Engineering, National Chiao Tung University, Taiwan *Discussion for "Recovery of Spent Backwash Water Using Coagulation-Assisted Membrane Filtration"* Discusser: **So-Ryong Chae**, Graduate School of Engineering, Hokkaido University
4:20pm - 5:10pm	*Low Pressure Membrane Filtration for Drinking Water Production in Germany : State of the Art and Future Developments* Speaker: **Stefan Panglisch**, Department of Water Technology, IWW Water Center, Germany *Comment on "Low Pressure Membrane Filtration for Drinking Water Production in Germany State of the Art and Future Developments"* Discusser: **Chung-Hak Lee**, School of Chemical and Biological Engineering, Seoul National University, Korea
5:10pm - 5:30pm	*Closing*
6:00pm -	*Party*

Day Two: Tuesday, August 8

Parallel Session 3:
Sustainable Metabolic System of Water and Waste for Area-Based Society

at Hotel Royton Sapporo

Group 2. Strategy for Sustainable Solid Waste Management

8:30am -	*Registration*

Opening

1:30pm -	*Opening* **Toshihiko Matsuto**, Graduate School of Engineering, Hokkaido University

Session

1:40pm - 2:40pm	*Waste Management, an Integrated Part of Sustainable Resource Management* **Paul H. Brunner**, Institute for Water Quality, Resource and Waste Management, Vienna University of Technology, Austria
2:40pm - 3:40pm	*Sustainable Land Disposal: Definitions and Possible Approaches* **Luis F. Diaz**, Calrecovery, Inc., U.S.A.
3:40pm - 4:00pm	*Coffee Break*
4:00pm - 5:00pm	*Integrated Strategy of Recycling in Korea* **Dong-Hoon Lee**, Department of Environmental Engineering, University of Seoul, Korea
5:00pm - 5:30pm	*Discussion*
5:30pm -	*Closing*

Day Three: Wednesday, August 9

Plenary Sessions: Prospects for Means of Solution

at Hokkaido University Conference Hall - Auditorium A

Session 1. Roles of Higher Education and International Collaboration for Sustainable Development

Chairperson: **Takeshi Kishinami**, Hokkaido University

Co-Chairperson: **Midori Yamagishi**, Hokkaido University ···P125-127

Keynote Speech

9:00am - 9:30am	*Education for Sustainable Development: If Not the Solution, At Least a Start* **Sheldon Shaeffer**, UNESCO Asia and Pacific Regional Bureau for Education, Bangkok, Thailand ···P99-110

Panel Discussion

Coordinator: **Norihito Tambo**, University of the Air, Japan ···P111-113

9:30am - 11:30am	*Panelists:* **John Cusick**, Environmental Center, University of Hawai'i at Manoa, U.S.A. ···P114-115 **Stephen Lincoln**, School of Chemistry and Physics, University of Adelaide, Australia ···P116-118 **M. Harun-ur-Rashid**, Training & Communication Wing, Bangladesh Agricultural Research Institute (BARI), Bangladesh ···P119-122 **Motoyoshi Ikeda**, Faculty of Environmental Earth Science, Hokkaido University ···P123-124 **Sheldon Shaeffer**, UNESCO Asia and Pacific Regional Bureau for Education, Bangkok, Thailand

Session 2. Poster Session
Higher Education and Countermeasures for Sustainable Development

11:30am - 12:15pm	*Poster Session at Room 1*
12:15pm - 1:15pm	*Lunch Break*

Session 3. Countermeasures for Sustainable Development

Chairperson: **Oleg Shcheka**, Department of International Programs and Projects, Far Eastern Branch of the Russian Academy of Sciences, Russia

Co-Chairperson: **Takayuki Shiraiwa**, Research Institute for Humanity and Nature, Japan ···P168-169

Keynote Speech

1:15pm - 1:45pm	*Interaction between the Amur River Watershed and the Sea of Okhotsk in the Model of Sustainable Development* **Petr Y. Baklanov**, Pacific Institute of Geography, Far Eastern Branch of the Russian Academy of Sciences, Russia ···P128-149
1:45pm - 2:05pm	*Sustainable Food Production: Integration of Food, Health, Environmental Challenges* **Kalidas Shetty**, Department of Food Science, University of Massachusetts, Amherst, U.S.A. ···P150-153
2:05pm - 2:25pm	*The Land Use Change in Northeast of China since 1980* **Bai Zhang**, Northeast Institute of Geography and Agricultural Ecology, Chinese Academy of Sciences, China ···P154-157
2:25pm - 2:40pm	*Break*

2:40pm - 3:00pm	*An Evaluation of Water Allocation Mechanisms: A Korean Case* **Dong-Geun Han**, School of Economics and Finance, Yeungnam University, Korea	···P158-160
3:00pm - 3:20pm	*Challenges and Strategies for the Planning and Design of Sustainable Landscapes* **Jack Ahern**, Department of Landscape Architecture and Regional Planning, University of Massachusetts, Amherst, U.S.A.	···P161-164
3:20pm - 3:40pm	*Creating Effective International Regimes: New Approach of Political Science* **Toru Miyamoto**, Graduate School of Public Policy, Hokkaido University	···P165-167
3:40pm - 3:45pm	*Summary of This Session*	
3:45pm - 4:00pm	*Break*	

Session 4. Summary of the Symposium

Chairperson: **Takeo Hondoh**, Hokkaido University Initiative for Sustainable Development (HUISD)

4:00pm - 4:05pm	*Overall Review* **Takeo Hondoh**, Hokkaido University Initiative for Sustainable Development (HUISD)	
4:05pm - 4:15pm	*Report from Parallel Session 1* **Mitsuru Osaki**, Sustainability Governance Project (SGP), Hokkaido University	···P170-173
4:15pm - 4:25pm	*Report from Parallel Session 2* **Hiroshi Kida**, Research Center for Zoonosis Control, Hokkaido University	···P174-176
4:25pm - 4:35pm	*Report from Parallel Session 3* **Yoshimasa Watanabe**, Graduate School of Engineering, Hokkaido University	···P177-179
4:35pm - 4:50pm	*Discussion*	
4:50pm - 5:00pm	*Closing Remarks: For Our Future Direction* **Takeo Hondoh**, Hokkaido University Initiative for Sustainable Development (HUISD)	···P180-181

Abstracts and Presentations

Congratulatory Speech by Guest of Honor

Daisuke Machida

Director
International Science and Technology Affairs Division,
Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan

It is a great pleasure for me to be invited to this international symposium on sustainable development and say a few words on behalf of my ministry, MEXT.

Sustainable development has been recognized as an important issue by the international community for a long time, at least since the Earth Summit in 1992. It is also identified as one of the six goals in the new Science and Technology Basic Plan. Therefore, I would like to congratulate Hokkaido University on launching the new initiative for sustainable development, and I am very glad that MEXT can support this initiative financially under its "Program for reinforcing the headquarters of universities for the strategic promotion of international activities".

Since I am in charge of international science and technology affairs at MEXT, today I would like to talk about a recent policy measure of MEXT with respect to promoting international research activities.

The 3rd Science and Technology Basic Plan, which is the basic guideline for the government policy of science and technology for the next 5 years, proposes to "strategically promote international activities" in the chapter of "Reforming the S&T System". More in detail, it proposes three things:

(1) To promote systematic efforts of international activities;
(2) To strengthen cooperation with Asian countries; and
(3) To promote environment for international activities.

The third one includes to reinforce the administrative system or administrative department of universities and other research institutions involved in international activities. To this end, MEXT started last year a new program to promote organizational and strategic international activities of universities by the name of the "Program for reinforcing the headquarters of universities for the strategic promotion of international activities". The background for starting this program is that there are some problems with traditional international activities at

Japanese universities, that is,

- Most international activities depend on personal efforts of individual researchers;
- As a result, there is too much burden on researchers involved in international activities;
- And those activities are not organizational or strategic;

and

- As an indicator to measure internationalization of Japanese universities, the ratio of non-Japanese academic staff is only 3.5%.

That is the background in which MEXT started the program for 20 universities to operate the headquarters for the strategic promotion of international activities. This program provides financial support for 5 years for various efforts by universities to strategically promote international activities with a view to establishing good models for all academic institutions in Japan. I understand that this symposium is held under the overall strategy of international activities of Hokkaido University.

I think that in Japan, scarce land and natural resources have forced us to develop advanced science and technology that could support sustainable development. Therefore, I am sure that the Japanese scientific community as well as industry has good potential to work on this issue in various fields and that Hokkaido University is one of the leading education and research institution in terms of human resources, research organization, and accumulation of expertise as a whole.

Sustainable development can be a domestic issue in each country, but it is usually considered as global issue because every problem originated in one country affects other countries or at least it is likely to happen in other countries too. So it is not sufficient to work on it within individual institutions or countries, but it is indispensable to collaborate internationally or globally and among different academic disciplines. I hope this symposium will be an excellent occasion for exchanging most updated information on the research on science for sustainable development and strengthening the ties of the international scientific community for the common interest of humanity.

Thank you very much for your attention.

Background of This Symposium

– Hokkaido University International Symposium on Sustainable Development–

Takeshi Kishinami

Vice President
Hokkaido University
E-mail: kisinami@coin.eng.hokudai.ac.jp

Hokkaido University, aspiring to promote its activities in the fields of education, research and social contribution as an internationally characteristic university, is engaged in various activities.

Four major activities to promote internationalization are:

(1) Reinforcement of exchanges with universities worldwide

Hokkaido University has concluded the Exchange Agreements with 141 universities (as of 1 April, 2006), including the Departmental Exchange Agreements, thereby widening the scope of exchanges of faculty members and students. We have, at the same time, been actively holding university-wide bilateral symposiums with our partner universities, thereby strengthening the cooperative activities with the limited number of partners.

(2) Increase in the number of international students

Today over 800 foreign students have been studying on campus at Hokkaido University. We have formulated the "Strategic Plan for International Activities" and have been promoting exchanges with Northeast Asia, particularly China, South Korea and Taiwan, in order to increase the number of international students..

(3) Strengthening international public relations activities and overseas networks

We have newly published and widely distributed the Hokkaido University introductory pamphlet's in Chinese and Korean versions in addition to English. The quarterly-published English and Chinese Newsletter also introduce Hokkaido University's most recent activities in an easy-to-understand manner. We have established a liaison office in Beijing in April 2006 to provide more information and better services for Chinese researchers and students, as well as to support former international students in alumni associations' activities.

(4) Promotion of international cooperation

We concluded the Comprehensive Partnership Agreement with the Japan International Cooperation Agency (JICA) in April 2005, forging a stronger cooperative framework than ever. Furthermore, we have accepted trainees regarding the establishment of a waste disposal system in Inland China in collaboration with the Japan Bank for International Cooperation (JBIC).

In addition to the above mentioned activities, Hokkaido University has started new challenges in the field of Sustainable Development. The concept of sustainable development involves environmental perspectives, such as the responsible use and conservation of the earth's finite resources, as well as economic and social perspectives, such as continued life and prosperity of humanity. Thus, sustainable development contains three elements - environment, economy and society. Sustainable development has become a shared concept in the international community as evidenced by its reoccurrence at various United Nations conferences as well as throughout academia, such as the Science Council of Japan, which, for example, stated that a keyword running through all of its targeted missions is "sustainability, that is, the harmony between environment and economy" in the Principles of Strategic Science and Technology Policy, Japan, which were released in the spring of 2005.

The single phrase "internationalization of universities" actually involves extensive areas and diverse approaches. Our first target is internationalization in the area of sustainable development. We intend to implement strategies concerning research, education and social contribution, by focusing on enhancements of functions in the following four areas: (1) international research partnership; (2) international education partnership; (3) international cooperation, public relations and brand equity; and (4) comprehensive support (services) for international exchanges.

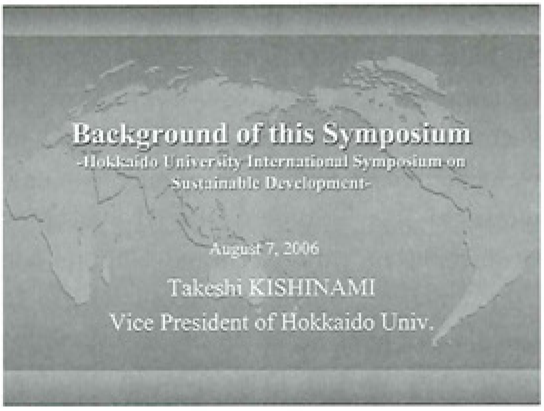
Hokkaido University Initiative for Sustainable Development, established in November 2005, has declared its objectives as follows:

- To make well known to the rest of the world the fact that Hokkaido University has practiced internationally competitive education and research;
- To make the university have a high affinity with the international community and abound in diversity;
- To make greater contributions to the international community through the spread of academic results and policy recommendations as well as the development of international cooperation activities

We at Hokkaido University have enough track record and accumulation of expertise to respond to international demands in extensive academic fields that constitute the foundation of sustainability. The representative academic fields are as follows:

- "Global warming"
- "Integrated water management"
- "Establishment of a recycle-oriented international community"
- "Stabilized supply of food and secured forest"
- "Measures against infections diseases"

I hope that plenty of fruitful discussion will be made during this international symposium, and your stay in Sapporo will be pleasant and memorable one.
Thank you.

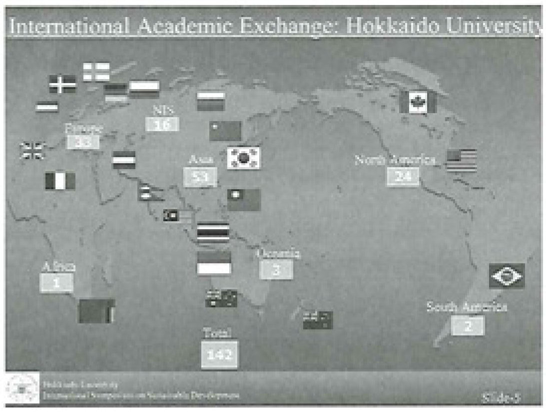

Background of this Symposium
-Hokkaido University International Symposium on Sustainable Development-
August 7, 2006
Takeshi KISHINAMI
Vice President of Hokkaido Univ.


History of Hokkaido University
1876-1907 Sapporo Agricultural College
The First College in Japan to Award Bachelor Degrees
1886 Tokyo Imperial University
1897 Kyoto Imperial University
1907 Tohoku Imperial University
1918-1947 Hokkaido Imperial University
1919 Kyusyu Imperial University
1931 Osaka Imperial University
1939 Nagoya Imperial University
1947- 2004 Hokkaido University
October, 2001 The 125th Anniversary of the University
April, 2004- National University Corporation Hokkaido University
Slide-1


Basic Philosophies of Hokkaido University
Frontier Spirit
Global Perspective
All-Round Education
Practical Learning
Slide-2


17 Graduate Schools & Faculties: Sapporo Campus
Letters
Education
Law
Public Policy
Economics & Business Administration
Science
Medicine
Dental Medicine
Pharmaceutical Sciences
Engineering
Agriculture
Veterinary Medicine
Fisheries Sciences
Environmental Earth Science
International Media and Communication
Information Science and Technology
Advanced Life Science
Slide-3


Four Major Activities to Promote Internationalization
Reinforcement of Exchange with Universities Worldwide
Increase in the number of International students
Strengthening International Public relations Activities and Overseas networks
Promotion of International Cooperation
Slide-4

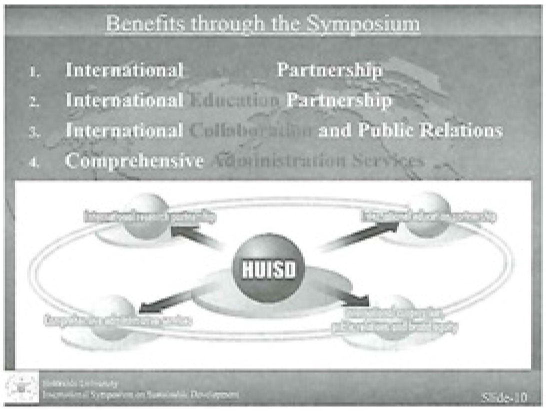

International Academic Exchange: Hokkaido University
Europe
43
NIS
16
Asia
53
North America
24
Africa
1
Oceania
3
South America
2
Total
142
Slide-5


Why did we launch Sustainable Development Projects?
1. Hokkaido is located at cross-area of Japan Sea, Okhotsk Sea(covered with ice during winter) and North Pacific Sea
2. Many Field Science Researches regarding to Environmental science, Marin science, Agriculture and Zoonosis in H.U.
3. Strengthening International Collaborative Research between Foreign Universities and Hokkaido University
Slide-6


Focusing Research Fields on Sustainable Development in Hokkaido University
1. Global Warming
2. Integrated Water Management
3. Establishment of a Recycle-Oriented Eco-System
4. Stabilized Securement of Food and Forest
5. Measures against Infections Diseases
Slide-7


Background and Aims of this Symposium
1. Sustainable Development has already become the top priority not only in academic circles, but also in the international community.
2. Hokkaido University desires to share scientific recognition with researchers from a broader range of Disciplines beyond national and regional boundaries.
3. To establish scientific consortium or International Collaborative Networks of Research and Education.
Hokkaido University
International Symposium on Sustainable Development
Slide-8


Challenges of this Symposium
1. Sustainability of the Earth System
2. Sustainable Society with Recycling System
3. Emerging Infections and Global Environment
4. Sustainability Governance on Food and Bioresource
5. Roles of Higher Education and International Collaboration for Sustainable Development
Hokkaido University
International Symposium on Sustainable Development
Slide-9


Benefits through the Symposium
1. International Partnership
2. International Education Partnership
3. International Collaboration and Public Relations
4. Comprehensive Administration Services
HUISD
Hokkaido University
International Symposium on Sustainable Development
Slide-10


END of THE PRESENTATION

Hokkaido University International Symposium on Sustainable Development
Monday August 7, 2006 / 9:00am-9:45am
Keynote Speaker

Prospects of the 21st Century with Respect to Sustainability

Itaru Yasui

Vice Rector
United Nations University, Japan
E-mail: yasui@hq.unu.edu

—Prof. Kishinami—

The keynote speech of the symposium will be presented by Prof. Itaru Yasui. Prof. Yasui has been the Vice-Rector of the United Nations University since 2003, after working for Tokyo University as a professor. As for the outline of his speech and profile, please refer to the booklet we have distributed. Prof. Yasui, please.

—Prof. Itaru Yasui—

Good morning, ladies and gentlemen, and thank you for the invitation by Hokkaido University. I'm very pleased and honoured to be here and to have an opportunity to deliver a talk.

It's quite hot today, and some say it's probably due to a global climate change. That may be so, but it may not be so. However, I choose "Prospects of the 21st Century with Respect to Sustainability" as the title of my talk, in which I will talk about sustainability, and also about the future. To talk about the future is quite dangerous because I don't have a time machine or magic mirror to tell the future, but I shall try.

Before proceeding, I would like to take a short time to introduce UNU. The UNU is an international community of scholars, and we are a bridge between the United Nations and the international academic community. (DATA 2) Also, we will be or we would like to be a platform for innovative and creative ideas for UN operation. Our name is has a word of "university" in it, but actually we are not a university at all, because we don't have any students or professors, and we are rather just an international committee of scholars. We would like to be a think-tank for the United Nations' system, and we are also doing some capacity building around the world. We have about 13 research training centres all around the world, and the activities in Tokyo are only about 10% of the activities of UNU.

Let's move to the topics, and to start with, some experiences in Japan. Japan is a very special country, and we have experienced very bad things in our environment. In the 1960s we had the Minamata and Itai-Itai diseases. (DATA 3) These were very bad and due to pollution caused by chemical industries at that time. After that, we happily improved the environmental situation to a great extent. But we had traffic pollution issues and also POPs - persistent organic pollutant issues - in the 1970s. In the 1980s there was illegal dumping of waste, and the 90s was the age of waste management and when we started recycling. In 1997, we had the Kyoto meeting and the so-called Kyoto protocol was founded there. Then, in 1999, some endocrine disrupting compound issues, and from the year of 2000, the sustainability issues started.

In a schematic diagram of the issues, at the top would be dioxin and POPs. We had a very hot issue in 1999 or so, but actually at that time the issues had been solved already, because dioxin emissions in the Japanese environment maximised in 1970, or so. Air pollution is about to be solved, and water and sea pollution may take a little longer to be solved. Endocrine disrupting compound issues can be a problem, but now we have found that it's not such a big issue, at least for human health, although it may have some adverse effects on the eco-system. With the depletion of the ozone layer, we are now waiting for the solution. It's completely down to the capacity of the earth. Soil and sediment pollution may take a long time to be solved because we have already emitted so many of these compounds into the environment in the 1970s and '80s. The other important issues are resource and energy consumption-related issues, and also global warming is a very, very important issue, and the importance is gradually increasing.

Let's go back to the dioxin issue. We had a hot issue in 1998 or '99 or so, but the real emission was due to herbicides named PCP or CNP, in the 1960s, '70s and early '80s. This part is a so-called Coplanar PCB, which is accompanied by the emission of PCB, and these measures are the cause of dioxin pollution in Japan. We had a very strong debate against incineration, but the actual contribution from incineration was very small. I think the overall trend now is that the situation is improving.

The other example is points of measurement of concentration of environmental standard. For example, lead, cadmium, arsenic, PCB and chromium, and others are all decreasing due to the very severe regulations of environmental schemes. The worst situation was in the 1970s, and within only 10 years or so the improvement is very, very quick. After that, still gradual improvement is continuing.

Now, with regards the sustainable development or sustainability, and as a definition of sustainability, I understand we have to think about the future generations. That's the real attitude towards sustainability. In September 2000, the United Nations had a Millennium Summit, where the Millennium Development Goals (MDGs) were agreed. We have 8 MDGs, and for each goal, one or more targets have been set, and certain goals have to be attained before 2015, using 1990 as a benchmark. These are the MDGs: first of all, to eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality and empower women; reduce child mortality; improve maternal health; combat HIV/AIDS, malaria and other diseases. We had an Earth Summit in 1992, but environmental sustainability was only the 7th item on the MDG. We agreed in 1992 that global environment issues were so important, but in only 8 years we had very different types of important issues.

Now I'd like to explain about the situation. This is the plot of life expectancies of more than 130 countries, with GDP per capita. The dots express all the countries. Japan has the longest life expectancy in the world. Several things can be seen from this figure. First of all, the life expectancy of 70 years of age can be rather easily achieved by a GDP per capita of only about 3,000 dollars. But I think this is a very big problem. So probably 3,000 dollars makes it possible to have a tap-water system for every home, and also children's diarrhoea can be treated using simple medicine. Then the life expectancy can reach 70. I think the human body is rather strong, so even with very advanced medical treatment we can only elongate life expectancy by about 10 years or so. This graph is based on the data for 1995, and when we drew a figure using the data of 2001, some very peculiar points appeared. One country, Luxembourg increased its GDP per capita substantially in this 6-year period. It completely changed the structure of its economy, from steelmaking to banking and other kinds of systems. Apparently, it's a good change if we'd like to have much money.

Four points moved and appeared at different places on the graph. We can congratulate them, but in reality they have dropped from somewhere else. This is the situation for the country of Botswana in Africa, which may not be all that well known to the people of Japan. It's just north of South Africa, and that area is very rich in mineral resources, so they can produce gold, diamonds and the like. So it's a very rich country in Africa. But the situation is something like this. In 1986 or so, the life expectancy exceeded 60 and almost reached 62, but after that it decreased sharply to 38 or so. Of course, you know the reason - HIV/AIDS. They want to do something, but there's no one available with enough power to do anything. This figure shows the importance of the 6th MDG item.

Now let me talk about other topics; this is the global warming issue, and this is a very famous and important figure from the report by IPPC in 2001. This shows the future trends of temperature increases, depending on the emission scenarios. It can be said that this green curve is not so bad, and this broken red line can be enough. But for the others, such as this black one, they are still increasing, so we cannot say where it will go, so we should probably avoid doing so. Taking a look at the emission scenarios corresponding to these curves, the green one is something like this. So the gradual increase of emission of CO2 up to 2040 or '50 is not too bad, but after that, we have to decrease the emission rather sharply. And for the broken red curves, more increase can be allowed, but after that, the situation is the same.

This is a graph prepared by myself. We can increase emissions up to the year 2050, but after that, we have to decrease rather sharply. That means each country should have this shape of emission scenarios. Some European countries have already started to decrease emission, and Japan is about to start to decrease of CO2 emissions. In the United States too, someday in the near future they have to start decreasing CO2 emissions. For the others, this can be a country like Cambodia, where they can increase CO2 emissions for some time, and then decrease.

Recently there is a new proposal, and this is actually a scenario by NIES, which we call the 475ppm scenario. According to their calculations, we have to limit the concentration of global-warming greenhouse gases to less than 475ppm in order to keep the temperature increase less than 2 degrees. But we have to be careful about that. This starting point is 1990, but already there is a 0.6-degree increase in that period because they counted the temperature increase after the industrial revolution. So to limit the total increase, it should be less than 2 degrees or so.

The corresponding emission scenario is something like this. This red line shows that from 2020 or so, in less than 10 years we have to decrease the emission by 40%. That's a very big amount, and I have to redraw the figures to something like this. If 475ppm is real, then we have to do something much, much quicker.

This is the trend in risks, and I'd like to divide risks into two categories: one is local; the other is global. The global risks are global warming, population issues, over consumption of resources, food supply, bird flu, etc. In Japan's case the local risks are going down, so probably we have to hope that it is possible to cope with these global risks.

Now I'd like to introduce the concept of environmental transition, and to understand the trend of environmental issues. The historical concept was proposed by a Russian, Professor Kuznets, who showed some figures, not for the environment but for the income of each country. This is the Environmental Kuznets Curve in which SOx concentration in capital area is plotted against GDP per capital in logarithmic scale. If the scale of the economy is very small, there's no pollution at all. But after some economical development starts, the pollution increases and peaks when the GDP is almost the same as the previous value of 3,000 dollars per year per person. After that, the concentration tends to decrease if we attain some economical development. For this region, a good spiral is achieved for the economy and environment. If it is possible for us to attain this curve for the emission of CO2, I think it's a solution.

Let's take a look at the emission of each country, against GDP per capita. If we look at the emission of CO2, we will notice that it's impossible to make a discussion using CO2 emission because one extreme example is for Iceland. Iceland consumes the most amount of energy, but they emit only 8 tons CO2, or so, per capita, owing to hydropower and also geothermal energy. The conclusion is quite simple: we have to use the idea of the consumption of energy instead of CO2 emission.

This is the plot of GDP per capita and the energy consumption per capita in oil equivalent. In Japan we consume about 4,000 kg of oil per person per year. Unbelievable it may seem, we each consume 4 tons of energy, annually. So I finally came to the conclusion that we can divide the countries up into (1) oil-producing countries like Bahrain, Kuwait, UAE, Trinidad & Tobago - although Saudi Arabia has improved a little; (2) big counties, like Russia, Canada and the United States; (3) northern countries like Norway; (4) countries like France and Japan, etc.; (5) others like Portugal and Hong Kong; and then (6) tropical countries. It seems like it works, but actually I think this curve is not true. Let's take a look at Luxembourg. Luxembourg is located just south of the Netherlands, so if only a geographic condition can determine this, then Luxemburg should be somewhere here. In Luxembourg they consume almost twice the energy of neighbouring countries, but maybe there's a different interpretation. If you visit Luxembourg you'll find that the price of gasoline is substantially cheaper than the surrounding countries. The tax in Luxembourg is much less than in Belgium or Germany, so the price of gasoline is much cheaper there. It is possible that Belgium and German people go into Luxembourg to buy gasoline. I don't know whether this spot is reflecting a true figure of the consumption of Luxembourg, or not. If we take a look at the United States, like Japan they are still increasing the consumption of energy, I believe. We are trying to stabilize the consumption of energy, but it's quite difficult. This kind of graph is so optimistic, and probably the real thing is something like that, we cannot be certain.

I'd like to point out some countries, such as Denmark and the UK to some extent, where they have already started to decrease the emission of CO2. Is there any explanation why European countries are so eager to decrease CO2? A possible explanation is the so-called Thermohaline Circulation, where the ocean is continuous and there's tidal flow, and this is the Mexican Gulf Stream. This stream comes from the hot areas and is a hot stream, and even people in Iceland can enjoy their lives. Although in the summertime it is only 14 degrees or so, in winter the temperature only drops to approximately 5 degrees below zero. Someone says that if the temperature increases more than 2 or 3 degrees, this tidal flow may stop. If something happens like this, there could be a sharp decrease in temperature like in the Younger Dryas Era 10,000 years ago. What happened at that time was during the course of increasing temperature after the ice age there was a sharp decrease in temperature. The glacier melted and there was a very big lake, then suddenly it collapsed and fresh water flowed into this region and stopped this Gulf Stream. That resulted in a very sharp decrease in the temperature. So that's why European countries are very careful about climate changes, and are so eager to reduce emissions of CO2.

The global warming issue has been caused by the over consumption of oil, but the production of oil is, again, another problem. This is a graph describing the production and oil resources found during that time. This is 1945; this is 1980. It's true that we only have oil for 40 years or so. The reason is that if we produced some oil during a period, finding new resources of oil was usually successful. That means the amount of found oil was much larger than the amount consumed. But after 1980 the amount found decreased, so we entered a deletion mode. Usually, 40 years is the amount of reserves we have, so plus 40 means that 2020 is the key year for us to take a look at oil depletion.

However, the precise year doesn't mean anything at all if we draw this kind of figure. This is a 20,000-year graph with 10,000 years in both ways. This shows the era with all kinds of fossil fuels, so we only have the reserves of 300 or 500 years. If we take a look at this era, there's nothing at all. So even 500 years from now there's no fossil fuel left. We are now in the middle of this era, so it seems quite normal for us, but actually it's a very special occasion for humankind.

These are the transitions already achieved in Japan. We achieved to handle the destruction of forests, pollution issues, disasters and also landfill. The maximum landfill we experienced was in 1991. Now we are about to challenge CO2 emissions and others. So this is the trend in Japan.

I will skip the water issues, but I'd like to point out we are importing virtual water. Virtual water means the indirect import of water with food. So we are consuming this much water, and it's actually decreasing. But the amount of virtual water is increasing. We need much water if we want to supply food by ourselves.

These are the regions with water stress. These are some sequences of human activity: energy use, global warming, climate change, food/drought, crop production and famine. This is one sequence of human activity. But now we are trying to do something new - that's automobile. In order to reduce energy use and global warming, now we are trying to introduce ethanol for automobile use. If this happens, there's a possibility to increase a conflict between ways of using crops, for food or for energy.

Now let's move to the population issues. These are the projections by the UN, and we always have high, medium and low projections. Usually we say that we'll have a population of 9 billion in 2050, but I don't think it's true. I believe it will be less than the lower projection. Probably in 2040 a population of 7.7 billion will be the reality. We have to keep that value, and this is the current trend and future projection of the population. Japan will have a very sharp decrease in population. Italy, Korea and Ukraine already started a population decrease from the year of 1991 because of their economic collapse. The only problem is cases like that of Uganda. I believe their population is increasing because of poverty. They need manpower to gather wood from the forest for energy use or daily consumption, or gather water from remote rivers, etc. They need children for labour, so if we can eradicate extreme poverty, these key factors will decrease the population. It is historically proven, already. We have to increase our human activities below the sustainable capacity of the earth within 300 years, or so. The reason global warming is happening is that we are now doing human activities at a far greater level than the value of the sustainable capacity of the earth, owing to the consumption of fossil fuel. After consuming all fossil fuels we may have two scenarios. One is trying to continue to keep the quantity of human activity at the same level by using nuclear fission and nuclear fusion. Nuclear fission is not so dependable, so it's a little bit doubtful, but is a possible scenario. The other scenario is to reduce the population and also reduce the quantity of human activities below the level of sustainable capacity of the earth. If we depend on new technologies, maybe some uncertainties occur; some intentional distraction, mis-operation or human error. In addition to the population issues, our economic system must be changed within several decades. Efficiency improvement by 2015, renewable energy or corporate responsibility or habit of mind for value by people can be very important.

One example in Japan is a hybrid vehicle, which is very popular in the United States. This vehicle can reduce the emission of CO2, almost by half. The energy efficiency already exceeded the so-called fuel-cell vehicle, and if we use gasoline, this is the answer, or better for only a few decades. After that, we need some change in the habits of minds.

Let's take a look at the life in Japan and in the world. This photograph was taken by a UN project in 1992 or '93. The UN asked the government to pick one typical family, and asked the family to bring all their furniture and belongings outside of the house. This is the case of Bhutan, and this is everything they own. There is some clothing and some others, but basically that's all. Bhutan is one of the poor countries, but the king, who has already retired, said he didn't want to be evaluated by values such as GDP. They introduced the concept of GNH - gross national happiness. They said they must be evaluated by the amount of happiness.

If we take a look at the situation of Japan, we can see the house is full of furniture and everything, so Japan is a country to be evaluated by the amount of furniture and domestic appliances. The total number of things here is about 9,000. The equivalent number in Bhutan is about 25, so if they are happier than us, then what can we do?

Going back to the history of human beings, first we achieved the agricultural revolution in the Younger Dryas era about 10,000 years ago, then in the 1800s the industrial revolution. I believe we are about to have a 3rd revolution. That is to accept the depletion of fossil fuel, to reduce the amount of human activity within the carrying capacity of the earth, and to find out the true goals of human beings on this planet. So we can probably say we have to decrease everything, but pursue an increase in happiness. Also with economical activities in Japan, Japanese companies have reduced emission, resources and other things, and they are about to reduce sales. But still they can pursue profits for a while, but probably after the end of the 21st century they have to change their policy to reduce profits of their own, and redistribute to attain some happiness.

It's a very important time for us. We are now facing the depletion of fossil fuel and others, and we have to cope with global risks. I sincerely hope there is a very effective discussion concerning future sustainability. Thank you very much for your kind concentration.

—Prof. Kishinami—

Thank you very much, Dr. Yasui. Now the paper is open for discussion. Do you have any questions or comments?

—Questioner 1—

It is said, if you were about to depart from this world, one thing that you should never think is "I wish I had spent more time in the office, working". I think we have to appreciate more our total picture of life and what it is all about. So I think that's a very important issue.

—Porf. Itaru Yasui—

I'm almost the same age as you, probably, so I'm facing my retirement. So I think some contribution to the society is a very important point for everybody. Being isolated from our society is not such a happy situation, so just a good connection with society is very important. I agree.

—Quesioner 2—

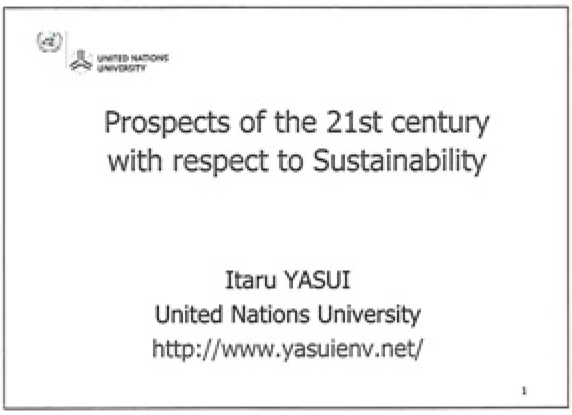
Thank you very much for this presentation. I think that if we have to reach these goals and the prospects of the 21st century, our advantage is that the people will not live 100 years to see whether our strategies functioned, or not. Do you think we need many more strategies or efforts? There is disorder now; you have mentioned this. I don't know whether these strategies could lead [to solutions] in the short term or medium term or long term. Poverty is a big problem. You mentioned the two families from Japan and Bhutan. I know that in China and in India there are families that only possess 5 dollars and one blanket. The poverty problem is not only in developing countries, but also in Europe and the United States. According to the last figures in Germany, we have two million young people who belong in the world poverty scale. It is a big challenge; it is not only in the developing countries, but also in the industrialised countries. The gap between the poor and the rich in all countries is increasing.

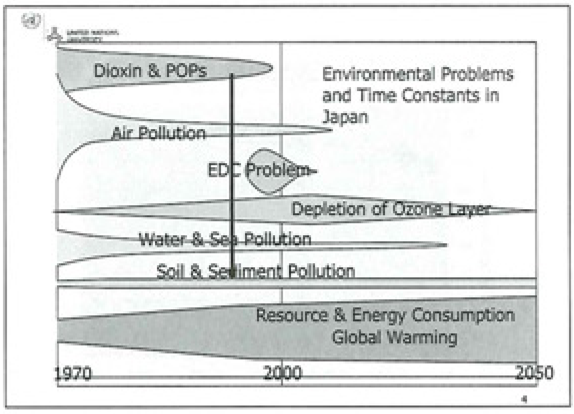
—Prof. Itaru Yasui—

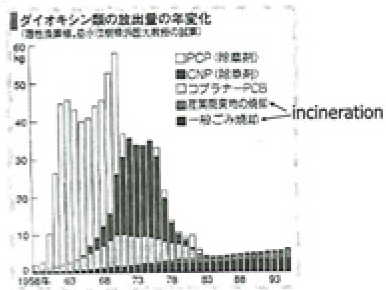
Thank you very much. I think it's an important point, and I have almost the same feeling as you. The solution is very difficult. I would say, as a person in the UN organisation, that the advanced countries should increase ODA. We have some pledges since 1970, and we repeated them several times. The last agreement was made in 2002 at the Johannesburg WSSS. Every advanced country should pay 0.7% of ODA to GDP. But now in Japan's case, we only pay 0.2% of ODA, and the United States pays 0.15%. For Germany it's also in the range of 0.2 or 0.3%. I think we have to increase the amount of ODA. Also we have to modify the economic system, or we have to change the habit of minds about the values of life of human beings. I think it's a very important point.

—Prof. Kishinami—

Thank you again, Dr. Yasui.



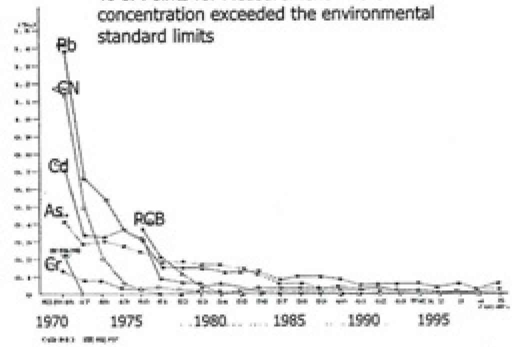




Emission of Dioxin and Related Chemicals to Environment

5

% of Points for Measurement where concentration exceeded the environmental standard limits



6

What is Sustainable Development?

7

Millennium Development Goals

- The Millennium Development Goals are an ambitious agenda for reducing poverty and improving lives that world leaders agreed on at the Millennium Summit in September 2000. For each goal one or more targets have been set, most for 2015, using 1990 as a benchmark:

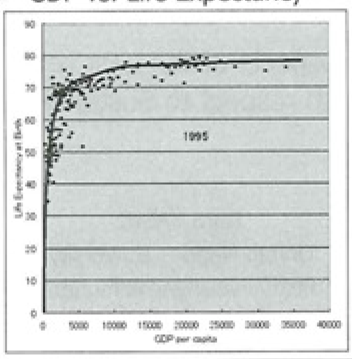
8

8 Goals in MDG

- 1. Eradicate extreme poverty and hunger
- 2. Achieve universal primary education
- 3. Promote gender equality and empower women
- 4. Reduce child mortality
- 5. Improve maternal health
- 6. Combat HIV/AIDS, malaria and other diseases
- 7. Ensure environmental sustainability
- 8. Develop a global partnership for development

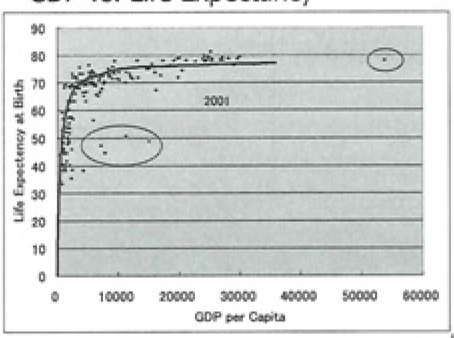
9

GDP vs. Life Expectancy

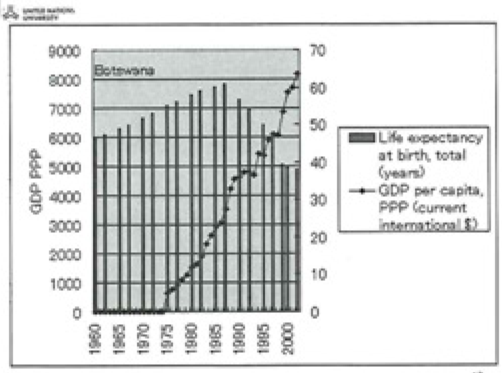


10

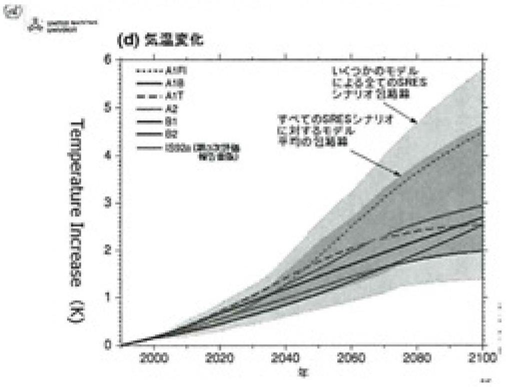
GDP vs. Life Expectancy

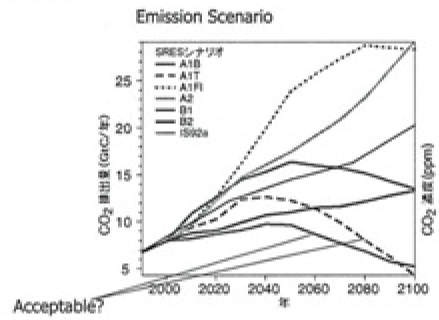


11

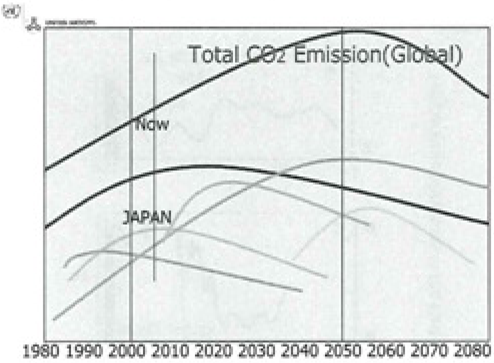


12

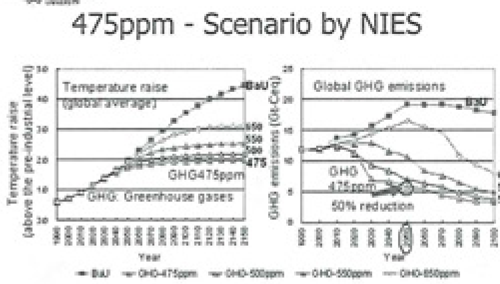




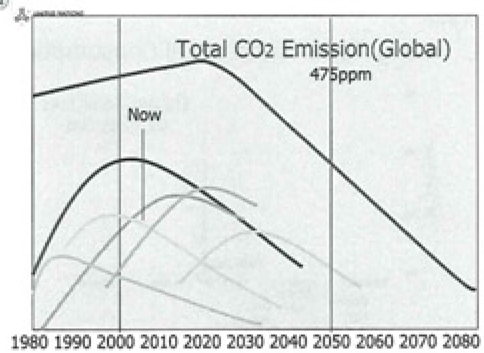
14



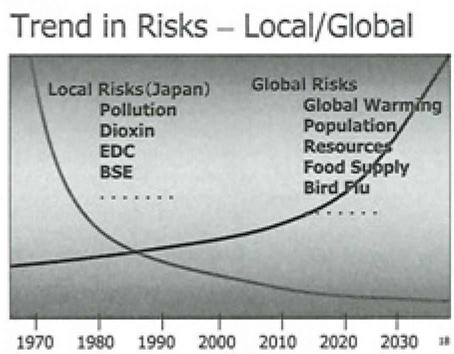
15



16



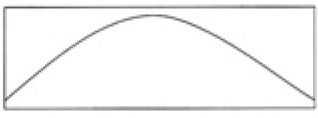
17



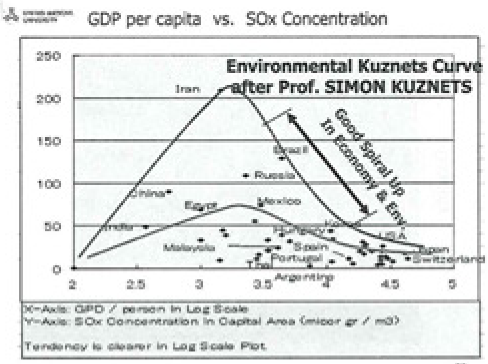
18

Environmental Transition

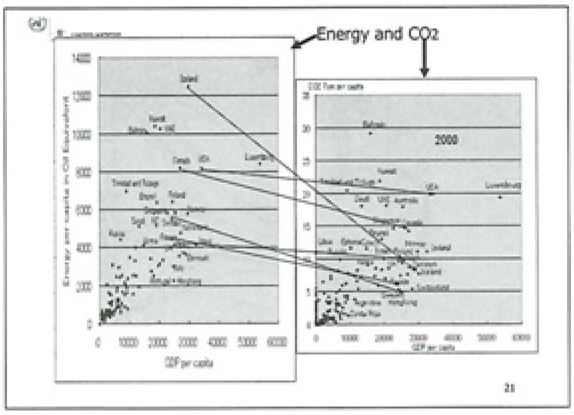
- Understand the Trend of Environmental Issues by using Several Curves!

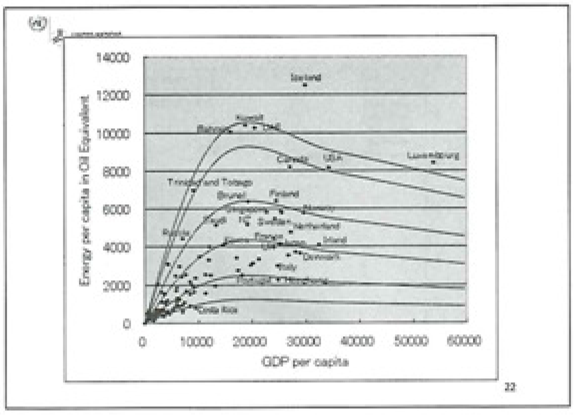


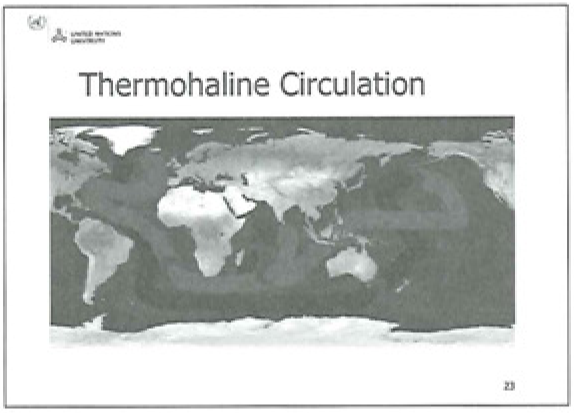
19

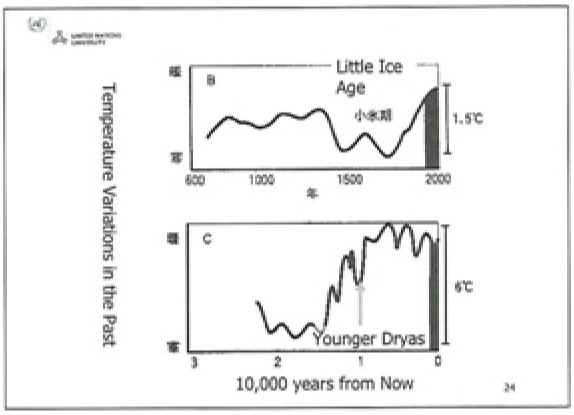


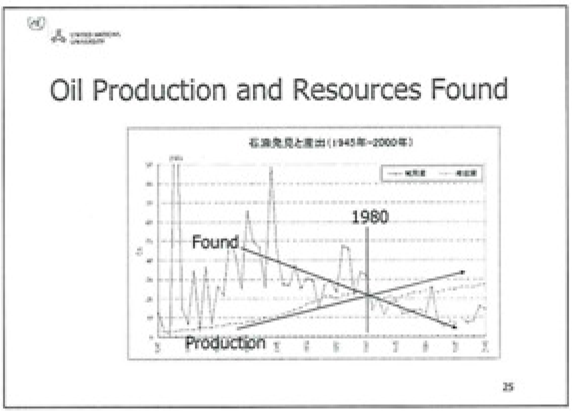
20

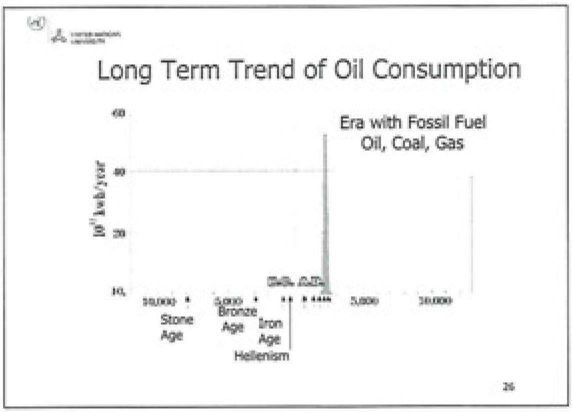


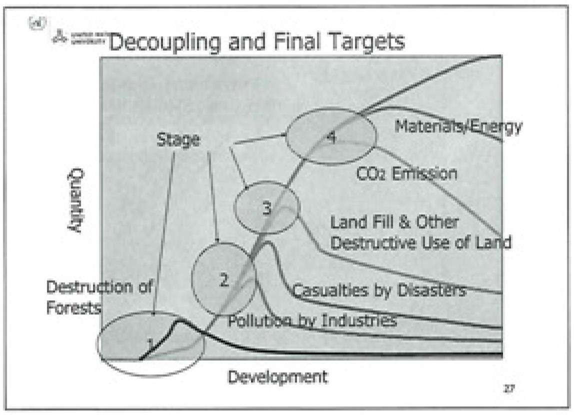












In the case of Water?

28

Daily Risk and Loss of Life Expectancies

	World	Japan*	NorthAm	EU
Underweight	20.73	0.01	0.01	0.00
Iron deficiency	4.22	0.05	0.18	0.09
Vitamin A deficiency	4.25	0.00	0.00	0.00
Zinc deficiency	4.36	0.00	0.00	0.00
Blood pressure	9.07	5.94	7.03	8.66
Cholesterol	5.71	3.01	6.44	6.97
Overweight	3.78	1.92	6.58	5.71
Low fruit and vegetable intake	3.83	1.87	3.65	2.53
Physical inactivity	2.59	1.78	3.03	2.95
Unsafe sex	12.57	0.23	0.88	0.46
Lack of contraception	0.69	0.00	0.00	0.00
Tobacco	7.45	6.15	13.81	11.43
Alcohol	5.34	1.61	2.80	3.01
Illicit drugs	0.79	0.49	1.27	0.97
Unsafe water, sanitation and hygiene	9.04	0.00	0.00	0.00
Urban air pollution	1.05	0.54	0.48	0.28
Indoor smoke from solid fuels	5.74	0.00	0.01	0.00
Lead exposure	0.46	0.05	0.12	0.13
Climate change	0.81	0.00	0.01	0.00
Risk factors for injury	1.16	0.23	0.20	0.23
Carcinogens	0.22	0.23	0.28	0.35
Airborne particulates	0.24	0.06	0.21	0.17
Ergonomic stressors	0.00	0.00	0.00	0.00
Noise	0.00	0.00	0.00	0.00
Unsafe health care injections	1.50	0.00	0.00	0.00
Childhood sexual abuse	0.28	0.16	0.12	0.07

29

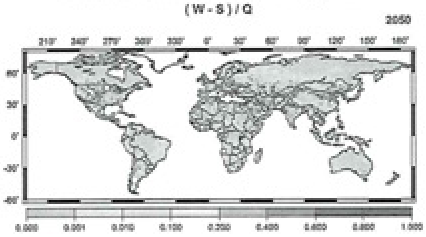
Water Use in Japan

- Daily Life: 130m³／Year·person
- Industrial Use: 110m³／Y·person
- Agricultural Use: 460m³／Y·person
- All Three Categories -- Decreasing

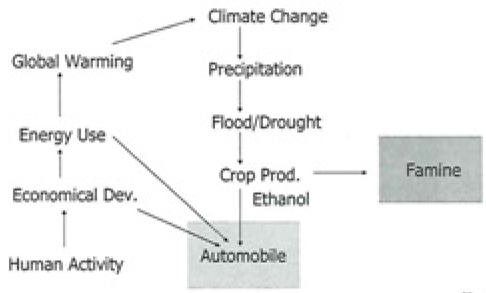
- Virtual Water : 600m³／Y·person =Indirect Import of Water
- Four Factors =Beef, Maize, Soy, Wheat
- In total, Japan use More Water than World Average

30

Regions with Water Stress



31

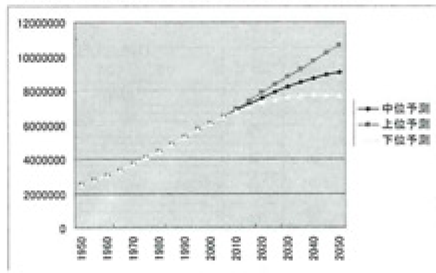


32

Population Issues

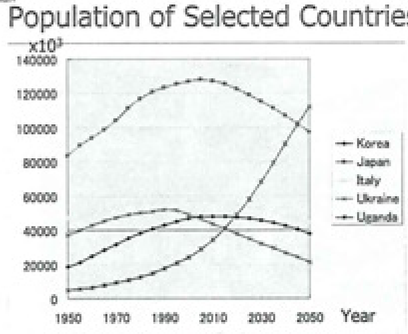
33

UN Population Projection



34

Population of Selected Countries



35

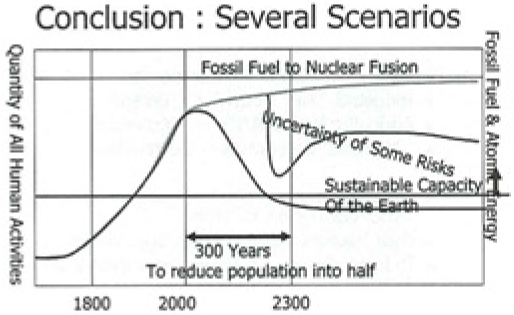
8 Goals in MDG

- 1. Eradicate extreme poverty and hunger
- 2. Achieve universal primary education
- 3. Promote gender equality and empower women
- 4. Reduce child mortality
- 5. Improve maternal health
- 6. Combat HIV/AIDS, malaria and other diseases
- 7. Ensure environmental sustainability
- 8. Develop a global partnership for development

Key Factors to Decrease Population

36

Conclusion : Several Scenarios



37

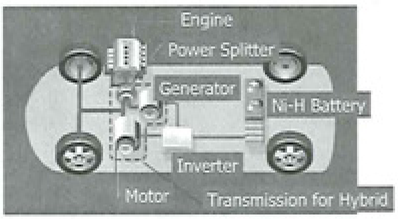
In addition to Population Issue

- Economic System Must Be Changed
- 1. Efficiency Improvement by 2015
- 2. To Use Renewable Energy by 2020
- 3. Corporate Responsibility by 2010
- 4. Change "A habit of Mind for Value" by 2030

38

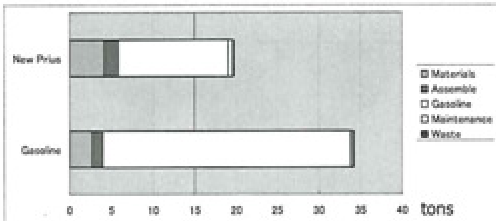
An Example = New Prius

- Hybrid Motor Vehicle by TOYOTA



39

Comparison of CO_2 Emission New Prius and Equivalent



Assumptions: 100,000km Driven in Tokyo
Fuel Consumption: 18km/L for Prius, 8km/L for Others

40

Energy Efficiency of New Prius

	Fuel E	Car E	Overall EE in %
Gasoline	88	16	14%
Prius 1	88	28	25%
Prius 1MC		32	28%
New Prius		37	32%
FCHV Now	58	50	29%
FCHV F	70	60	42%

41

Life in Japan, Life in World

42

Bhutan 13 Family Members

186 US$ 65㎡

Radio 1

(C)Material World / ユニフォトプレス

43

Japan 4 Family Members

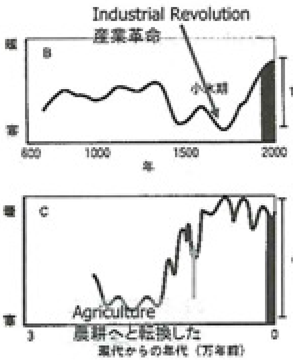
32350 US$ 128㎡

Radio(3)
TV(1)
Telephone(1)
Car(1)
Bicycle(1)
PC(1)
Game Machine(1)
Electric Piano(1)
Frig(1)
MW Oven(1)
Toaster(1)
Washer Dryer(1)
Rice Cooker(1)
Kotatsu(1)

44

In medieval Little Ice Age, people started to good use of coal and started "Industrial Revolution".

In Younger Dryas Cooling, people began cultivating some crops.



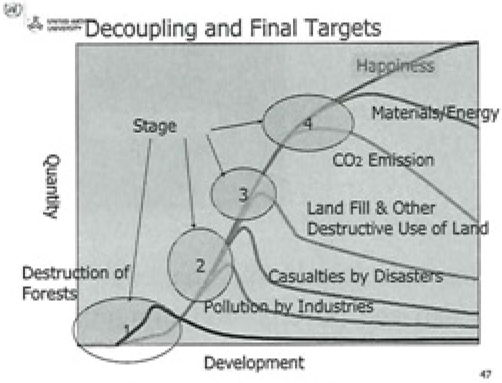
45

The Third Revolution

- To Accept the Depletion of Fossil Fuel
- To Reduce the Amount of Human Activities within the Carrying Capacity of the Earth
- Possibly to Enhance the use of Nuclear Fusion, but it may be Risky
- To Find Out the True Goal of Human Beings on this Planet

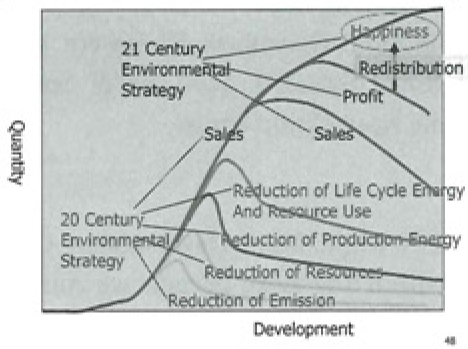
46

Decoupling and Final Targets



47

Economical Activities in 20 & 21 Century



48

Hokkaido University International Symposium on Sustainable Development
Plenary Session 1: Monday August 7, 2006 / 10:00am-10:40am
Speaker

Creating an Applied Earth System Science: Linking Global Environmental Change Science to Sustainability Issues

Kevin J. Noone

Executive Director
International Geosphere-Biosphere Programme (IGBP)
The Royal Swedish Academy of Sciences, Sweden
E-mail: zippy@igbp.kva.se

The UN Millennium Development Goals are an inspiring and formidable challenge for society: within the next decade we must aim to eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality and empower women; reduce child mortality; improve maternal health; combat deadly diseases; ensure environmental sustainability; and construct a global partnership for development. At the same time, society is faced with other challenges such as global climate change, air pollution, decreases in global biodiversity, food resources and how all of these issues tie into global security.

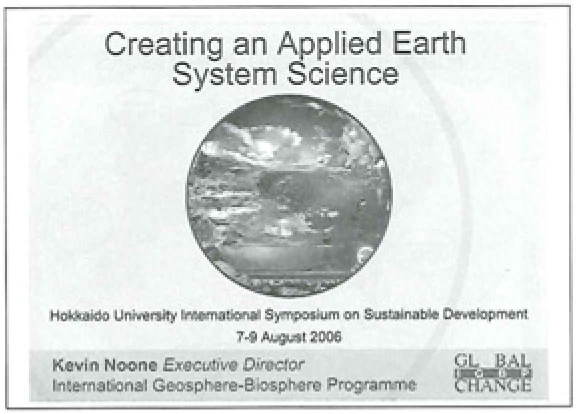
Some have argued that it is not feasible to address all of these issues at once, and that we should simply use a sort of cost-benefit analysis to choose one on which to concentrate. This view may be appealing, but it is fundamentally misguided. It would be a tragedy if, for instance, we were able to completely eradicate HIV/AIDS only to discover that by ignoring global environmental change issues, malaria had become even more widespread or fresh water resources even more scarce. We do not have the luxury of solving these problems one at a time; they need to be tackled together. Understanding how the natural Earth System works, and how we humans influence (and are influenced by) it is at the very heart of addressing these issues, and achieving the Millennium Development Goals.

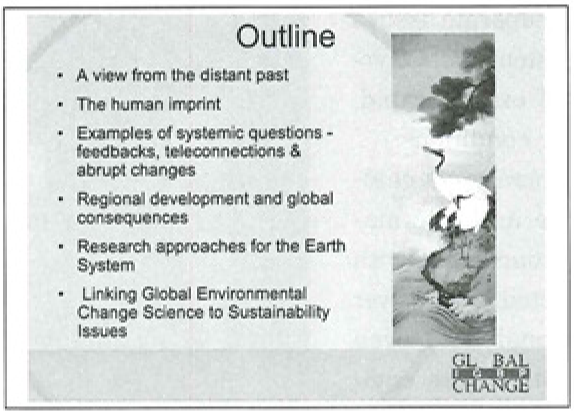
We now know that human activities now match (and often exceed) the natural forces that regulate the Earth System. Recent ice core data show that current levels of carbon dioxide and methane are well outside the range of natural variability over the last 800,000 years. Roughly half of the world's ice-free land surface has been altered by human actions. Humans now fix more nitrogen than nature does. Particles emitted by human activities alter the energy balance of the planet, as well as have adverse effects on human health. These may seem to be unrelated issues; however, over the last decades, we have gained a deeper

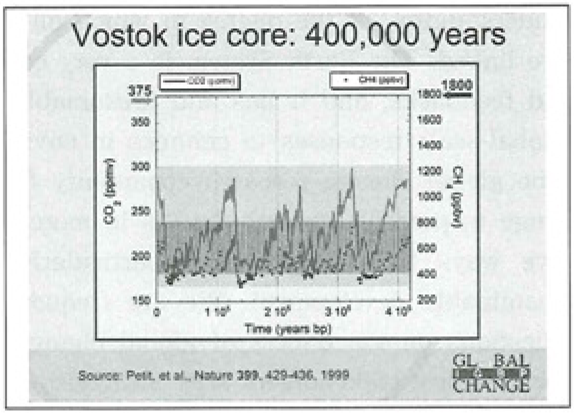
understanding of the degree to which all of these separate issues are linked. The Earth System is a very complex system with myriad feedbacks, and it has and presumably can still exhibit rapid, global-scale responses to changes in environmental conditions.
The global change research community faces an increasing challenge to present research results in more accessible and informative ways to stakeholders - particularly those concerned with sustainable development. We are frequently expected to answer questions on the effects of global change on regional- and even local scales: stakeholders seek strategies to deal with future environmental change.

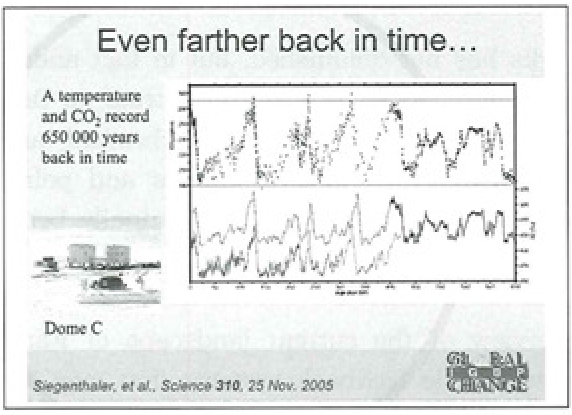
The need to understand how the natural world works has not diminished, but in fact underpins the answers to questions of sustainable development. We still must concentrate on first class science involving the interactions and feedbacks between biological, chemical and physical processes and human systems. However, scientists, resource managers and policy makers require a common understanding in order for their interactions to be mutually beneficial.

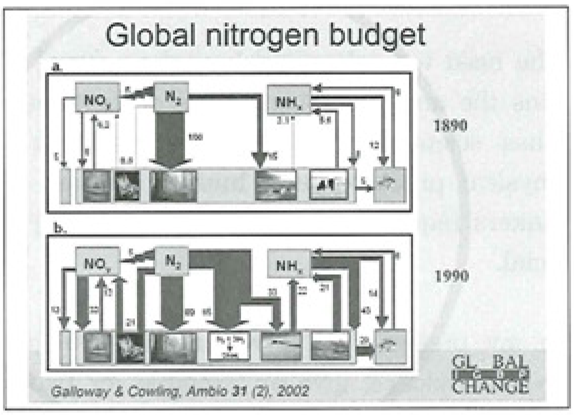
In my presentation, I will attempt to give an overview of the current landscape of Earth *System* Science, give an example (or two) of planetary-scale feedback systems that may impact sustainable development strategies, discuss some the current structural challenges we have in addressing the interdisciplinary questions with which we are faced, and provide some ideas for creating an *Applied Earth System Science* linking global environmental change research to sustainable development.

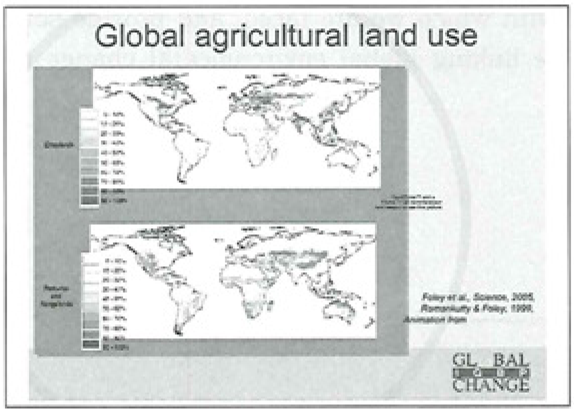



Outline
A view from the distant past
The human imprint
Examples of systemic questions - feedbacks, teleconnections & abrupt changes
Regional development and global consequences
Research approaches for the Earth System
Linking Global Environmental Change Science to Sustainability Issues
GLOBAL CHANGE

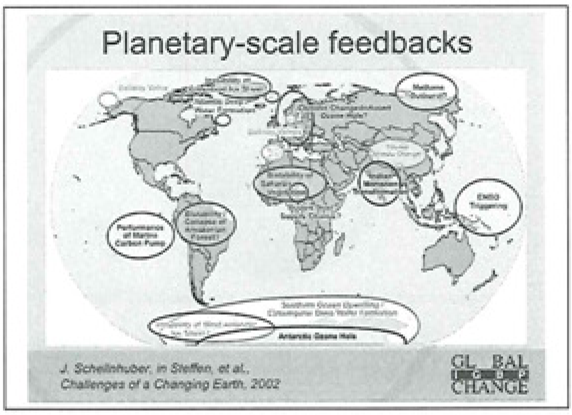

Vostok ice core: 400,000 years
375
1800
CO2 (ppmv)
CH4 (ppbv)
Time (years bp)
Source: Petit, et al., Nature 399, 429-436, 1999
GLOBAL CHANGE

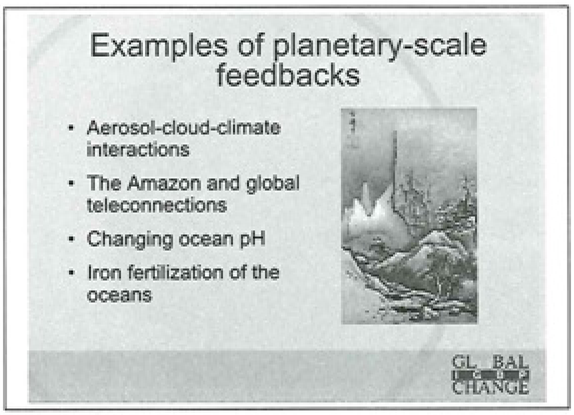

Even farther back in time…
A temperature and CO2 record 650 000 years back in time
Dome C
Siegenthaler, et al., Science 310, 25 Nov. 2005
GLOBAL CHANGE

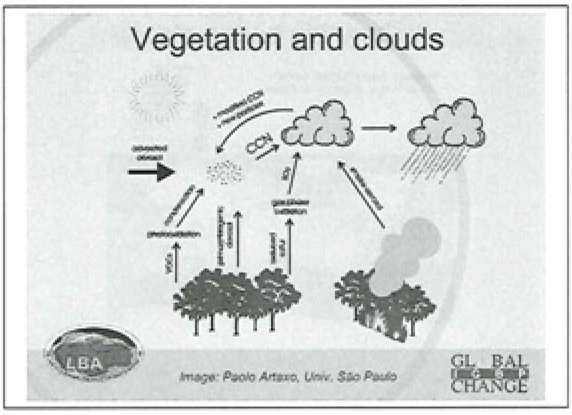

Global nitrogen budget
a.
b.
NOx
N2
NHx
1890
1990
Galloway & Cowling, Ambio 31 (2), 2002
GLOBAL CHANGE


Global agricultural land use
Foley et al., Science, 2005,
Ramankutty & Foley, 1999,
Animation from
GLOBAL CHANGE

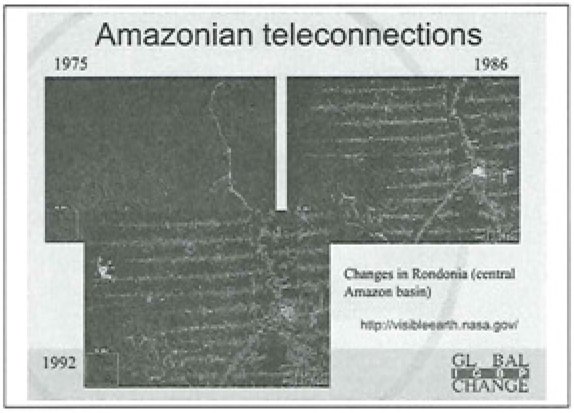

Human influence seen from space
http://visibleearth.nasa.gov/images/1438/earth_lights.jpg
GLOBAL CHANGE


Planetary-scale feedbacks
Methane Outbursts?
ENSO Triggering
Antarctic Ozone Hole
J. Schellnhuber, in Steffen, et al.,
Challenges of a Changing Earth, 2002
GLOBAL CHANGE

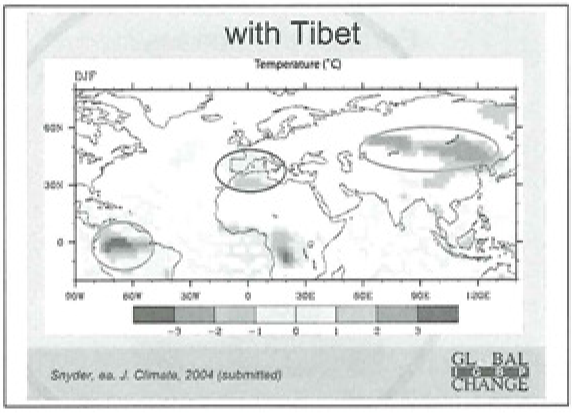

Examples of planetary-scale feedbacks
Aerosol-cloud-climate interactions
The Amazon and global teleconnections
Changing ocean pH
Iron fertilization of the oceans
GLOBAL CHANGE



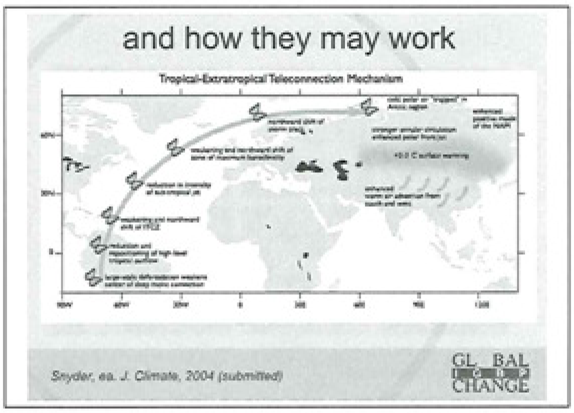
Vegetation and clouds
CCN
LBA
Image: Paolo Artaxo, Univ. São Paulo
GLOBAL IGBP CHANGE



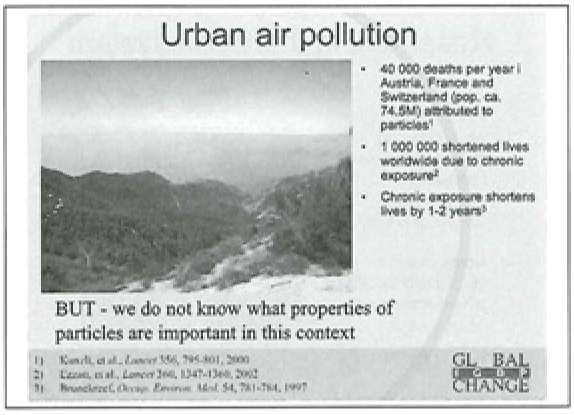
Amazonian teleconnections
1975
1986
1992
Changes in Rondonia (central Amazon basin)
http://visibleearth.nasa.gov/
GLOBAL IGBP CHANGE



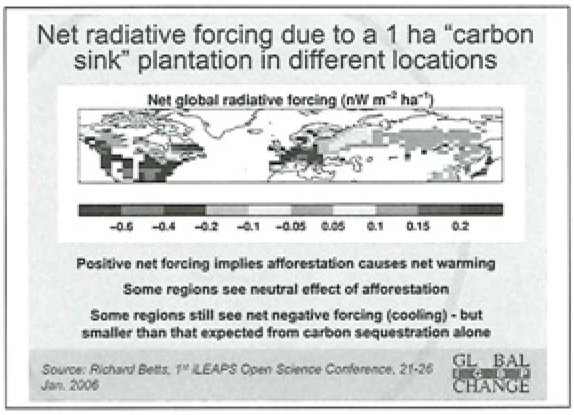
with Tibet
Temperature (°C)
DJF
Snyder, ea. J. Climate, 2004 (submitted)
GLOBAL IGBP CHANGE



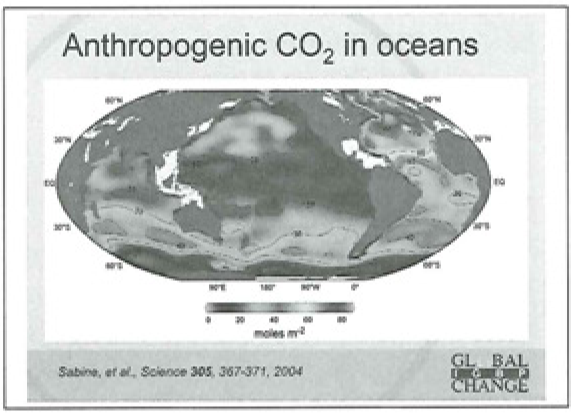
and how they may work
Tropical-Extratropical Teleconnection Mechanism
Snyder, ea. J. Climate, 2004 (submitted)
GLOBAL IGBP CHANGE



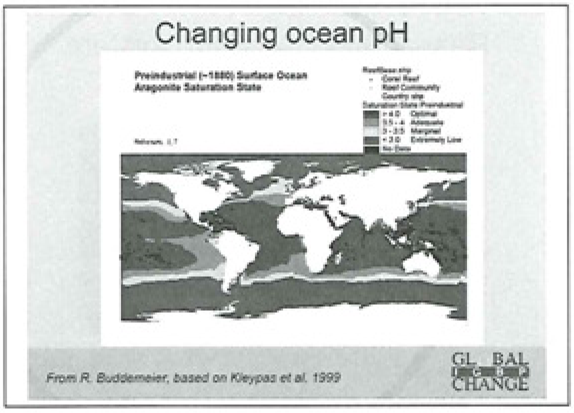
Urban air pollution
40 000 deaths per year i Austria, France and Switzerland (pop. ca. 74.5M) attributed to particles[1]
1 000 000 shortened lives worldwide due to chronic exposure[2]
Chronic exposure shortens lives by 1-2 years[3]
BUT - we do not know what properties of particles are important in this context
GLOBAL IGBP CHANGE



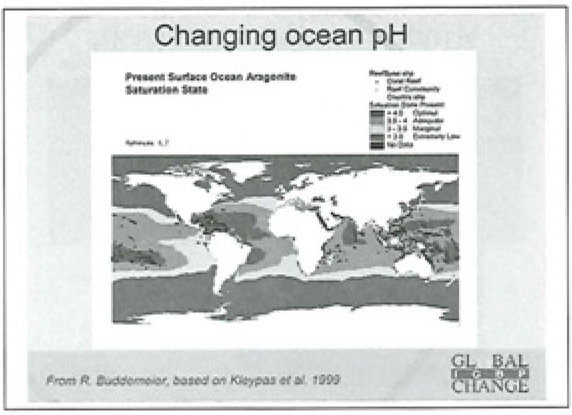
Net radiative forcing due to a 1 ha "carbon sink" plantation in different locations
Net global radiative forcing (nW m^{-2} ha^{-1})
-0.6 -0.4 -0.2 -0.1 -0.05 0.05 0.1 0.15 0.2
Positive net forcing implies afforestation causes net warming
Some regions see neutral effect of afforestation
Some regions still see net negative forcing (cooling) - but smaller than that expected from carbon sequestration alone
Source: Richard Betts, 1st iLEAPS Open Science Conference, 21-26 Jan. 2006
GLOBAL IGBP CHANGE

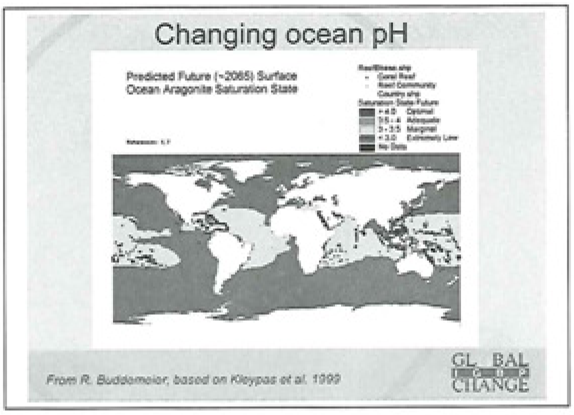


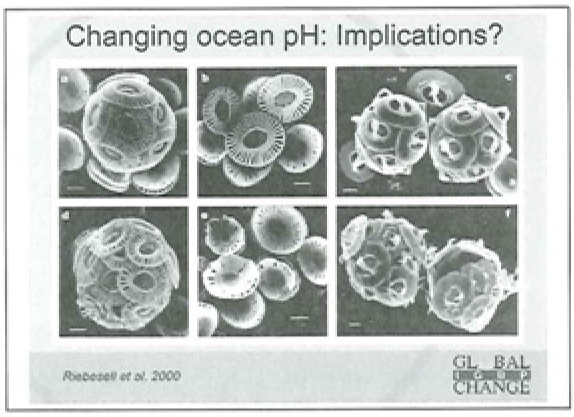
Anthropogenic CO_2 in oceans
0 20 40 60 80
moles m^{-2}
Sabine, et al., Science 305, 367-371, 2004
GLOBAL IGBP CHANGE

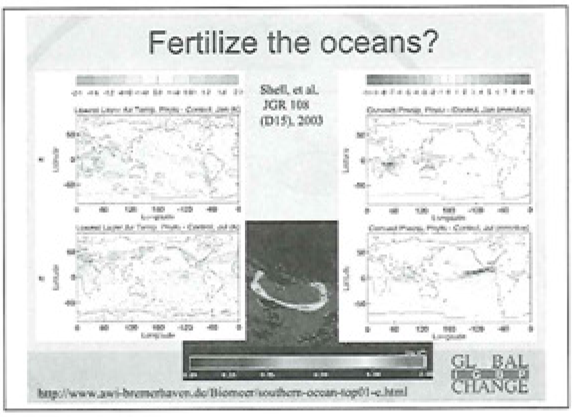


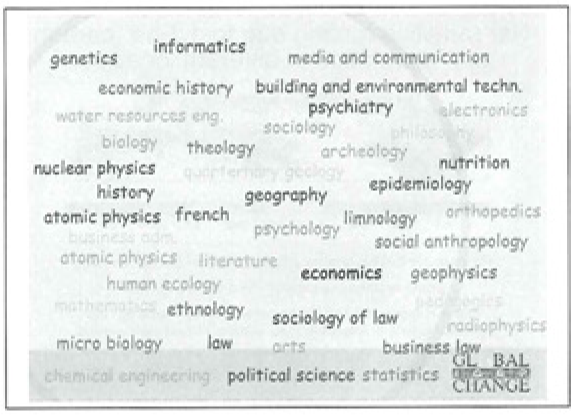
Changing ocean pH
Preindustrial (~1880) Surface Ocean Aragonite Saturation State
From R. Buddemeier, based on Kleypas et al. 1999
GLOBAL IGBP CHANGE

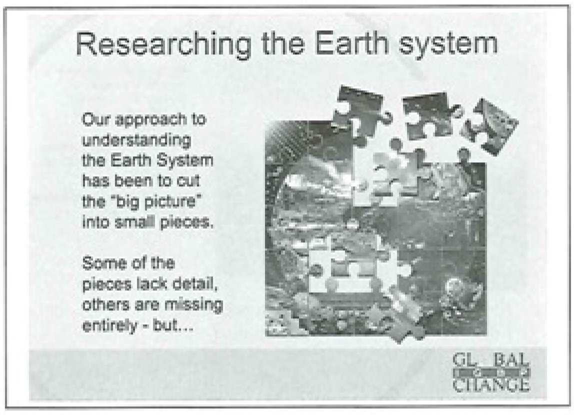

Changing ocean pH
Present Surface Ocean Aragonite Saturation State
From R. Buddemeier, based on Kleypas et al. 1999
GLOBAL CHANGE

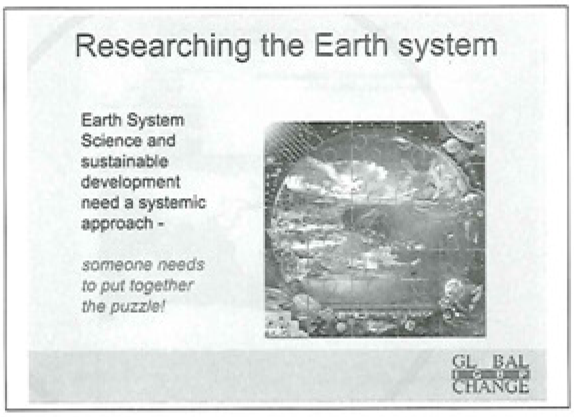

Changing ocean pH
Predicted Future (~2065) Surface Ocean Aragonite Saturation State
From R. Buddemeier, based on Kleypas et al. 1999
GLOBAL CHANGE

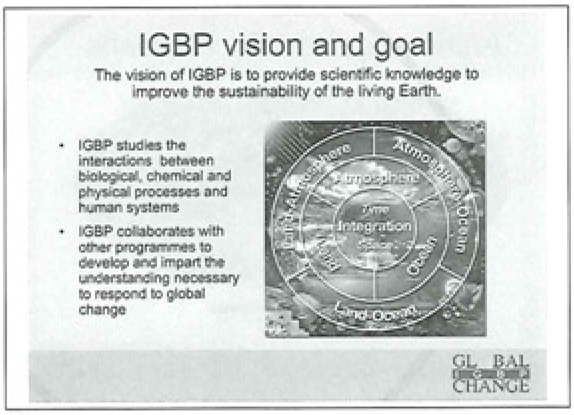

Changing ocean pH: Implications?
Riebesell et al. 2000
GLOBAL CHANGE

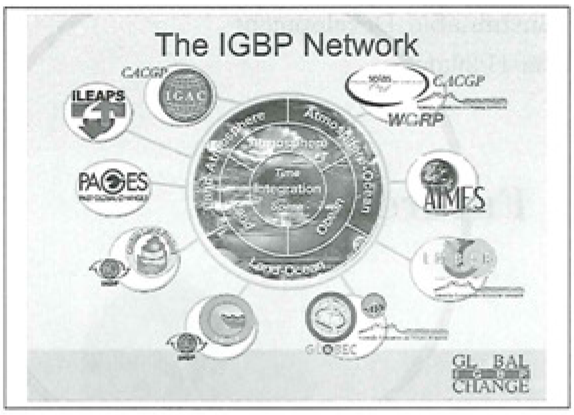

Fertilize the oceans?
Shell, et al.
JGR 108
(D15), 2003
http://www.awi-bremerhaven.de/Biomeer/southern-ocean-top01-e.html
GLOBAL CHANGE


genetics
informatics
media and communication
economic history
building and environmental techn.
water resources eng.
psychiatry
electronics
sociology
biology
theology
archeology
nuclear physics
nutrition
history
geography
epidemiology
atomic physics
french
psychology
limnology
orthopedics
social anthropology
atomic physics
literature
human ecology
economics
geophysics
ethnology
sociology of law
radiophysics
micro biology
law
arts
business law
chemical engineering
political science
statistics
GLOBAL CHANGE

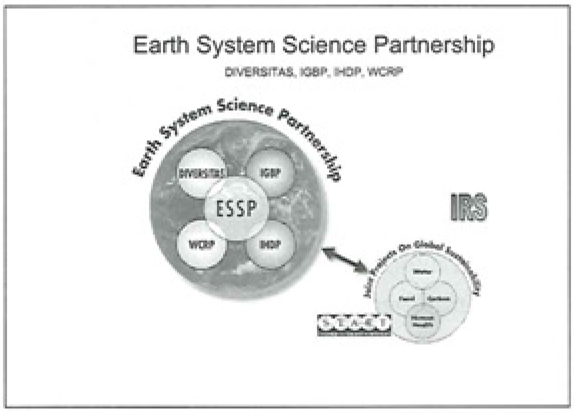

Researching the Earth system
Our approach to understanding the Earth System has been to cut the "big picture" into small pieces.
Some of the pieces lack detail, others are missing entirely - but...
GLOBAL CHANGE

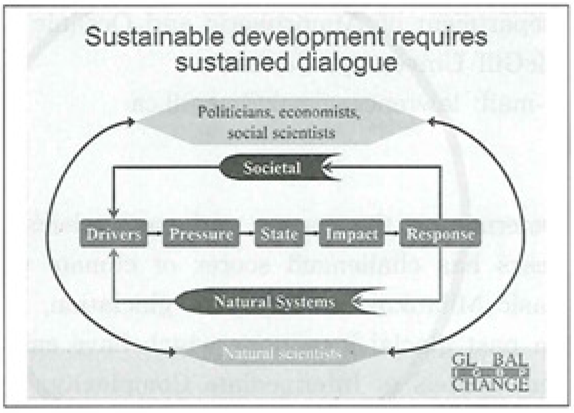

Researching the Earth system
Earth System Science and sustainable development need a systemic approach -
someone needs to put together the puzzle!
GLOBAL CHANGE

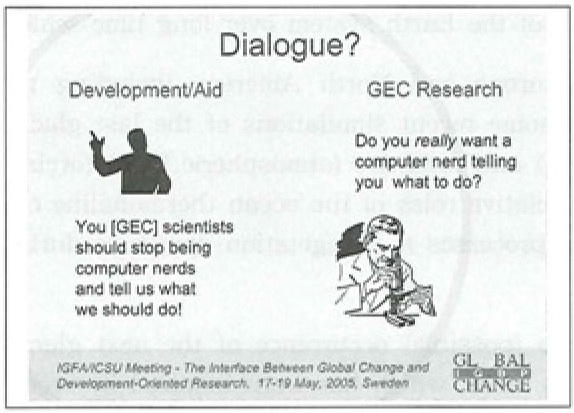

IGBP vision and goal
The vision of IGBP is to provide scientific knowledge to improve the sustainability of the living Earth.
IGBP studies the interactions between biological, chemical and physical processes and human systems
IGBP collaborates with other programmes to develop and impart the understanding necessary to respond to global change
Atmosphere
Ocean
Land-Ocean
Integration
GLOBAL CHANGE

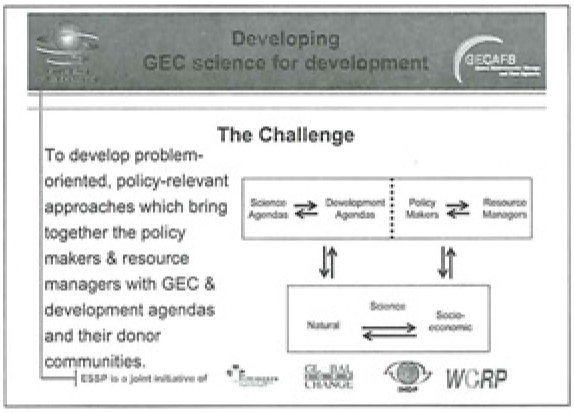

The IGBP Network
CACGP
ILEAPS
IGAC
CACGP
WCRP
PAGES
AIMES
Time
Integration
GLOBEC
GLOBAL CHANGE


Earth System Science Partnership
DIVERSITAS, IGBP, IHDP, WCRP
• an integrated study of the Earth System,
• the changes occurring to the System, and
• the implications for global sustainability.


Earth System Science Partnership
DIVERSITAS, IGBP, IHDP, WCRP
Earth System Science Partnership
DIVERSITAS
IGBP
ESSP
WCRP
IHDP
IRS
Joint Projects On Global Sustainability


Sustainable development requires sustained dialogue
Politicians, economists, social scientists
Societal
Drivers
Pressure
State
Impact
Response
Natural Systems
Natural scientists
GLOBAL CHANGE


Dialogue?
Development/Aid
GEC Research
Do you really want a computer nerd telling you what to do?
You [GEC] scientists should stop being computer nerds and tell us what we should do!
IGFA/ICSU Meeting - The Interface Between Global Change and Development-Oriented Research, 17-19 May, 2005, Sweden
GLOBAL CHANGE


Developing
GEC science for development
GECAFS
The Challenge
To develop problem-oriented, policy-relevant approaches which bring together the policy makers & resource managers with GEC & development agendas and their donor communities.
Science Agendas
Development Agendas
Policy Makers
Resource Managers
Science
Natural
Socio-economic
ESSP is a joint initiative of
WCRP


One way forward
• An Earth System Science Institute
• Gather natural & social scientists, economists, engineers in a long-term framework
• Look at regional/global feedbacks
• Involve stakeholders
GLOBAL CHANGE


Thank you for your attention!
GLOBAL CHANGE

Hokkaido University International Symposium on Sustainable Development
Plenary Session 1: Monday August 7, 2006 / 10:40am-11:20am
Speaker

Glacial Inceptions: Past and Future

Lawrence A. Mysak

Professor
Department of Atmospheric and Oceanic Sciences
McGill University, Canada
E-mail: lawrence.mysak@mcgill.ca

Determining the causes and mechanisms of glacial inceptions during the past half million years has challenged scores of climate theoreticians and modellers. After introducing the basic Milankovitch theory of glaciation, I will review a number of earlier modelling studies on past glacial inceptions which have employed high-resolution GCMs or EMICs: Earth system Models of Intermediate Complexity. The latter class of climate models has been developed over the past two decades in order to investigate the many interactions and feedbacks among the geophysical and biospheric components of the Earth system over long time-scales.

Following an overview of various EMICs from Europe and North America, including the McGill Paleoclimate Model (MPM), I will present some recent simulations of the last glacial inception (LGI) in response to orbital (Milankovitch) and radiative (atmospheric CO2) forcing. Special attention will be given to determining the relative roles of the ocean thermohaline circulation, freshwater fluxes, orography, cryospheric processes and vegetation dynamics during the inception phase.

The lecture will conclude with a discussion on the (possible) occurrence of the next glacial period. To address this issue, which has been inspired by recent Berger-Loutre papers with titles like "An exceptionally long interglacial ahead?", I shall present EMIC simulations of the climate for the next 100 kyr which are forced by a various prescribed atmospheric CO2 levels, as well as insolation changes. The influence of a near-term global warming scenario on glacial inception will also be examined.

Finally, the recent simulations of glacial inceptions in the Potsdam (PIK) EMIC which includes an interactive carbon cycle will be described. It is not inconceivable that due to human activities, the current interglacial will last for at least another half million years.

Glacial Inceptions: Past and Future

Lawrence A. Mysak

with Z. Wang, A.-S. Cochelin and Y. Wang

Atmospheric & Oceanic Sciences,
McGill University, Montreal, Canada

McGill www.esmg.mcgill.ca $C^2GCR \rightarrow$ GEC3 (2004)

Recent Collaborators:

- A. Berger, H. Blatter, V. Brovkin,
- M. Claussen, A. Ganopolski, O. Marchal,
- J. McManus, V. Petoukhov, S. Rahmstorf

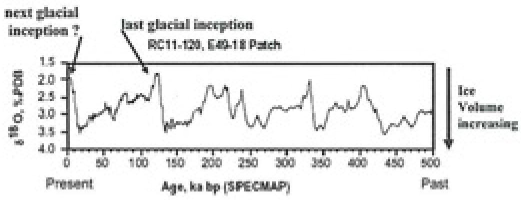
- Others at McGill: A. Antico, A. Jahn, J.-F. Lemieux, B. Papa, N. Roulet, J. Sedláček, G. Smith, K. Wright

McGill

Outline

1. Introduction
2. On the theory of glacial inceptions
3. Modelling work on the last glacial inception
4. The McGill Paleoclimate Model (MPM): an EMIC
5. Simulation of the last glacial inception with the MPM
6. On the (possible) occurrence of the next glacial
7. Conclusions

1. Introduction



- Glacial periods occur naturally due to a complex set of interactions involving external forcing and internal processes.

… Some questions

- How did the last glacial start?
- When will the present interglacial end?
- What will the climate be like in the next 100 kyr?
- Will mankind's activities affect the occurrence of the next glacial?

EMICs with Milankovitch forcing (and prescribed CO_2); transient runs:

Without vegetation:
- Loutre and Berger (2000, Clim. Change)
  - Simulated the last two glacial cycles with the 2-D LLN model
- Wang and Mysak (2002, GRL)
  - Used the 5-component geophysical MPM
  - Showed that THC intensity increased during ice sheet growth; however, ice sheet volumes over N. Amer. and Eurasia were similar

With vegetation:
- Gallée et al. (1992, JGR)
  - First to show vegetation important
- Crucifix and Loutre (2002, Clim. Dyn.)
  - Simulated a large southward treeline shift in high northern latitudes; this was necessary for the appearance of perennial snow cover

2. On the theory of glacial inceptions

The natural evolution of the climate

The primary driver of ice ages is the summer solar radiation received in high northern latitudes (Milankovitch 1930, 1941).

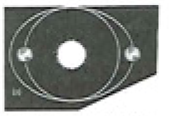
This insolation depends on the variations of 3 orbital parameters of the Earth's motion about the Sun:

- the eccentricity, e
- the obliquity
- the precession of the equinoxes

1879-1958

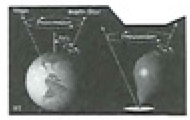
The Orbital Parameters

- The **eccentricity**, e measures the ellipticity of the orbit of the Earth around the Sun.
- The **obliquity** measures the inclination of the Earth's rotation axis, perpendicular to the plan of the ellipse.
- The **precession of the equinoxes**, which is due to the Earth's wobble (c), and the precession of the earth's elliptical orbit (shift of the perihelion). The combined movement has a strong cycle near 23 kyr. However, this cycle is modulated by the eccentricity, resulting in a quantity called the "climatic precession".



T = 400 kyr and 100 kyr

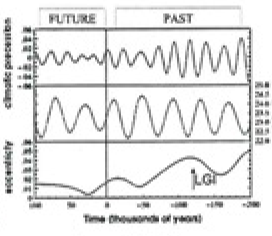
T = 41 kyr



T = 25.7 kyr

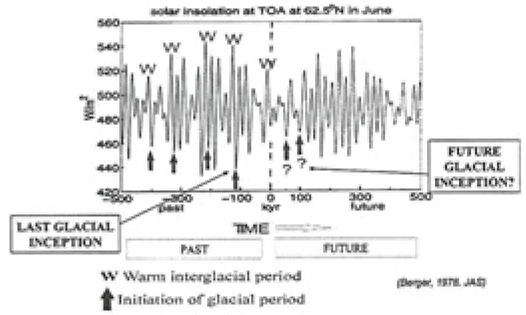
The Milankovitch theory of glacial inception

- At the last glacial inception (~116 kyr BP), the climatic precession (a measure of the Earth-Sun distance at the summer solstice) and eccentricity were high and the obliquity was low.
- These factors led to a very low summer insolation at high northern latitudes (see next figure).



(Berger, 1978, JAS)

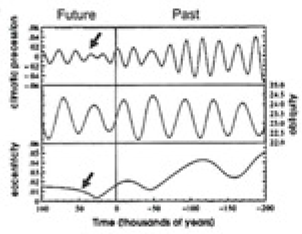
The natural evolution of climate



(Berger, 1978, JAS)

The Next Glacial Inception

- During the next 100 kyr, the climatic precession and eccentricity will have only weak variations.
- This results in relatively small variations of summer insolation at higher northern latitudes.

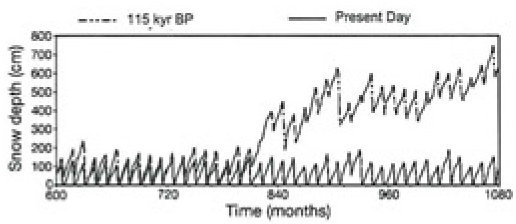


3. Modelling work on the last glacial inception

AGCMs with Milankovitch forcing (and prescribed atmospheric CO_2); time-slice runs:

- de Noblet et al. (1996, GRL)
- Gallimore and Kutzbach (1996, Nature)
  } Showed vegetation important
- Pollard and Thompson (1997, Ann. Glaciol.) } Ice sheet growth too small
- Khodri et al. (2001, Nature) (with OGCM)
  - Showed that the THC could be important
- Yoshimori et al. (2002, Clim. Dyn.)
  - Examined the role of SST and sea-ice cover
- Kubatzki et al. (2006, Clim. Dyn.)
  - Examined the sensitivity of inception to size of Greenland ice sheet
- Vettoretti and Peltier (2004, Quat. Sci. Rev.)
  - Did transient runs with an AGCM coupled to a mixed layer ocean to investigate the relative roles of the orbital parameters: obliquity dominates

High-latitude (70° N, 80° W) snow accumulation at 115 kyr BP in coupled A-O GCM over a 40-year period (Khodri et al., 2001)



EMICs with Milankovitch forcing (and prescribed CO_2); transient runs:

Without vegetation:

- Loutre and Berger (2000, Clim. Change)
  - Simulated the last two glacial cycles with the 2-D LLN model
- Wang and Mysak (2002, GRL)
  - Used the 5-component geophysical MPM
  - Showed that THC intensity increased during ice sheet growth; however, ice sheet volumes over N. Amer. and Eurasia were similar

With vegetation:

- Gallée et al. (1992, JGR)
  - First to show vegetation important
- Crucifix and Loutre (2002, Clim. Dyn.)
  - Simulated a large southward treeline shift in high northern latitudes; this was necessary for the appearance of perennial snow cover

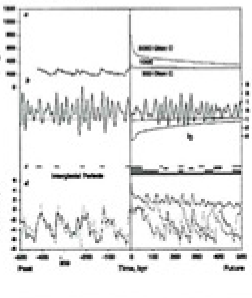
EMIC transient runs with vegetation continued:

- Kageyama et al. (2004, GRL)
  - The inclusion of vegetation produced a large ice sheet over N. America; however, Eurasia was ice free.
- Calov et al. (2005a, 2005b, Clim. Dyn.)
  - Found that the ice-albedo feedback was dominate for ice sheet growth; vegetation played a secondary role.
- Wang et al. (2005, GRL)
  - With vegetation, the resulting ice sheet volume over N. America was larger than that over Eurasia.

Notes:

1. An important time-slice investigation which looked at the role of vegetation on temperature and sea-ice cover:
   - Meissner et al. (2003, Clim. Dyn.)
2. In all the above references, the **atmospheric CO_2 was prescribed.**

Archer and Ganopolski (2005, G³): Simulation of past and future (?) glacials using an EMIC with an interactive carbon cycle.



- Anthropogenic releases of 300, 1000 and 5000 GtC are indicated by blue, orange, and red lines resp. in panel a.

(5000 GtC is the total amount of coal available.)

- The impacts of the above carbon releases on glacial inception and global temperature are shown in panels c and d.

4. The McGill Paleoclimate Model (MPM): an EMIC

- Ref: Claussen et al. (2002, Clim. Dyn.):
  Earth system models of intermediate complexity: closing the gap in the spectrum of climate system models
  - A new perspective on the hierarchy of climate models is proposed.
  - Most notably, we introduce a new indicator, called "integration", which characterizes the number of interacting components of the climate system in the model.
  - The location of several model types, from conceptual to comprehensive, is presented in a new spectrum of climate system models.

The Natural Earth System

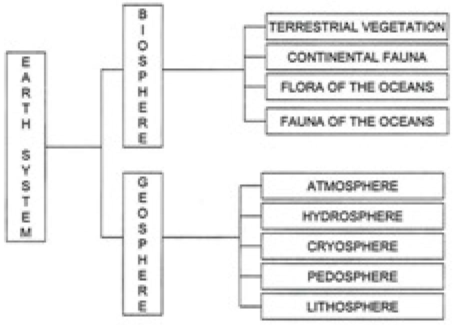
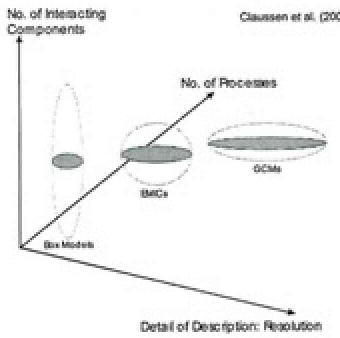


Table of EMICs (Claussen et al., 2002)

No.	Model	Institution
1	Bern 2.5D	University of Bern, Switzerland
2	CLIMBER-2	Potsdam Institute for Climate Impact Research, Germany
3	EcBilt	Royal Netherlands Meteorological Institute, Netherlands
4	EcBilt-Clio	ASTR-UCL, Belgium
5	IAP RAS	Inst. Atmos. Phys., Russia
6	MPM	McGill University, Canada
7	MIT	MIT, USA
8	MoBidiC	ASTR-UCL, Belgium
9	PUMA	Max-Planck-Institute for Meteorology, Germany
10	UVic	University of Victoria, Canada
11	IMAGE 2	U. of Kassel, Germany

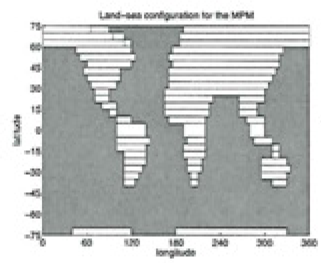
Interactive components of the climate system being implemented into EMICs (Claussen et al., 2002)

Model	Atmos.	Ocean	Biosph.	Sea ice	Inland ice
1	[illegible]	[illegible], 3 basins	[illegible]	T	
2	[illegible]	[illegible], 3 basins	[illegible]	TD	3-D, polythermal
3	[illegible]	[illegible]		T	
4	[illegible]	[illegible]	[illegible]	TD	
5	[illegible]	[illegible]		T	
6	[illegible]	[illegible], 3 basins		TD	[illegible], isothermal
7	[illegible]	[illegible]	[illegible]	T	
8	[illegible]	[illegible], 3 basins	[illegible]	TD	[illegible], isothermal
9	[illegible]	[illegible]	[illegible]	TD	
10	[illegible]	[illegible]		TD	3-D, polythermal
11	[illegible]	[illegible]	[illegible]	T	



Land-Sea configuration in the MPM

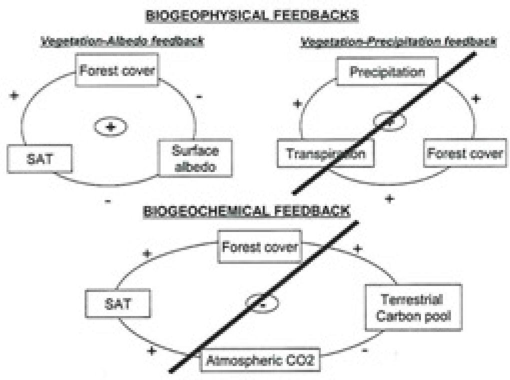
(Wang and Mysak, 2000)



- Model variables in each latitude band are sectorially averaged in zonal direction across each continent and ocean basin.
- However, downscaling for the atmospheric variables is used north of 30° to obtain 2-D distributions of vegetation cover and ice sheets in this region (Wang and Mysak, 2002).

Components of the "green" MPM

- **Atmosphere**: a sectorially averaged energy-moisture balance model based on Fanning and Weaver (1996, JGR) with modified heat and moisture transports.
- **Ocean**: a zonally averaged 2-D ocean model from Wright and Stocker (1991, JPO).
- **Sea ice**: a zero-layer thermodynamic model based on Semtner (1976, JPO) and Hibler (1979, JPO), but with prescribed advection in NH.
- **Ice sheet**: a 2-D vertically integrated dynamic isothermal ice sheet model (Marshall and Clarke,1997, JGR), with a latitude-longitude resolution of 0.5° x 0.5°.
- **Land surface**: an energy budget and bucket model based on Ledley (1988, JGR) and Manabe (1969, MWR). Updated with Biosphere – Atmosphere Transfer Scheme (BATS) (Dickinson et al., 1986, NCAR; Y. Wang et al., 2005, Clim. Dyn.).
- **Vegetation**: VECODE model from Brovkin et al. (1997, Ecol. Mod.), modified by
- Y. Wang et al. (2005, Clim. Dyn.). Vegetation is grass or trees (evergreen or deciduous). e.g., Snow free albedo: $\alpha_{Sfree} = \underbrace{f_t\,\alpha_t}_{\text{trees}} + \underbrace{f_g\,\alpha_g}_{\text{grass}} + \underbrace{f_d\,\alpha_d}_{\text{desert}}$



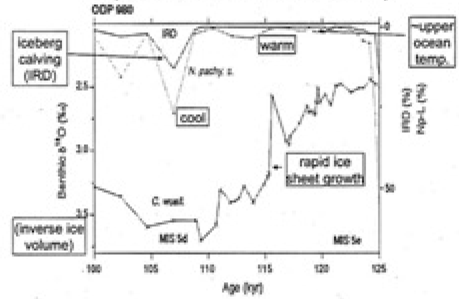
5. Simulation of the last glacial inception with the MPM

- Without vegetation: Wang and Mysak (2002, GRL)
- With vegetation: Wang et al. (2005, GRL)
  - Application of the "green" MPM

Paleoceanographic data reveal:

- Subpolar N. Atlantic was warm during the initial phase of the LGI, around 120 kyr BP (Ruddiman and McIntyre, 1979, Science).
- Rapid ice sheet growth occurred during the next 10 kyr and the sea level dropped over 50 m (Johnson and Andrews, 1979, Quat. Res.)

ODP SITE 980 (55°29′N, 14°42′W, depth: 2179 m; N.E. N. Atlantic)

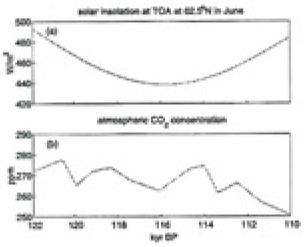


Jerry McManus, pers. comm. (2002)

External forcing used in the geophysical MPM

(Wang and Mysak, 2002)

- Variable solar insolation calculated by realistic orbital parameter changes (Berger, 1978).
- Vostok atmospheric CO_2 concentration (Barnola et al., 1999).
- The model is integrated from 122 to 110 kyr BP.



Experimental Design

Run	Coupling	CO_2	Mountain	Freezing /Refreezing
1. Control run	Fully coupled	Vostok	yes	yes
2. Fixed freshwater flux (into the ocean)	P-E+R prescribed	Vostok	yes	yes
3. Fixed ocean	SST prescribed	Vostok	yes	yes
4. No mountain	Fully coupled	Vostok	no	yes
5. No freezing/refreezing	Fully coupled	Vostok	yes	no
6. No mountain and no freezing/refreezing	Fully coupled	Vostok	no	no
7. Milankovitch only	SST prescribed	280 ppm	no	no

Ice sheet growth in the geophysical MPM

- Run 1 (control run – in red) produces the most rapid ice sheet growth.
- Run 7 (only Milankovitch forcing – in black) produces the smallest ice volume.
- For a rapid ice sheet growth, the elevation effect of mountains, freezing of rain and refreezing of meltwater, and an active ocean component are necessary.

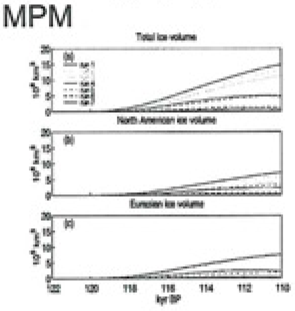


Figure 2. Simulated ice volume growths.

THC response and its effect on ice sheet growth

- The THC is significantly intensified for run 1 (in red) due to the high latitude cooling and reduced freshwater flux.
- The strong THC maintains a large land-sea thermal contrast at high latitudes and hence is favorable for rapid ice sheet growth due to moisture transport from the ocean to the land.

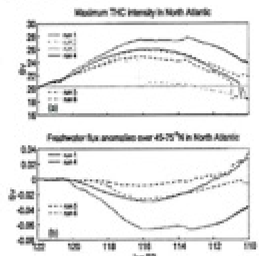


Figure 3. The maximum THC intensities and freshwater flux anomalies.

Ice sheet thickness over N. America and Eurasia in the geophysical MPM

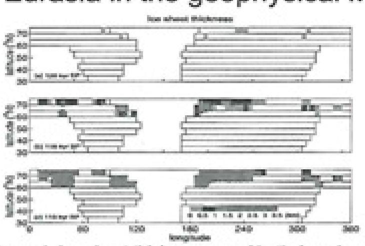
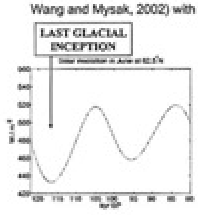


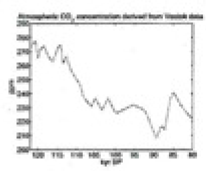
Figure 4. Ice sheet thickness over North America and Eurasia for run 1 (control run) at 120 kyr BP (a), 116 kyr BP (b), and 110 kyr BP (c).

Simulation of glacial inception in the "green" MPM

(Cochelin, 2004, MSc thesis; Wang et al., 2005, GRL)

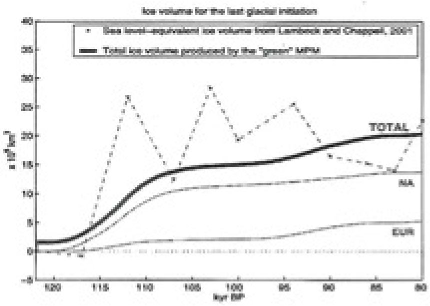
- The model is run from 122 to 80 kyr BP (versus a 12 kyr run in Wang and Mysak, 2002) with the following forcing:



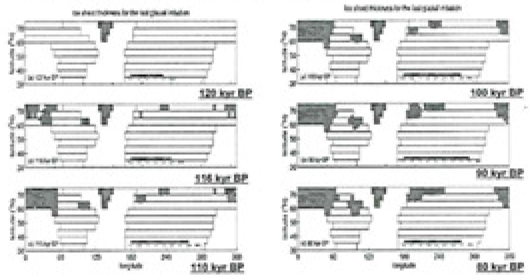


- We want to observe the changes in the climate simulation, due to the addition of the vegetation.

Ice sheet growth in the "green" MPM



Ice sheet distributions obtained with the "green" MPM at 120, 116, 110, 100, 90 and 80 kyr BP



Northern tree and desert fractions in the "green" MPM

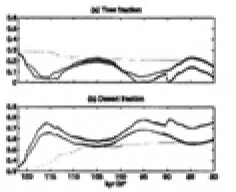
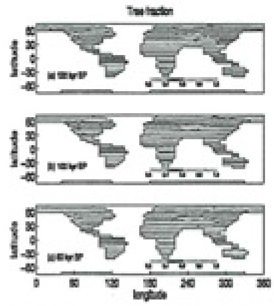


Figure 3. (a) Tree fractions in total land (including ice sheets) and (b) desert fractions in total land (including ice sheets), averaged between 60 and 75°N, for the control experiment (red), the experiment with fixed SAT (green) and the experiment with fixed precipitation (blue) in the vegetation component.

- Note that in the control run (in red), the tree fraction closely follows the summer insolation variation, showing the climatic precession signal (23 kyr). However, the desert fraction has the opposite behaviour.
- The similarity of the red (control) and blue (fixed precip.) curves in panel (a) indicates that *temperature predominately drives vegetation in high northern latitudes.*

Tree fraction distribution in the "green" MPM at 122, 100 and 80 kyr BP



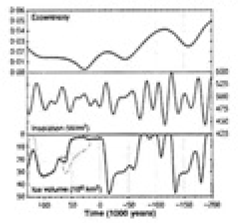
- As the ice sheets buildup, the trees progressively disappear and give way to desert in the high northern latitudes.
- In the high northern latitudes, the treeline has shifted southward by 5° to 10° lat.
- The changes in vegetation and the associated changes in surface albedo contribute to the expansion of the ice sheets, owing to the positive vegetation-albedo and ice-albedo feedbacks.

Conclusions from the simulation of the last glacial inception in the "green" MPM

- Under realistic external forcings, the "green" MPM simulates the last glacial inception at ~ 119 kyr BP.
- The glacial inception is followed by a rapid ice sheet growth over North America and a slower growth over Eurasia. This contrasts with the results of Wang and Mysak (2002, GRL) who found comparable growths over North America and Eurasia.
- The volume of ice simulated is too low until 90 kyr BP, but it finally reaches the estimated observed value around 80 kyr BP.
- As the ice sheets develop, we observe a southward shift of the treeline and an expansion of the desert at high latitudes.

6. On the (possible) occurrence of the next glacial

- Loutre and Berger (2000, Clim. Change)
- Berger and Loutre (2002, Science): "An Exceptionally Long Interglacial Ahead?"

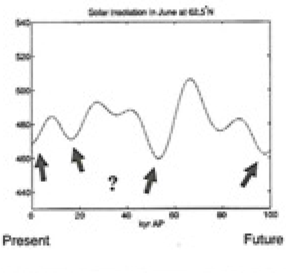


Long-term variations of eccentricity (top), June insolation at 65° N (middle), and simulated Northern Hemisphere ice volume (increasing downward) (bottom) for 200,000 years before the present to 130,000 from now using the 2-D LLN EMIC.

Vostok CO_2
Global Warming CO_2
Constant CO_2 (210 ppmv)

Cochelin et al. (2006, Clim. Change): Simulation of the next glacial inception.

- The "green" MPM is run for the next 100 kyr, with different atmospheric CO_2 levels and Milankovitch forcing.

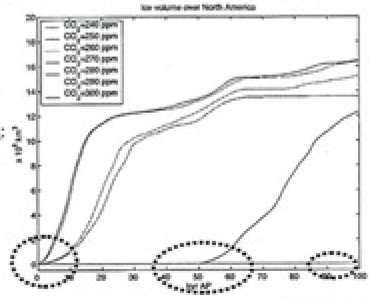


Solar insolation in June, at 62.5° N

When will the next glaciation occur?

Simulation of the next glacial inception

- **Simulations with constant CO_2 concentrations:** 240, 250, 260, 270, 280, 290 and 300 ppm.



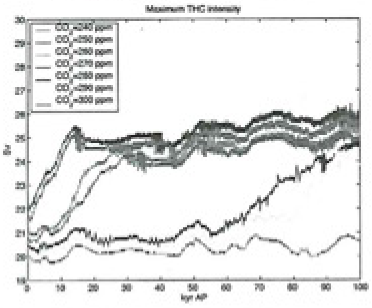
240 – 270 ppm

ICE VOLUME GROWTH

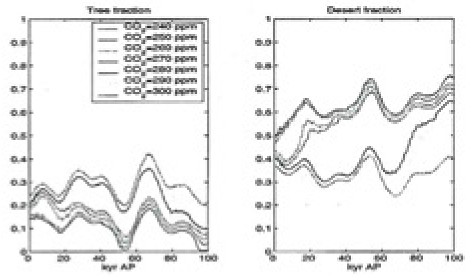
280 – 290 ppm

≥ 300 ppm

Simulation of the THC behaviour for the next 100 kyr



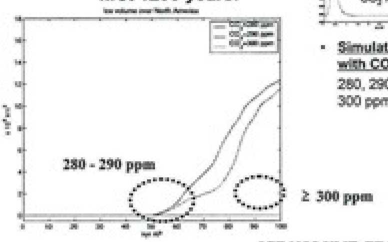
Tree and desert fractions at high latitudes for the next 100 kyr



TREE *DESERT*

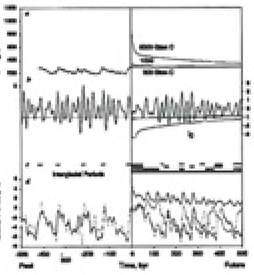
Simulation of the next glacial inception when a WARMING EPISODE is included during the first 1200 years.

- <u>Simulations with CO_2:</u> 280, 290 and 300 ppm.



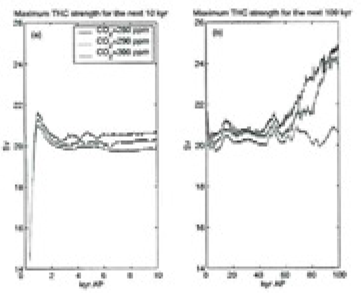
ICE VOLUME GROWTH

Archer and Ganopolski (2005, G³): Simulation of past and future (?) glacials using an EMIC with an <u>interactive carbon cycle</u>.

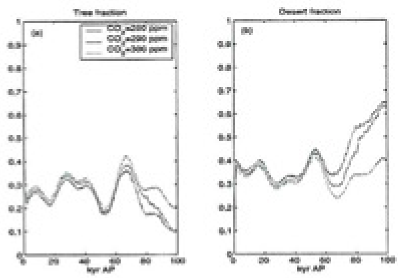


- The 300 GtC anthropogenic input (in blue) corresponds to our prescribed lower-level CO_2 concentrations for which glaciation was simulated after 50 kyr AP.
- The 1000 GtC anthropogenic input (in orange) corresponds to our higher-level CO_2 concentration (≥ 300 ppm) for which glaciation was simulated after 100 kyr AP.
- The 5000 GtC anthropogenic input (in red) produces the "Anthropocene", a period of no future glaciations.

Simulated THC behaviour when an initial global warming episode is included



Tree and desert fractions at high latitudes, when an initial global warming episode is included



7. Conclusions

- To investigate long-term climate changes involving interactions among all the climate components, EMICs can play a useful role.
- In particular, EMICs can be used to address certain questions that are normally outside the utility of higher resolution GCMs.

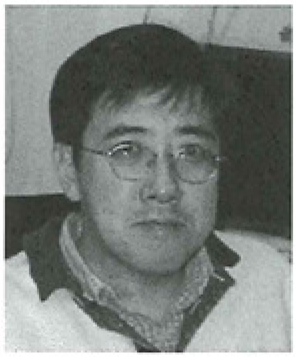
7. Conclusions cont.

- For the next 100 kyr, under "natural" climate forcing,
  1. The next glacial inception occurs in the "green" MPM at around 50 kyr AP if atmos. CO_2 lies between 280 and 290 ppm;
  2. For a lower CO_2 level, glacial inception is imminent;
  3. For a higher CO_2 level, no inception will occur during the next 100 kyr.
- If a global warming episode is included and the atmospheric CO_2 level asymptotes to a constant value after 5 kyr, cases 1. and 3. still apply.

www.esmg.mcgill.ca McGill

Hokkaido University International Symposium on Sustainable Development
Plenary Session 1: Monday August 7, 2006 / 11:20am-11:50am
Speaker

Ecological Constraints on System Sustainability*

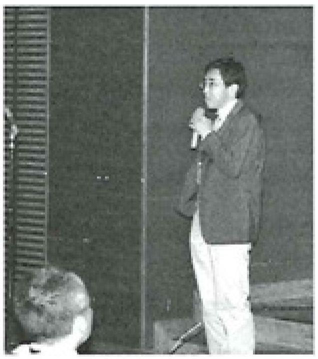


Takashi Kohyama

Professor
Section of Environmental Biology
Faculty of Environmental Earth Science, Hokkaido University
E-mail: kohyama@ees.hokudai.ac.jp

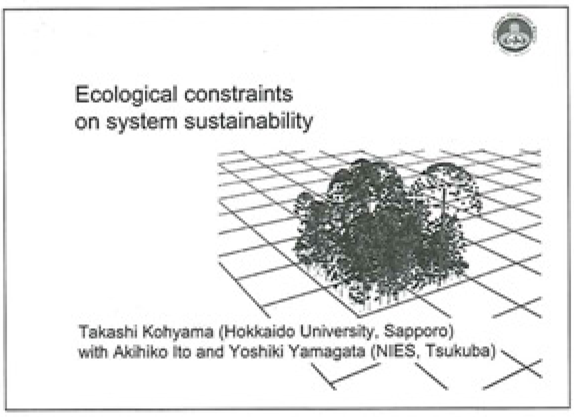
The anthropogenic biosphere is a complex adaptive system, constrained by a variety of processes, of which typical spatial-temporal scale is different from each other. In this lecture, I show the need of multi-scale analysis of system change, taking an example of forest ecosystems. I also propose that a similar approach is valid for socio-environmental systems.

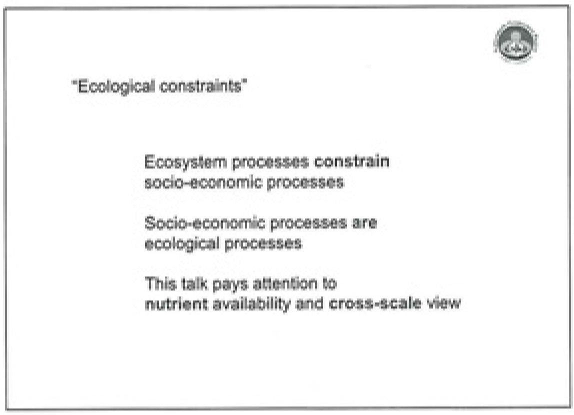
We carried out a synthetic investigation of forest ecosystems in eastern Monsoon Asia. The target area is characterized by the continuous forested biomes from tropic to subarctic zones under prevailing humid climate. We made challenge to link physiological processes of foliage canopy to landscape-scale processes of tree-population demography and tree-community dynamics, and to integrate forest ecosystem processes into watershed-scale budget. So far, physiological screening and micrometeorological monitoring gave a fine-scale validation of land ecosystem processes. However, the prediction of the long-term response of forest systems to global change requires the coupling of ecosystem physiology and tree population demography. To interface the gap between them, we developed multi-scaled models and predicted such processes as the time delay in vegetation response to global change.

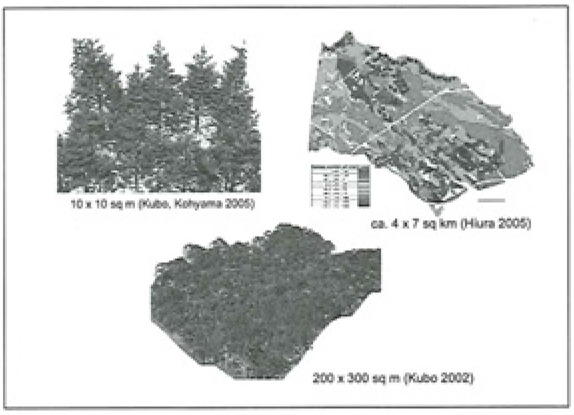


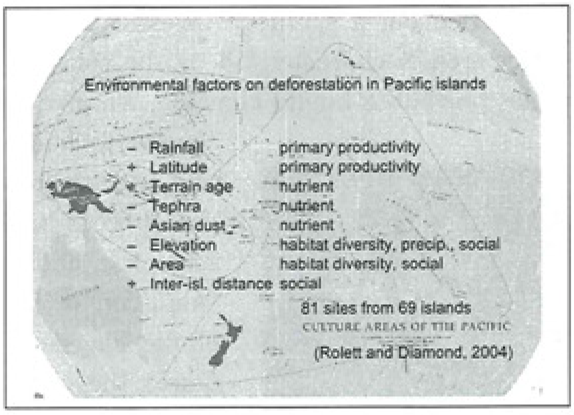
Ecosystem modeling uses such procedure to deal with biological units with naturally variable sizes such as biological individuals, species populations, etc. This situation is somewhat similar to social systems, where available statistic data is arranged with municipal/state/country basis with a variable size, and where, for instance, per capita demand of resources by human population is also largely variable. It is also obvious that the maintenance of human population is constrained by net primary productivity (NPP), as a measure of ecosystems. I show examples of relating NPP and vegetation/soil organic mass to the socio-economical statistics, at various scales, to elucidate emerging unit-scale-dependent components of socio-environmental systems, for the meaningful examination of the system sustainability.

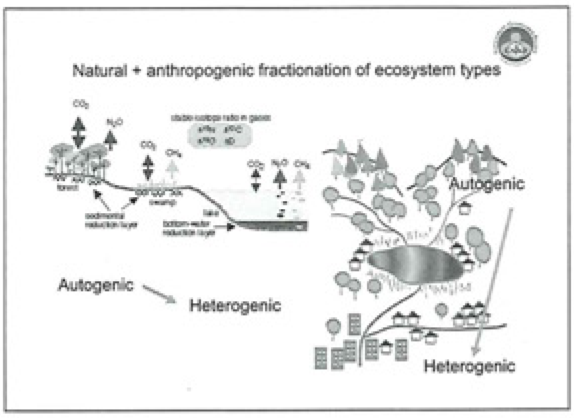
* This paper has been prepared in collaboration with Akihiko Ito and Yoshiki Yamagata of National Institute for Environmental Studies, Tsukuba, Japan.

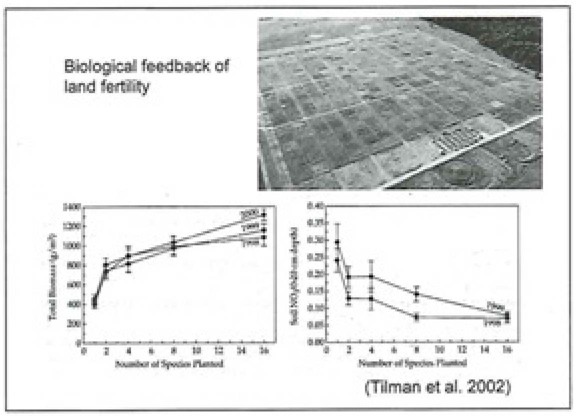












Natural + anthropogenic geochemical transportation

Running off
Leaching
Dust translocation
Guano transportation
...

+

Fertilizer trade
Food/fiber trade
Garbage transport

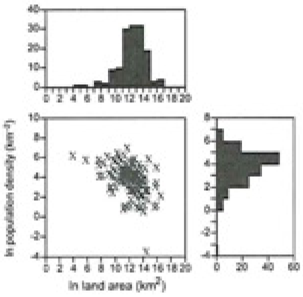
Social/political statistics
social unit basis

Mesh data per unit area
Coupled GCM's

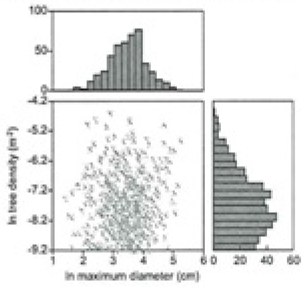
Social/political unit-based analysis

Biological/ecological unit, with a large variation in physical dimension;
e.g. biological species and individuals

Country variation in land area and population size

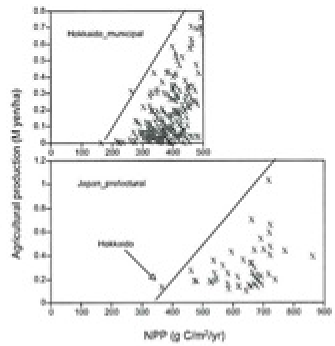


Tree species variation in abundance and maximum size

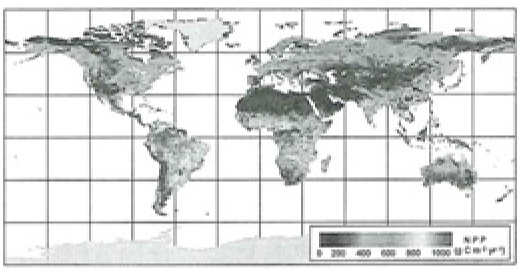


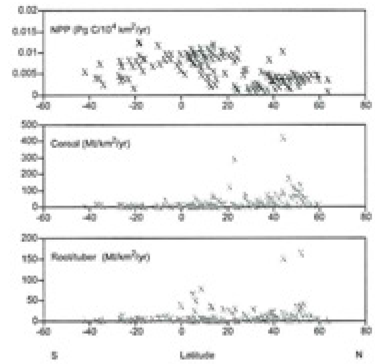
Pasoh 50-ha plot, Malaysia; CTFS, FRIM, AA Harvard Univ.

Net primary productivity (NPP) in mesh map by TsuBiMo
Municipal averaging and merging with socio-economic data

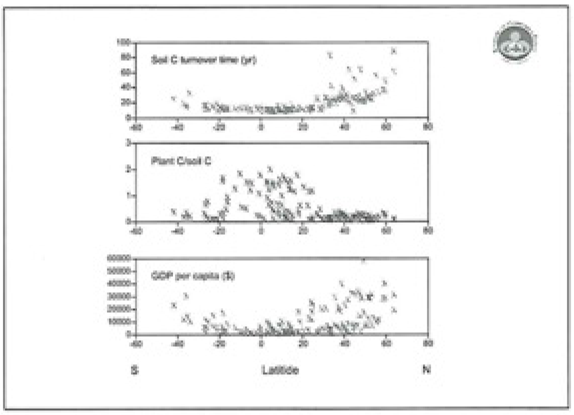


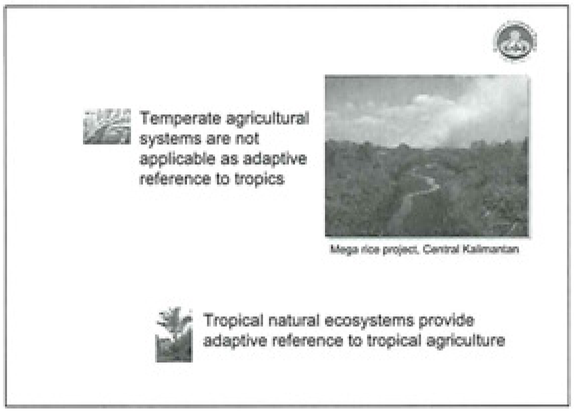
NPP and C storage in mesh map by SimCYCLE
Nation averaging and merging with socio-economic data

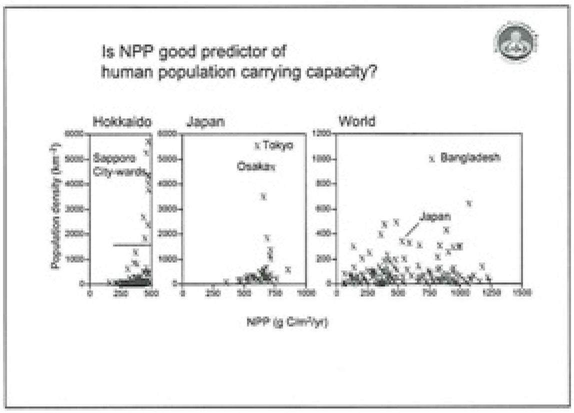


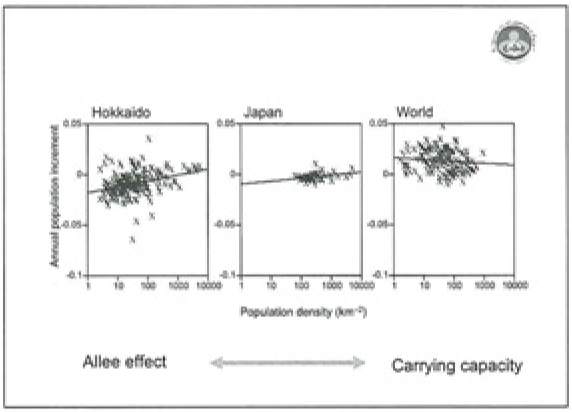



Biomass
NPP
soil


Soil C turnover time (yr)
Plant C/soil C
GDP per capita ($)
S
Latitude
N

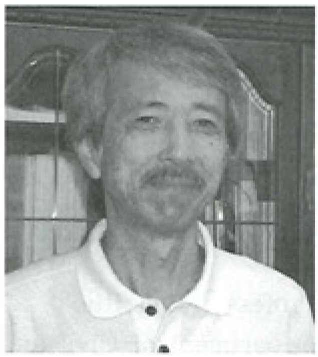

Temperate agricultural systems are not applicable as adaptive reference to tropics
Mega rice project, Central Kalimantan
Tropical natural ecosystems provide adaptive reference to tropical agriculture


Is NPP good predictor of human population carrying capacity?
Hokkaido
Japan
World
Sapporo City-wards
Tokyo
Osaka
Bangladesh
Japan
Population density (km⁻²)
NPP (g C/m²/yr)


Hokkaido
Japan
World
Annual population increment
Population density (km⁻²)
Allee effect
Carrying capacity


サスティナビリティ・ガバナンス
プロジェクト
Global Land Project (GLP)
– Sapporo Nodal Office –
platform.

Summary of Plenary Session 1: Sustainability of the Earth System



Chaired by **Motoyoshi Ikeda**

Professor
Faculty of Environmental Earth Science, Hokkaido University
E-mail: mikeda@ees.hokudai.ac.jp

Speakers:
Kevin J. Noone, Executive Director, International Geosphere-Biosphere Programme (IGBP), Sweden
Lawrence A. Mysak, Professor, Department of Atmospheric and Oceanic Sciences, McGill University, Canada
Takashi Kohyama, Professor, Faculty of Environmental Earth Science, Hokkaido University

This session stands on the idea that the earth is under pressure by human activities, and interactions between ecosystem and geosphere play a key role in determining seriousness of the human impacts in near future. On the top of this, we should consider feedback between the natural system and the human system for finding out the optimal way to overcome the difficult and important issue how we can sustain the earth.

Dr. Noone showed an overview of the present and occurring problems within society, such as hunger and diseases, along with the other natural challenges, such as global warming. He pointed out how these issues are interrelated with each other. The examples were teleconnections from deforestation in the tropical Amazon region to the mid-latitude climate, impacts of a changing nitrogen cycle, and a pH decrease caused by carbon dioxide absorption into the ocean. Finally, scientists, resource managers and policy makers require a common understanding of the issues and interactions among themselves.

Dr. Mysak presented the model-predicted glaciation after the current interglacial period and provided an important basis for our decision making during global warming. Milankovitch theory revealed that the next glacial period will be more modest than any previous one in last 400,000 years. In particular, the glaciation is very sensitive to the carbon dioxide content in the atmosphere: i.e., no glaciation will appear under carbon dioxide over 300 ppm in the equilibrium condition. Here, ecosystem-geosphere coupling is a crucial component to determine the glaciation.

Dr. Kohyama suggested the approach to couple ecosystem physiology and tree population demography in order to predict the long-term responses of forest systems to global change. He and his colleagues carried out a synthetic investigation of forests extending from tropical to subarctic zones. One of the important results is that higher ecosystem diversity prevents leakage of soil nutrient. This is one of the reasons why we should include biodiversity in system sustainability.

Hokkaido University International Symposium on Sustainable Development
Plenary Session 2: Monday August 7, 2006 / 1:00pm-1:40pm
Speaker

Recovering Sustainable Water from Wastewater

Takashi Asano

Professor Emeritus
Department of Civil and Environmental Engineering
University of California, Davis, U.S.A.
E-mail: tasano@ucdavis.edu

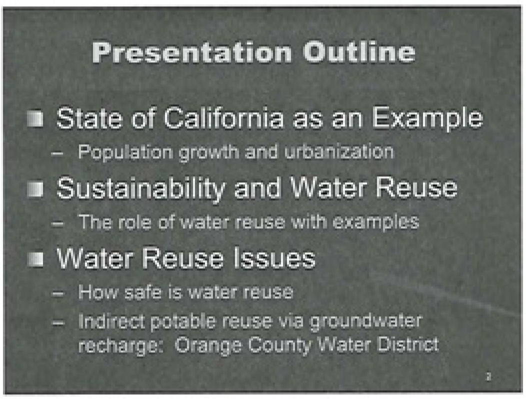
The sustainability of water resources is of particular importance in light of projected increases in global population. It has been reported that the current world population of 6.2 billion is increasing at a rate of about 1.2 percent per year (United Nations, 2003) with the highest rates of population growth occurring in urban areas in mostly developing countries where supplies of freshwater tend to be limited or already exploited. Increasing urbanization has resulted in an uneven distribution of population and water, thus imposing unprecedented pressures on limited water supplies. These pressures are exacerbated during periods of drought.

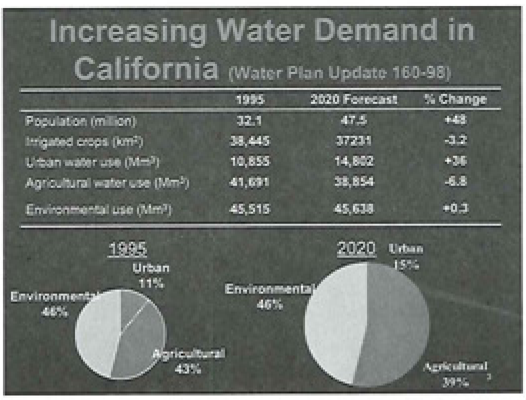
For water supplies to be sustainable, the rate at which water is withdrawn from water sources needs to be in balance with the rate of renewal or replenishment of these water sources. In addition to a balance of water quantity, water quality must also be sustainable, recoverable or reusable. Water that is withdrawn for societal needs is also a source of water replenishment that should be considered in the sustainability equation.

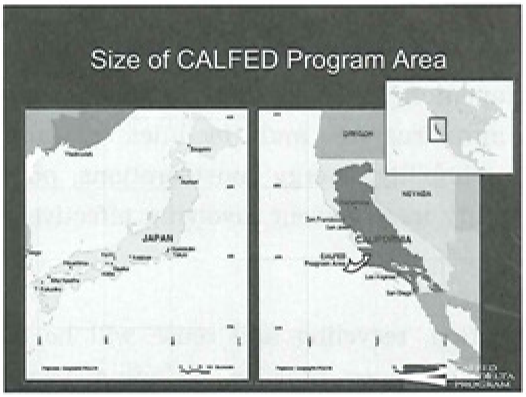
Historically, after water has been used for societal needs, it has been labeled as "waste"water and treated to the extent deemed necessary for discharge into a receiving water or for land disposal. During most of the 20th century, the emphasis of wastewater treatment was on pollution abatement, protection of public health, and prevention of environmental degradation through removal of biodegradable material, nutrients, and pathogens. However, over the last few decades, the potential for recovering water from wastewater has been recognized. In fact, in many parts of the world, it is no longer practical or possible for water to be used only once. Thus, water reclamation, recycling and reuse are one element of water resources development and management that provides a viable option for traditional water supply. Water reclamation, recycling and reuse are multi-disciplined and require close examinations of infrastructure and facilities planning, wastewater treatment plant siting, treatment process reliability, energy considerations, public health, economic and financial analyses, and water utility management involving effective integration of water and reclaimed water functions.

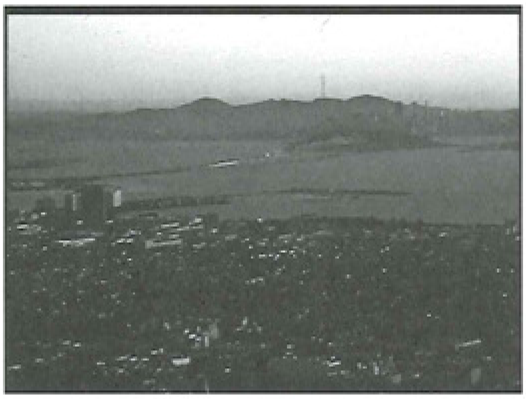
In this presentation, the foundation of water reclamation, recycling and reuse will be discussed and the salient features of implementing water reuse projects including Orange County's Groundwater Replenishment System in California are summarized with considerations for future research needs.

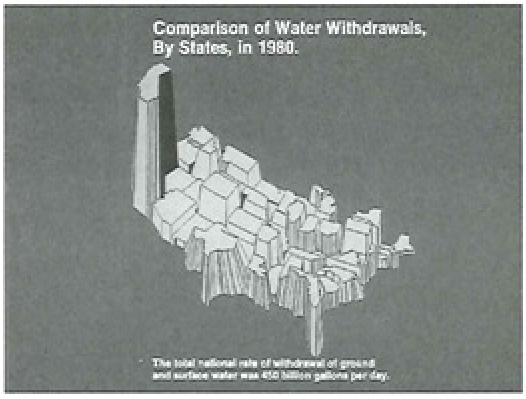
REFERENCE: United Nations (UN Population Division) (2003) *World Population Prospects: The 2002 Revision - Highlights*, United Nations Population Division, Department of Economic and Social Affairs. Accessed at: http://www.un.org/esa/population/unpop.htm

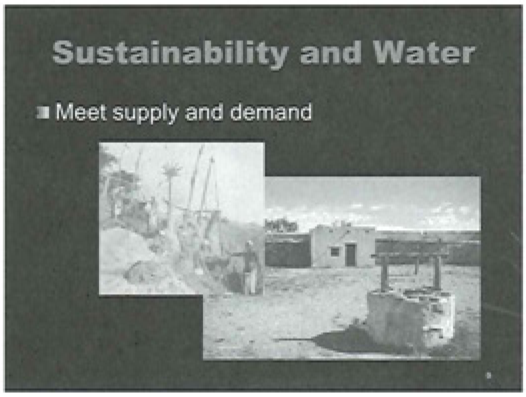


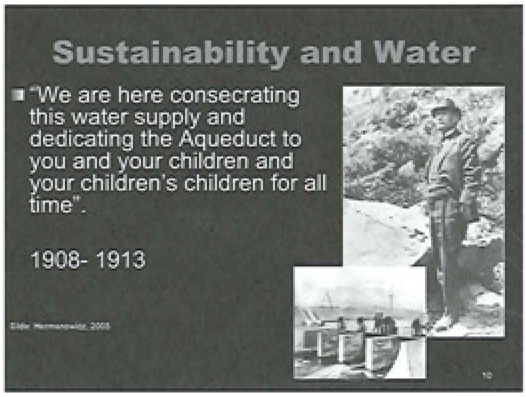


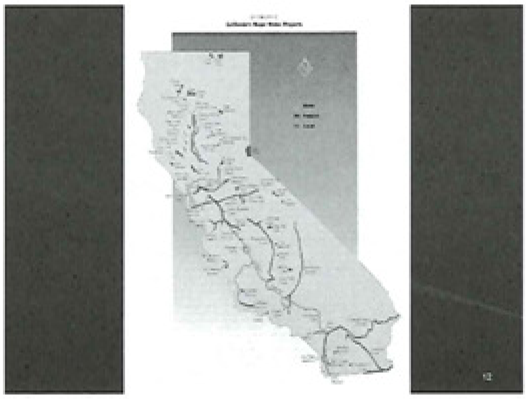

Size of CALFED Program Area
JAPAN
CALIFORNIA

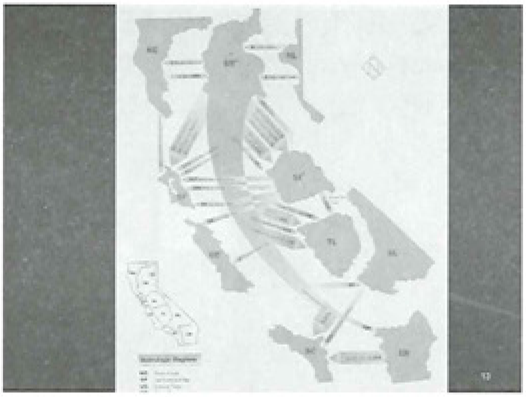


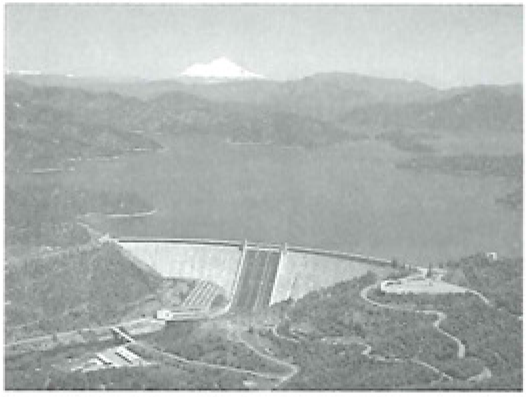

Comparison of Water Withdrawals, By States, in 1980.
The total national rate of withdrawal of ground and surface water was 450 billion gallons per day.

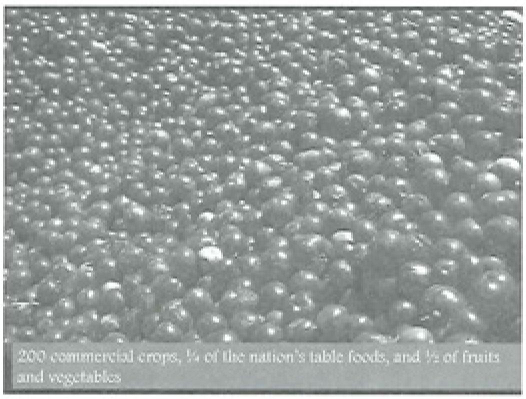

Sustainability and Water
Meet supply and demand

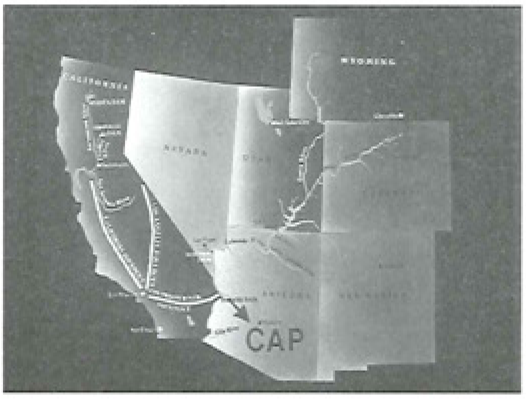

Sustainability and Water
"We are here consecrating this water supply and dedicating the Aqueduct to you and your children and your children's children for all time".
1908- 1913











California Water Plan Update 2005

Integrated regional water management

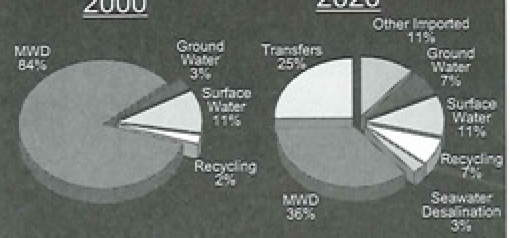
- Use water efficiently
- Protect water quality
- Manage water in ways that protect and restore the environment

DWR Bulletin 160-05 December 2005

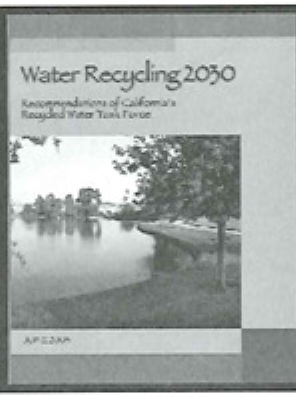
Sustainability and Water

- Paradigm shift
  - Meeting supply and demand no longer sufficient but still necessary
  - Quality and quantity
  - Demand for highest quality controls all supplies
  - Increasingly technical and complex solutions

Regional Water Supply Sources Comparison – San Diego, CA



Task Force Report to the Legislature (June 2003)



WATER REUSE IN THE U.S.A.

- U.S.A. - Approx. 4 Billion m³/yr {11 Mm³/d (3 billion gal/d)} in 2005 Growing at about 15%/yr (WateReuse Association)
- California – 648 Mm³/yr (2002) Goal 1,234 Mm³/yr (2010)
- Florida – 833 Mm³/yr (2003)

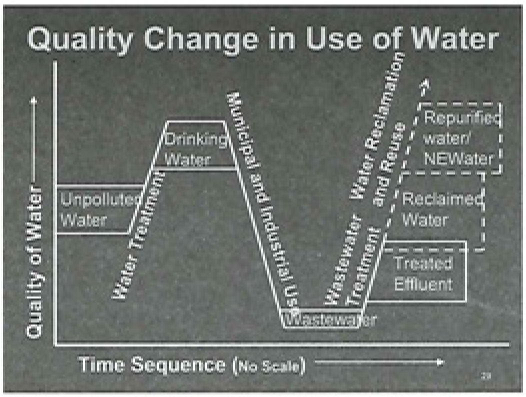
Water Reuse Definitions

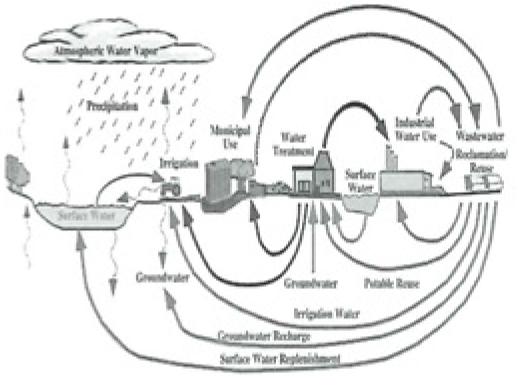
- Wastewater – Used water discharged from homes, business, and cities, e.g. Municipal wastewater (sewage)
- Water reclamation – Treatment or processing of wastewater to make it reusable
- Water reuse – The use of treated wastewater for beneficial use such as agricultural irrigation and industrial cooling

Benefit of Water Reuse

- Important element of integrated water resources management
- Treated effluent is used as a water resource for beneficial purposes
- The wastewater is kept out of streams, lakes, and beaches; thus reducing pollution of surface water and groundwater

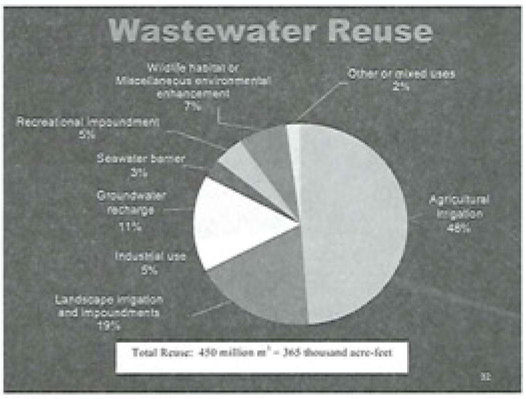
City of Los Angeles Hyperion Wastewater Treatment Plant 1.7 M m³/d (450 mgd), dedicated on May 15, 1999

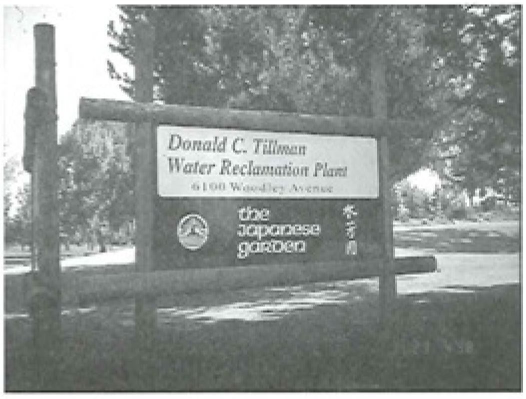


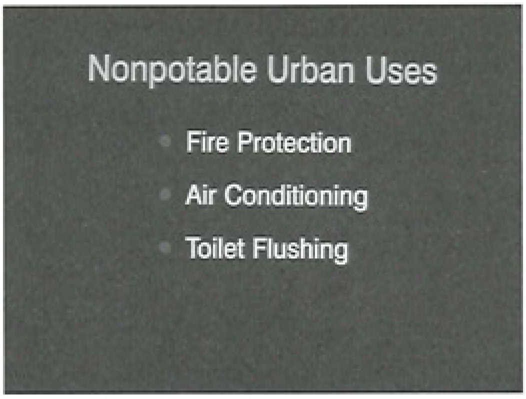


Categories of Reuse

1. Agricultural Irrigation
2. Landscape Irrigation
3. Industrial Reuse
4. Recreational and Environmental
5. Nonpotable Urban Reuses
6. Groundwater Recharge
7. Potable Reuse






Nonpotable Urban Uses
Fire Protection
Air Conditioning
Toilet Flushing


42

INDIRECT POTABLE REUSE

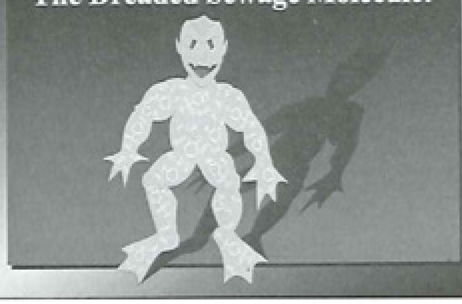
via groundwater recharge

- Regulatory Framework—1996
- Groundwater Recharge Criteria—2003
  - Control of pathogens and trace organics

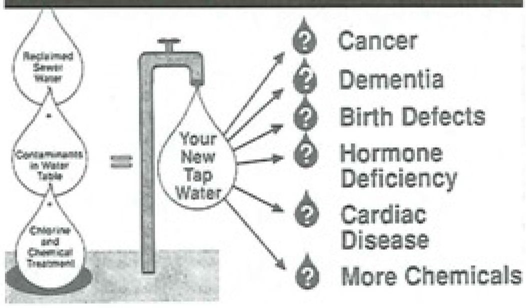
- Spreading:
  - Disinfected Tertiary Treatment
  - 6- Month Retention
  - 150 m (500 ft) Distance
- Injection:
  - Disinfected Advanced Treatment
  - 12-Month Retention
  - 600 m (2,000 ft) Distance

45

The Dreaded Sewage Molecule!



Scare tactic: Toilet-to-Tap Made Simple

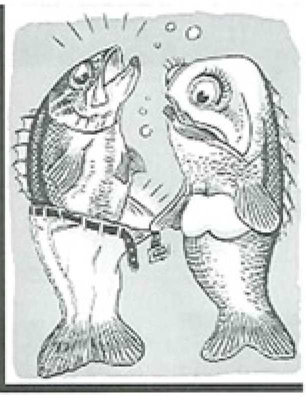


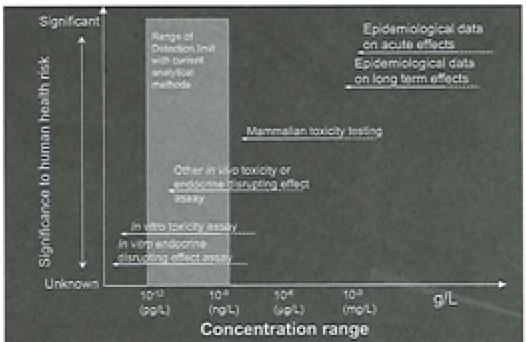
Endocrine Disrupting Compounds (EDCs)

Phamaceutically Active Compounds (PhACs)

Phamaceuticals & Personal Care Products (PPCPs)

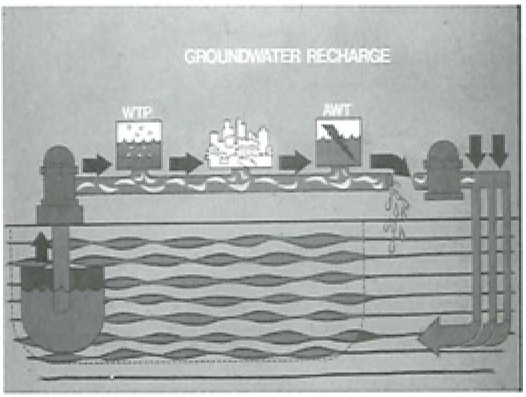
Courtesy of
Dr. Shane Snyder,
Southern Nevada Water Authority





Various assay methods for trace organic compounds and their relative significance to human health risk

49



Orange County Water District

http://www.ocwd.com/

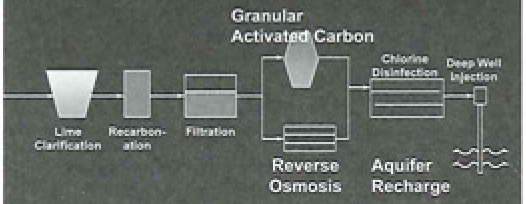
- Formed in 1933 to protect rights to water in the Santa Ana River
- Manage groundwater basins that supplies > 20 cities and >2 million residents
- Source of recharge water: Santa Ana, Colorado, State Water Projects, and reclaimed water
- Water Factory 21 1976 - 2000: 57 x 10^3 m^3/d (15 mgd)
- Groundwater Replenishment (GWR) System, 236 (473) x 10^3 m^3/d \$487 Million project; O&M annual cost \$26 million, opens 2007.

51

Water Factory 21

52

Water Factory 21

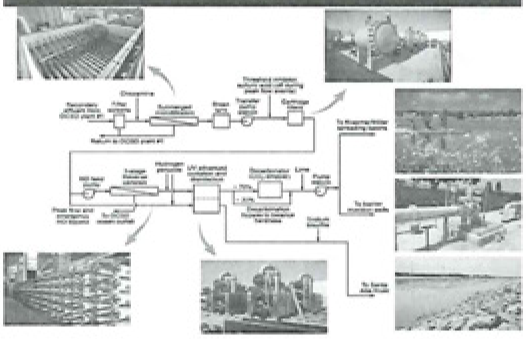


1976 - 2000
21 Mm^3/ yr (15 mgd)

What is the Groundwater Replenishment System?

- Indirect potable reuse project
  - Phase I — 236 x 10^3 m^3/d
  - Ultimate Capacity — 473 x 10^3 m^3/d
- Treatment: 100% MF, RO & UV + H_2O_2
- Half the water will be injected into wells for a seawater intrusion barrier
- Half the water will be percolated into the groundwater basin
- Partnering agencies: OCWD and OCSD

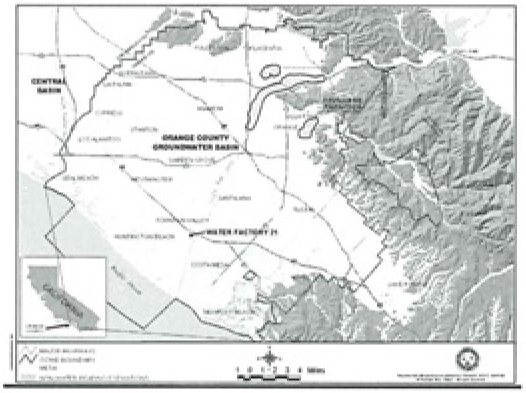
GWRS being constructed



Energy requirement for water delivery to Orange County

Various water sources	Energy requirement, kWh/m3
Desalination	3.5 – 4.0
State water project	2.62
Colorado River	1.82
Groundwater Replenishment (GWR) System	1.19

Adapted from Orange County Water District, 2006.



Local Benefits of GWRS

- Provides reliable, local water supply
- Improves water quality
- Helps drought-proof Orange County
- Protects groundwater basin from seawater intrusion
- Reuses valuable resource
- Decreases wastewater discharge to ocean

Trends in Water Reuse

- Integrated regional water resource planning
- Dual distribution systems
- Decentralized systems
- Push for planned indirect potable reuse
- UV disinfection
- Membrane processes: MF and RO
- Microbial and chemical risk assessments
- Regulatory development
- Public communication and perception studies

IDP Implementation Issues

- The need for new water is becoming critical
- Non-potable water reuse may reach practical limits
- Technology for IPR Is mature, now
- Costs are competitive, now
- Public acceptance is not assured
- Communication of value, benefits, alternatives is essential
- Once Implemented, opposition may melt away

Editorial: Yuck!; San Diego should flush "toilet to tap" plan

San Diego Union-Tribune – 7/24/06

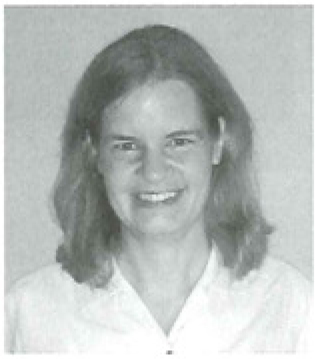
- **RECYCLED DRINKING WATER:**

Your golden retriever may drink out of the toilet with no ill effects. But that doesn't mean humans should do the same. San Diego's infamous "toilet to tap" plan is back once again, courtesy of Water Department bureaucrats who are prodding the City Council to adopt this very costly boondoggle. The project was rightly shelved seven years ago amid a public outcry over potential health hazards and the fact that some of San Diego's least affluent neighborhoods were to be the recipients of the treated wastewater.

San Diegans do not need to run the risks associated with drinking toilet water. The City Council should reject this project once and for all.

Hokkaido University International Symposium on Sustainable Development
Plenary Session 2: Monday August 7, 2006 / 1:40pm-2:20pm
Speaker

Mottainai: A Comparative Study of the Politics of Innovation in Waste Management

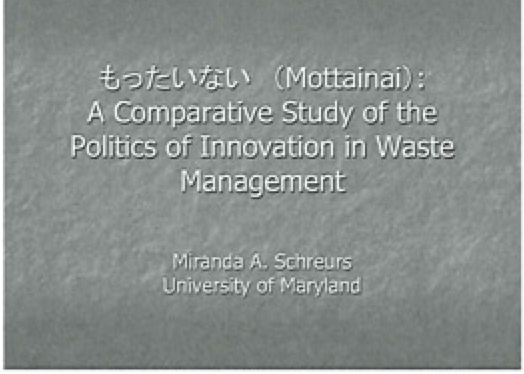


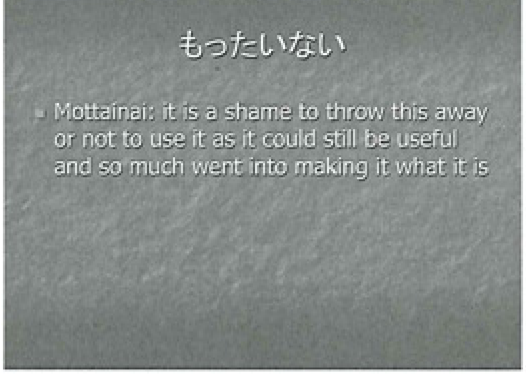
Miranda Schreurs

Associate Professor
Department of Government and Politics
University of Maryland, U.S.A.
E-mail: mschreurs@gvpt.umd.edu

Consumer societies are being faced by increasingly difficult and pressing problems related to waste management. Household waste contains an increasingly large share of electronic products--computers, televisions, DVDs--that have added new challenges for municipalities that already have great difficulties in disposing of waste.

This paper examines innovative measures that are being developed to reduce waste at its source in the European Union, Japan, and the United States and considers how policy ideas are diffusing across borders.





Wangari Mattai, 2004 Nobel Peace Prize.

The Politics of Waste and the Role of Governments

-US led innovations in hazardous waste response

-EU, Japan are leading when it comes to recycling, circular economies

-US, at federal level, focuses on education and voluntary methods

History of Waste: Fun Facts

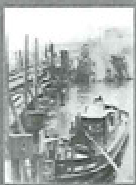
Source: US EPA

- 1690 First paper recycling mill in US
- 1757 Ben Franklin organizes municipal street clean service in Philadelphia
- 1874 Nottingham England, development of the "destructor" (an incinerator)
- 1885 NY builds its first incinerator
- 1899 NYC organizes first recycling plant in US
- 1904 First aluminum recycling plant

Where to with your Waste?

- 1900s, piggeries developed in small and medium towns to use food waste
- 1902, 70% of 161 towns offered refuse collection
- 1914, estimated 300 incinerators in US, Canada
- 1920s, wetlands used for garbage dumping
- 1934, US bans municipal dumping of waste in ocean
- WWII, big push for recycling of materials, 25% of waste stream recycled
- 1940s, first sanitary landfills emerge
- 1950s, Open burning dumps used in many cities

Rivers on Fire



Cuyahoga River Fire

1969, oil wastes in the Cuyahoga River in Ohio caught fire

The river had caught on fire before: in 1936 and 1952

Became a symbol of a polluted United States

The US: Hazardous Waste Crisis and Response

1965 Federal Solid Waste Disposal Act (focused on research)

1976 Resource Recovery and Response Act

1978-80 Love Canal
(Super Fund Legislation)

1984 Bhopal Disaster
(Emergency Planning & Community Right to Know Act; Toxic Release Inventory)

1989 Exxon Valdez Oil Spill
(Oil Pollution Prevention Act of 1990)

Resource Conservation and Recovery Act 1976

Gave EPA authority to control hazardous waste from cradle to grave.

Set framework for management of non-hazardous wastes

Amended 1984 phasing out landfilling of hazardous wastes

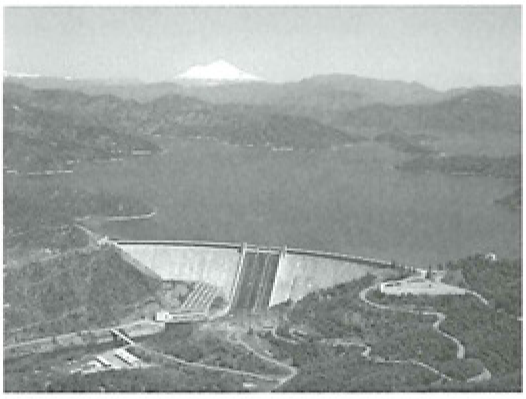
Amended 1986 to address underground tanks storing petroleum and other hazardous substances

Amended in 1987/8 to authorize EPA to initiate educ program on problems of plastics in marine environment; restricted use of plastic ring carriers; tracking of medical waste

Love Canal: 1978-1980

University Archives, State University of New York at Buffalo

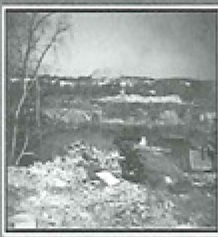
Lois Gibbs and the Love Canal Home Owners Association



SUPERFUND

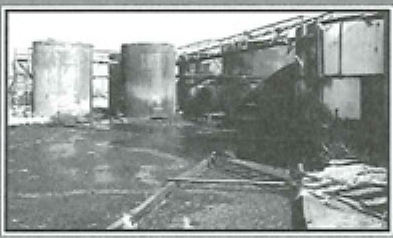
- Provides a federal superfund for the clean-up of abandoned hazardous waste sites as well as accidents, spills, and other emergency releases of pollutants
- Makes a broad class of parties strictly liable for clean up costs for releases of hazardous substances

SUPERFUND 25th Anniversary



- As of Dec 2005, Superfund construction had been conducted at over 900 federal and private sites
- But 1 in 4 Americans lives within 3 miles (4.8 km of a Superfund Site)

Before



Hidden dangers

1984 Bhopal: The world's worst chemical disaster

BBC pictures

Bhopal

Dec 3, 1984 –

- Union Carbide Co. fertilizer plant leaks methyl icocyanide
- 2000 dead, another 8,000 die of chronic effects. Estimated 2000 casualties, 100,000 injuries, and significant damage to livestock and crops.

Emergency Planning & Community Right to Know Act

-required establishment of state emergency planning commissions
-requires companies to notify authorities of extremely hazardous substances above certain quantities
-requires companies to report annually on toxic releases of over 600 chemicals, info made available to public

Toxic Release Inventory

- Publicly available database of annual releases of toxic chemicals
- Made available to the public through www.scorecard.org
- Communities have used this information to pressure companies to reduce their emissions
- Many companies have reduced their chemical use voluntarily as a result of TRI

Toxic Release Inventory

Montgomery County, MD

Pounds

1	[illegible]	DICKERSON	2038708
2	[illegible]	ROCKVILLE	547
3	[illegible]	ROCKVILLE	510
4	[illegible]	DICKERSON	250
5	[illegible]	GAITHERSBURG	11
6	[illegible]	GAITHERSBURG	8
7	[illegible]	GERMANTOWN	0

States with Animal Waste (TRI)

Rank	State	Tons of Waste in 1992
1.	TEXAS	110,000,000
2.	CALIFORNIA	55,000,000
3.	IOWA	51,000,000
4.	NEBRASKA	47,000,000
5.	KANSAS	46,000,000
6.	WISCONSIN	39,000,000
7.	OKLAHOMA	36,000,000
8.	MISSOURI	35,000,000
9.	MINNESOTA	33,000,000
10.	NORTH CAROLINA	31,000,000

Education/Voluntary Activities for Waste Reduction

- Reduce, reuse, recycle

(Resource Conservation Challenge)

-voluntary, education focused program

-Earth 911

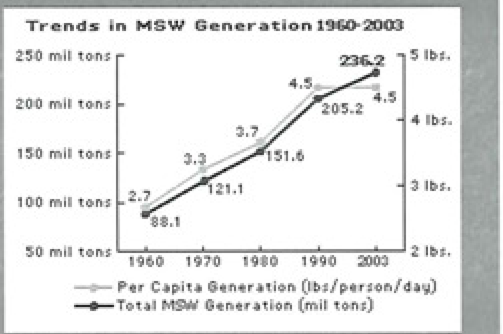
Earth 911

- Provides information about local recycling services identified by zip code across the country
- Household hazardous waste
- Aluminum Can recycling
- Cell phone and computer recycling
- Paints
- Mercury

Earth 911: Computers

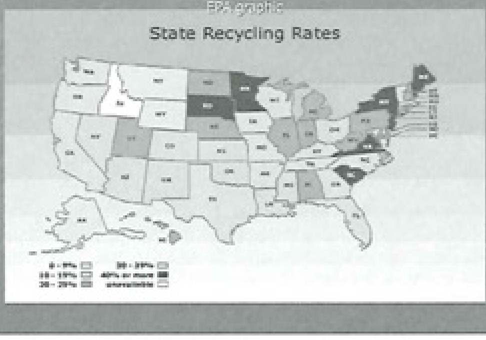
- Computer donation
- Computer recycling information
- Computer components recycling

EPA data

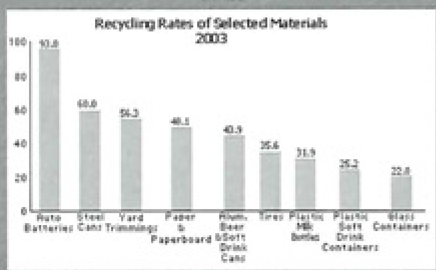


US municipal solid waste generation (EPA data)

EPA graphic



EPA data



U.S. Cities Recycling Rates

(Waste News 2001 data)

- **Portland 53.6%**
- **Seattle 52%**
- **Chicago 47.9%**
- **San Jose 47%**
- **San Diego 46%**
- **San Francisco 42%**
- **LA 40.9%**
- **Baltimore 35.3%**
- **New York 19.7%**

The Role of the Federal Govt in Recycling

1991 Federal Agency Recycling Exec. Order

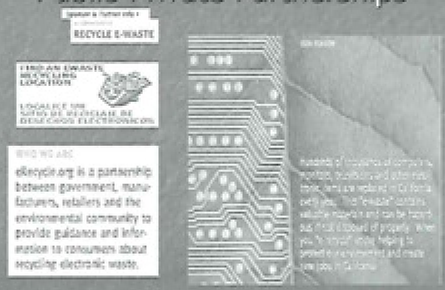
1998 Federal Acquisition, Waste Prevention, and Recycling Exec. Order

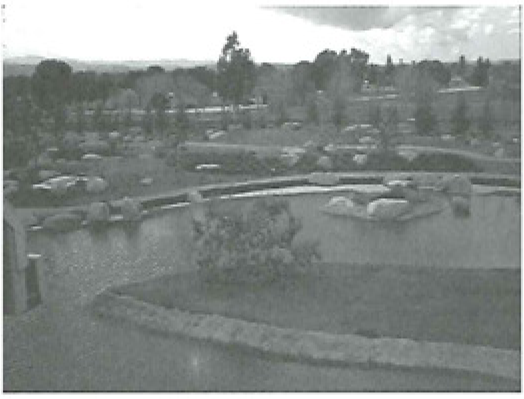
The US Federal government has limited its role in household recycling and producer packaging matters to education and promoting voluntary initiatives

The States Take the Lead: 2003 CA's Electro Waste Recycling Act

-reduction of hazardous wastes in certain electronic products sold in CA
-collection of electronic waste recycling fee at point of sale of certain products
-distribution of recovery and recycling payments to qualified entitites
-recommend env'lly friendly purchasing criteria for state entities

Public-Private Partnerships





Stockholm Convention on Persistent Organic Pollutants

- Global treaty to protect human health and environment from Persistent Organic Pollutants (POPs)

(US has signed but not ratified; Japan and EU have both ratified)

Lessons for Sustainability: How does the US Compare?

Planet Ark: Recycling Olympics National Municipal Waste Generation (kg/person)

- Japan 410
- Portugal 440
- Sweden 470
- Italy 510
- France 530
- UK 580
- Germany 590
- Spain 650
- Switzerland 660
- Australia 690
- USA 730

Planet Ark: Recycling Olympics Paper and Cardboard

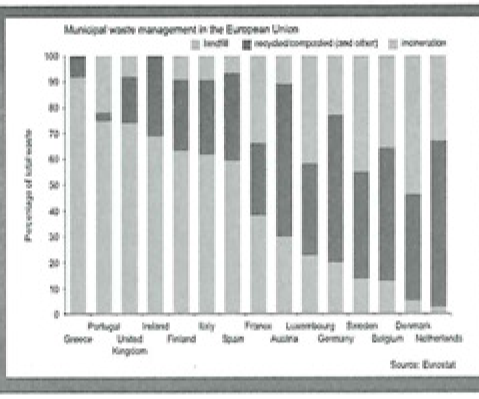
- Germany 70%
- Sweden, Switz 63%
- Japan 59%
- France 50%
- Spain 48%
- Australia 47%
- Portugal 46%
- USA 42%
- UK 41%
- Italy 37%

Planet Ark: Recycling Olympics National Rankings

1-Japan
2-Sweden
3-Switzerland
4-Germany
5-France
6-Australia, Italy
8-Portugal
9-Spain, US
11-UK

The European Union

Pioneering New Approaches to Waste Reduction, Recycling, Reuse



EU: Regulatory Developments Influenced by US law

- 1975 Framework Directive on Waste Management
- Seveso I (1982) and II (1996) (Chemical Accident Prevention, Preparedness, Response)
- 1991 Controlled Management of Hazardous Wastes
- 1996 Integrated Pollution Prevention and Control (requires highly polluting industries and agricultural operators to have a permit which can only be used if environmental conditions are met)

EU Taking the Lead

- Reduction, reuse, recycle
- Development of Recycling society
- Producer Responsibility

1994 EU Packaging Directive

- Harmonizes national legislation
- Requires members to take measures to reduce packaging waste and promote reuse
- Reduces heavy metal content
- Requires intro of systems to return/collect used packaging
- Establishes recycling targets
- Harmonizes data bases

End of Use Vehicles

- Reduces use of hazardous substances
- Encourages design of vehicles to be recycling friendly
- Encourages use of recycled parts
- Introduces provisions on collection and recycling of used vehicles

6th Environment Action Programme

- Set target of developing recycling society
- Commission proposed new strategy on prevention and recycling of waste
- Proposes revising 1975 Waste Framework Directive to set recycling standards and oblige members to develop national waste prevention programs

EU Directives on Recycling

- Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment
- Directive 2002/96/EC on waste electrical and electronic equipment (WEEE)

EU Approves Battery Recycling Law (July 2006)

- Will standardize measures for the collection and recycling of batteries and accumulators
- Shops will be required to dispose of spent batteries
- New batteries will be restricted in the amount of mercury and cadmium they may contain
- Will require more accurate labelling

Waste Management Laws

- 1970 Waste Management Law
- 1972 Industrial safety and health law
- 1972 Ordinance on prevention of hazards due to specified chemical substances

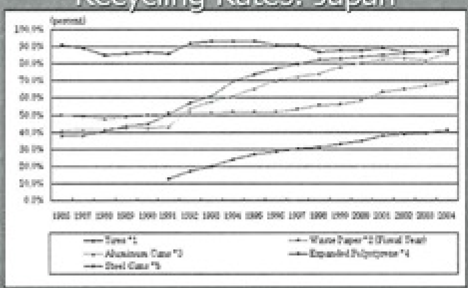
Japan: Catching up & Surpassing the EU?

- 1991 Law for the Effective Utilization of Resources (reduce by-products, reuse recycled materials, reducing end-of-life waste, making products that are easily recycled, taking back end of life products (batteries, PCs)
- Enactment of a Fundamental Law for Establishing a Sound Material Cycling Society (June 2000)
- Fundamental Plan for a Sound Material Cycling Society (2003)

Japanese Regulations

- Action Plan for Greening Government Purchases
- Packaging Recycling Law
- Electric Appliances Recycling Law
- Construction Waste Recycling Law
- Food Waste Recycling Law
- End of Life Vehicle Recycling Law (2002, entered into force 2004)

Recycling Rates: Japan



Recycling in Japan: 44 categories in Kamikatsu!

Hokkaido University International Symposium on Sustainable Development
Plenary Session 2: Monday August 7, 2006 / 2:20pm-2:50pm
Speaker

Sustainable and Cyclical Economy of Asia: Overview

Fumikazu Yoshida

Professor
Graduate School of Public Policy
Hokkaido University
E-mail: yoshida@econ.hokudai.ac.jp

Cross-Border Resource Cycling

Because of economic globalization, the material cycle has totally transcended national borders. In particular, imports and exports of scrap metal, post-consumer waste paper, waste plastic, and other reclaimed materials are booming due to heavy demand stemming from falling demand in Japan and to Asian economic growth.

Building a Cyclical Society Including All of East Asia

East Asia already has a large product and material cycle, making it impossible to create a cyclical society conceived for Japan alone. Therefore I would like to discuss the challenges for each actor in building a cyclical society system in East Asia, while taking into consideration the proposals mentioned thus far.

First, it is essential to assemble statistical data on the used consumer appliances/electronics and automobiles that are exported. This is impossible to determine from current Ministry of Finance customs statistics. We must also find out how resources are being recycled in importing countries. In view of the need for this information, the government must start by assembling statistics.

Second, information exchange and discussions on wide-area recycling should be carried out on the government level. Haste is needed especially on issues related to the Basel Convention. The EU practices wide-area waste management on the grounds that within the EU this does not constitute transboundary movement under the convention.

Third, in relation to manufacturers, the government should consider the application of EPR to used products and those produced overseas. Unless this is done, exporters cannot escape criticism that they are trying to avoid domestic environmental regulations.

And fourth, recyclers should run recycling businesses - not only in Japan, but in other Asian countries as well - that use their technology and expertise to advantage. Of course environmental friendliness and transparency will be crucial, and they should start with pilot projects.

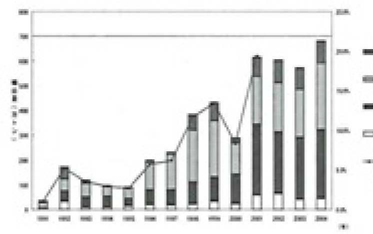
Sustainable and Cyclical Economy of Asia: Overview

Fumikazu Yoshida
Hokkaido University

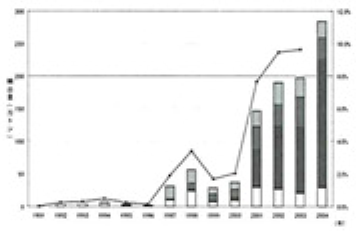
Cross-Border Resource Cycling

- Because of economic globalization, the material cycle has totally transcended national borders.
- In particular, imports and exports of scrap metal, post-consumer waste paper, waste plastic, and other reclaimed materials are booming due to heavy demand stemming from falling demand in Japan and to Asian economic growth.

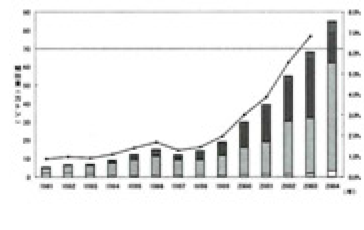
Cross-Border Resource Cycling Ferrous scrap exports and importing countries from Japan



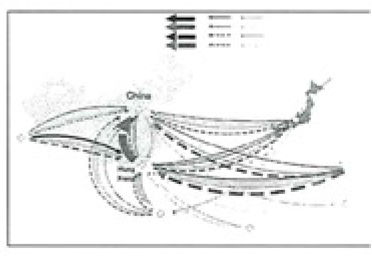
Waste paper exports and importing countries from Japan

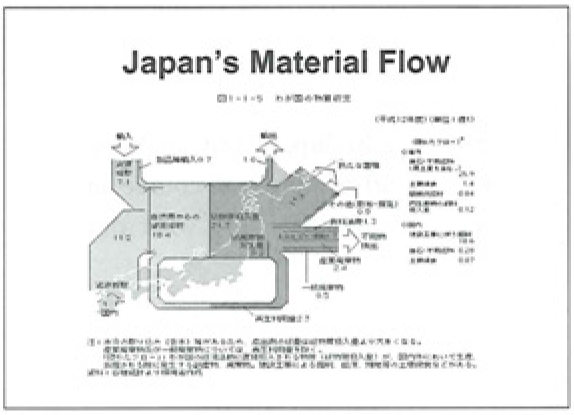


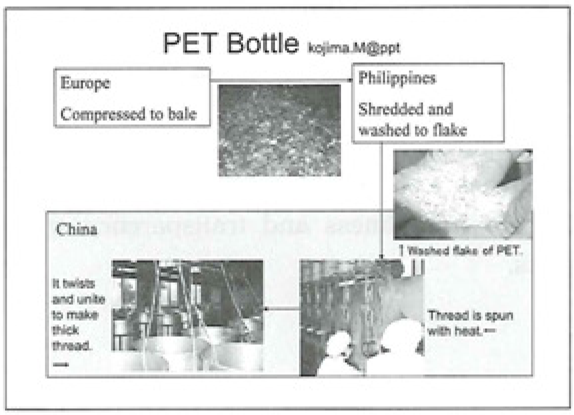
Plastic scrap exports and importing countries from Japan

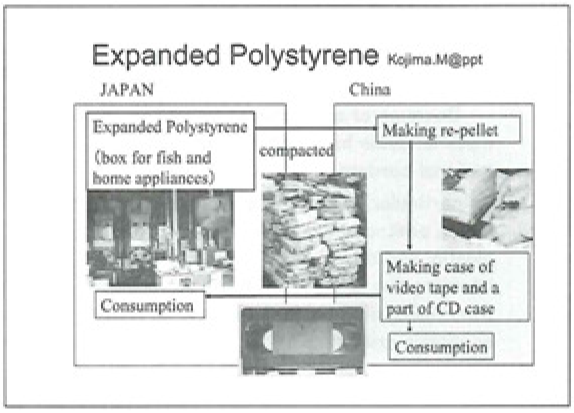


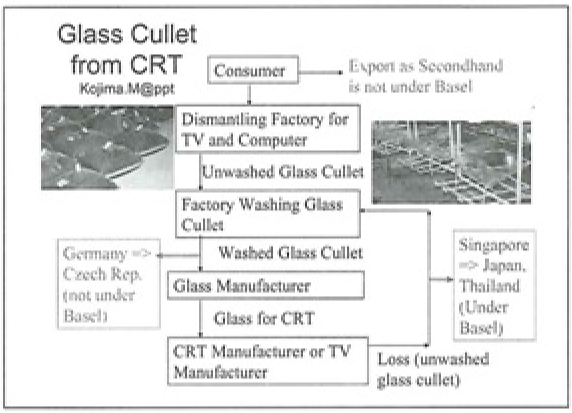
Material flows of plastic waste among Japan, China, and Hong Kong in 2001. by Terazono

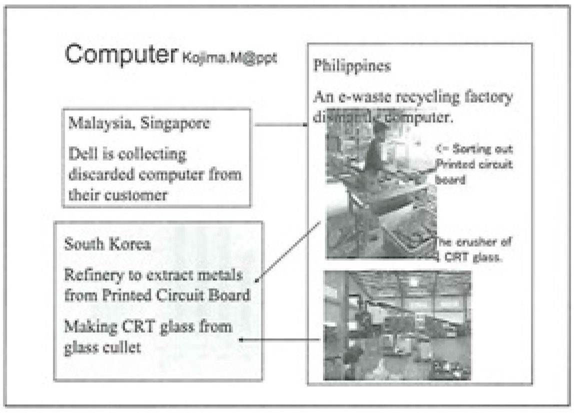


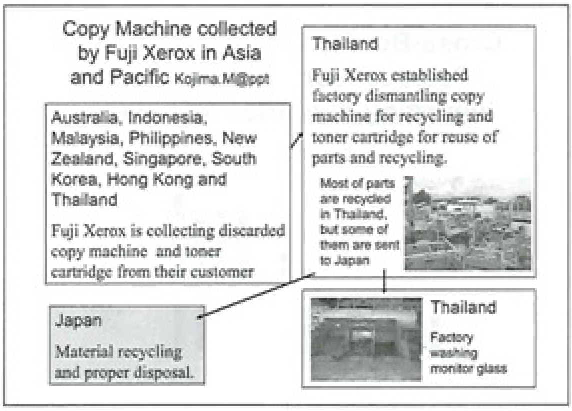












Waste Import by Selected Asian Countries in 2005 (unit: thousand ton)

	Plastics	Paper	Steel	Copper	Al.
China	4956	17032	10135	4820	1687
Indonesia	4	1957	1202	13	23
Japan	3	77	181	102	108
S. Korea	24	1349	6813	205	297
Malaysia	75	166	3370	236	*
Philippines	7	287	13	4	0
Thailand	1	946	1683	5	31

Note: * : Not reliable data

Source: Trade statistics of each countries.
Kojima.M @ppt

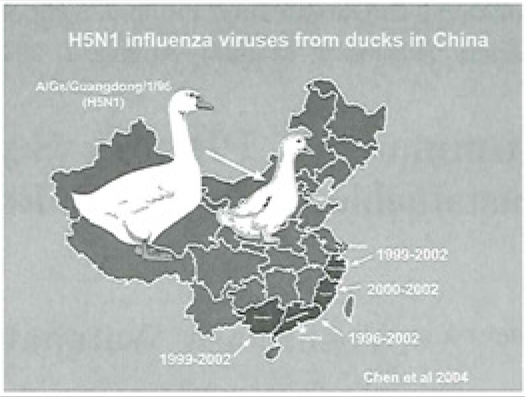
Pollution from Recycling of Imported Waste Kojima.M@ppt

- Basel Action Network and Silicon Valley Toxics Coalition published "Exporting Harm" in February 2002, which report the pollution from e-waste recycling in Guiyu, Guangdong, China.
- Although Chinese government tightened the prohibition of importing e-waste. But e-waste recycling in Guiyu still cause pollution.

IC chips are removed from PCB by using heat. (Guiyu, Nov. 2004)

Building a Cyclical Society Including All of East Asia

- East Asia already has a large product and material cycle, making it impossible to create a cyclical society conceived for Japan alone. Therefore we would like to discuss the challenges for each actor in building a cyclical society system in East Asia, while taking into consideration the proposals mentioned thus far.



Second:Basel Convention

- **Information exchange and discussions on wide-area recycling should be carried out on the government level. Haste is needed especially on issues related to the Basel Convention. The EU practices wide-area waste management on the grounds that within the EU this does not constitute transboundary movement under the convention.**

Third：EPR

- **In relation to manufacturers, the government should consider the application of EPR to used products and those produced overseas. Unless this is done, exporters cannot escape criticism that they are trying to avoid domestic environmental regulations.**

Fourth: environmental friendliness and transparency

- Recyclers should run recycling businesses — not only in Japan, but in other Asian countries as well — that use their technology and expertise to advantage. Of course environmental friendliness and transparency will be crucial, and they should start with pilot projects.

Summary of Plenary Session 2: Sustainable Society with Recycling System

Chaired by **Yoshimasa Watanabe**

Professor
Graduate School of Engineering, Hokkaido University
E-mail: yoshiw@eng.hokudai.ac.jp

Speakers:
Takashi Asano, Professor Emeritus, Department of Civil and Environmental Engineering, University of California, Davis, U.S.A.
Miranda Schreurs, Associate Professor, Department of Government and Politics, University of Maryland, U.S.A.
Fumikazu Yoshida, Professor, Graduate School of Public Policy, Hokkaido University

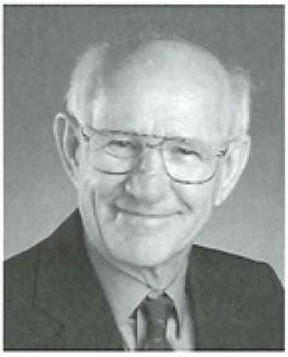
The sustainability of water resources is of particular importance in light of projected increase in global population. For water supplies to be sustainable, the rate at which water is withdrawn from water sources needs to be in balance with the rate of renewal or replenishment of these water sources. In addition to a balance of water quantity, water quality must also be sustainable, recoverable and reusable. Water that is withdrawn for societal needs is also a source of water replenishment that should be considered in the sustainability equation. Prof. Asano presented the foundation of water reclamation, recycling and reuse. He summarized the salient features of implementing water reuse project including Orange County's Groundwater Replenishment System in California.

Consumer societies are being faced by increasingly difficult and pressing problems related to waste management. Household waste contains an increasingly large share of electronic products-computers, televisions, DVDs-that have added new challenges for municipalities that already have great difficulties in disposing of waste. Prof. Schreurs talked about innovation measures that are being developed to reduce waste at its source in the European Union, Japan and United States and considered how policy ideas are diffusing across borders.

Because of economic globalization, the material cycle has totally transcended national borders. In particular, imports and exports of scrap metal, post- consumer waste paper, waste plastic, and other reclaimed materials are booming due to heavy demand stemming from falling demand in Japan and to Asian economic growth. Prof. Yoshida discussed the challenges for each actor in building a cyclical society system in East Asia.

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3: Monday August 7, 2006 / 2:55pm-3:35pm
Speaker

Origin and Evolution of Influenza Virus



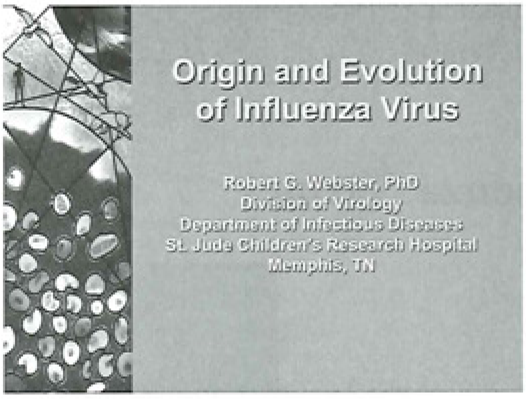
Robert G. Webster

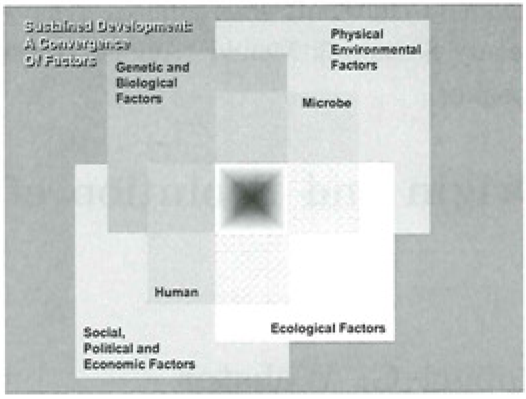
Professor
Division of Virology, Department of Infectious Diseases,
St. Jude Children's Research Hospital, U.S.A.
E-mail: robert.webster@stjude.org

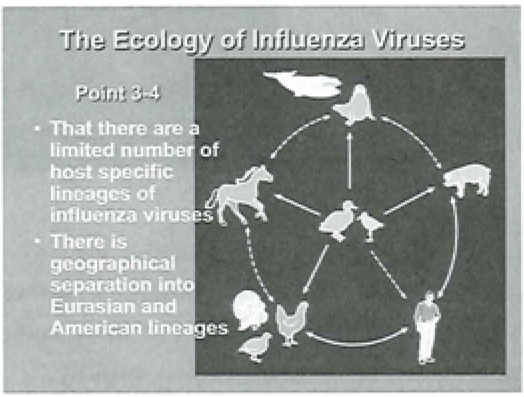
Pandemic influenza is a zoonotic disease caused by the transfer of influenza A viruses or virus gene segments from aquatic bird reservoirs to humans and domestic animals. In wild aquatic birds - the natural hosts of all influenza viruses - these viruses exist in harmony with their natural host. After transfer to other species influenza viruses evolve rapidly.

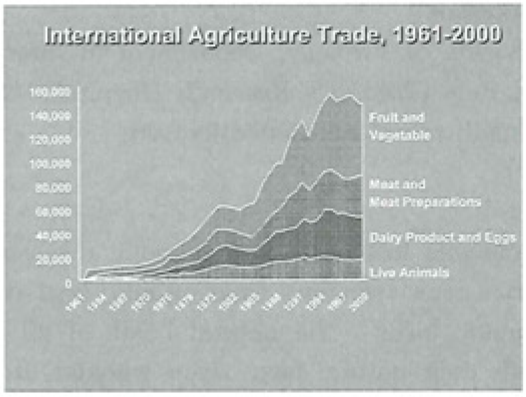
In the past century there have been three pandemics in humans: 1918 Spanish, 1957 Asian, 1968 Hong Kong. These have emerged after reassortment between human influenza viruses and those in the aquatic birds of the world or directly from avian sources probably via intermediate hosts.

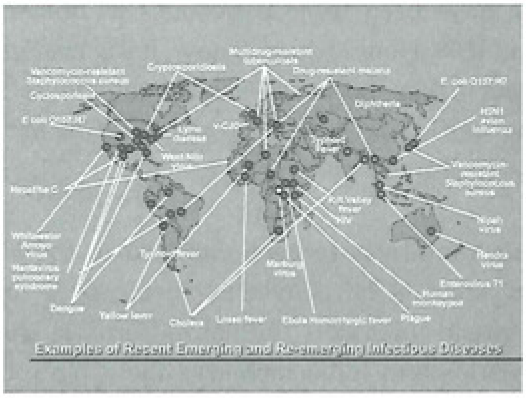
The pandemics of the past century have been confined to the H1, H2 and H3 subtypes but there is no convincing evidence to exclude the others. The spread of H5N1 influenza viruses from Eastern Asia to Europe, Africa and India increases the geographical range and pandemic potential of this virus. Ducks are playing an important role in the continued evolution and spread of the H5N1 viruses including prolonged shedding and selection of antigenic variants. The H5N1 viruses from 2004-2006 are highly pathogenic in poultry, ferrets, felids and humans. The role of migrating birds in the spread of H5N1 and exchange of viruses between domestic and wild birds in Asia is of great concern. H5N1 viruses continue to break the ecological rules established for other highly pathogenic avian influenza viruses. What are the prospects for the H5N1/06 virus to become consistently transmitted from human to human and cause a global catastrophe? Options for control include increase biosecurity and the use of reverse genetics to produce standardized vaccines for human and veterinary use. The immediate control of the spread of H5N1 is through the use of the antiviral neuraminidase inhibitors. Continuing stockpiling of anti-neuraminidase drugs is prudent.

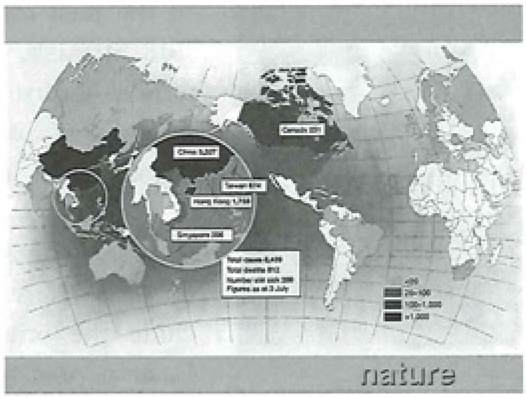

Origin and Evolution of Influenza Virus
Robert G. Webster, PhD
Division of Virology
Department of Infectious Diseases
St. Jude Children's Research Hospital
Memphis, TN

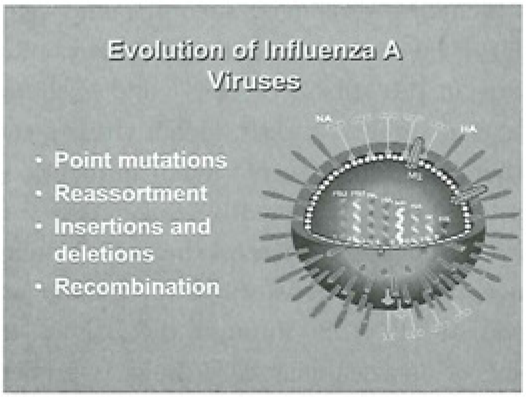

Sustained Development: A Convergence Of Factors
Physical Environmental Factors
Genetic and Biological Factors
Microbe
Human
Social, Political and Economic Factors
Ecological Factors

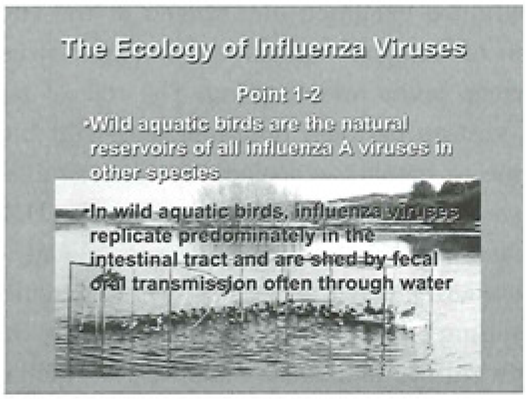

The Ecology of Influenza Viruses
Point 3-4
That there are a limited number of host specific lineages of influenza viruses
There is geographical separation into Eurasian and American lineages


International Agriculture Trade, 1961-2000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Fruit and Vegetable
Meat and Meat Preparations
Dairy Product and Eggs
Live Animals


Examples of Recent Emerging and Re-emerging Infectious Diseases


nature

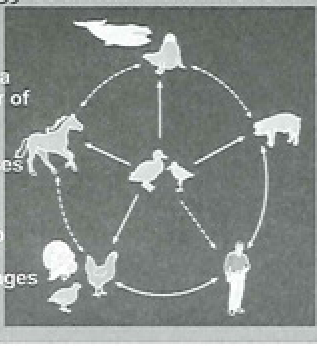

Evolution of Influenza A Viruses
Point mutations
Reassortment
Insertions and deletions
Recombination
HA


The Ecology of Influenza Viruses
Point 1-2
·Wild aquatic birds are the natural reservoirs of all influenza A viruses in other species
·In wild aquatic birds, influenza viruses replicate predominately in the intestinal tract and are shed by fecal oral transmission often through water

The Ecology of Influenza Viruses

Point 3-4

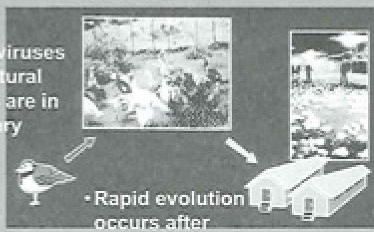
- That there are a limited number of host specific lineages of influenza viruses
- There is geographical separation into Eurasian and American lineages



The Ecology of Influenza Viruses

Point 5-6

- Influenza viruses in their natural reservoirs are in evolutionary stasis



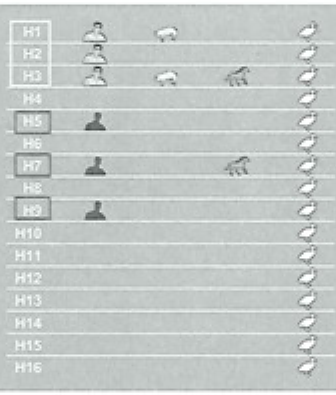
- Rapid evolution occurs after transfer to new hosts

The Ecology of Influenza Viruses

Point 7-8

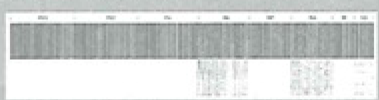
- Most interspecies transmissions are transitory and do not result in stable lineages
- Intermediate hosts involved in interspecies transmission of avian influenza viruses include pigs, chickens, and quail

Influenza A Virus Host Range



The Avian Influenza Genome Project

- 413 avian influenza viruses
- "proteotyping" or bar-codes for rapid analysis of data
  - Certain proteins inherited as pairs
- Variation in HA, NA, NS



Obenauer et al 2006

Reassortment/Recombination

- Reassortment of gene segments is rampant, especially HA, NA
- Evidence for homologous recombination not found
  - *a rare event*

Genesis of H5N1 Influenza In Asia

1996 Goose/Guangdong/1/96 (H5N1)

1997 Emergence of H5N1 Bird Flu

A reassortant

Goose X Quail X Duck

H5N1 H9N2 H6N1

6 of 18 infected persons died

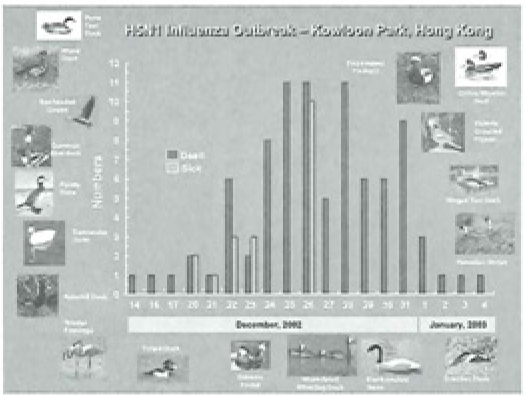
1997-2002 ▸ Multiple genotypes

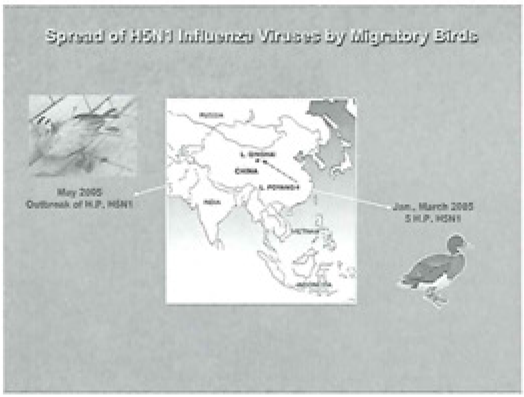
2003-2005 ▸ Pathogenic for aquatic birds

▸ Spread across Asia

H5N1 influenza viruses from ducks in China

Chen et al 2004



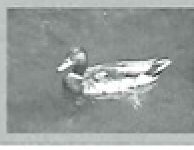


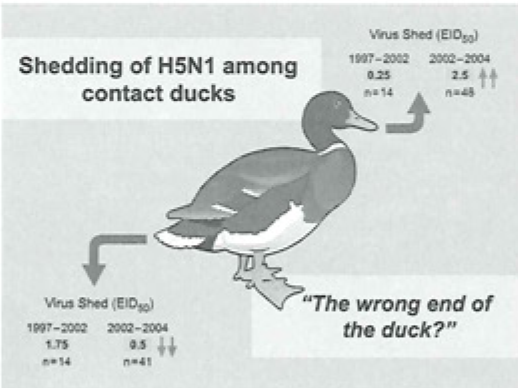
Serological Analysis of Migratory Ducks in China 2005

No. Examined	*Serological Reactivity With:*	
	DK/JX/3345/05 (H5N2) [LP]	MDK/JX/1653/05 (H5N1) [HP]
1092	47 (4.3%)	34 (3.1%)

Pathogenicity of H5N1 Viruses for Ducks and Geese

Virus	Date of Isolation	Lethality for: Ducks	Geese
Mallard duck/JX/05	January/05	4/9	6/6
Bar-headed goose/QH/05	May/05	0/9	6/6



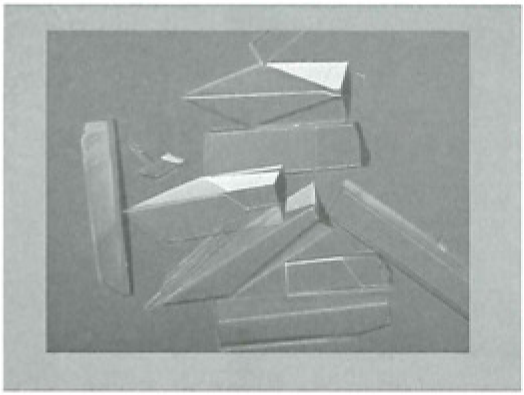


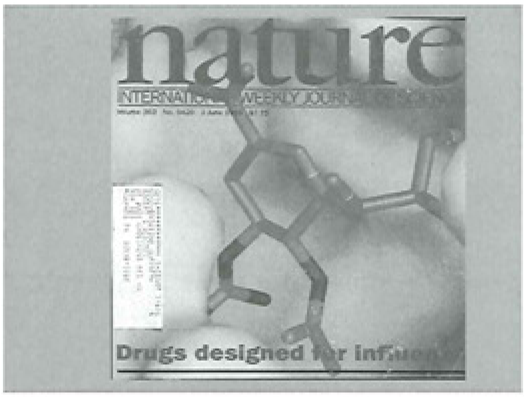
When H5N1 emerged in Southern China in 1996 the current strategy for making anti-influenza drugs and vaccines did not exist

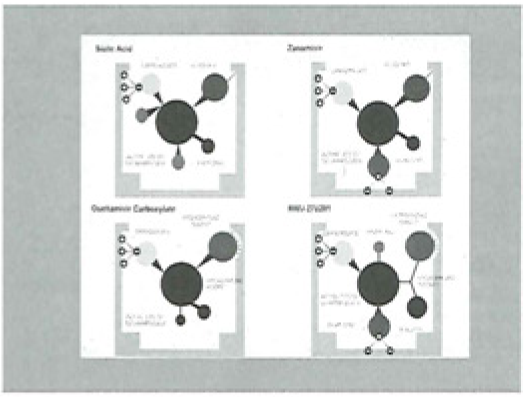
- The importance of sustained development:
  - *Development of anti neuraminidase drugs*
  - *Development of reverse genetics for vaccines and understanding pathogenesis*

Sustained Development

Development of antineuraminidase drugs





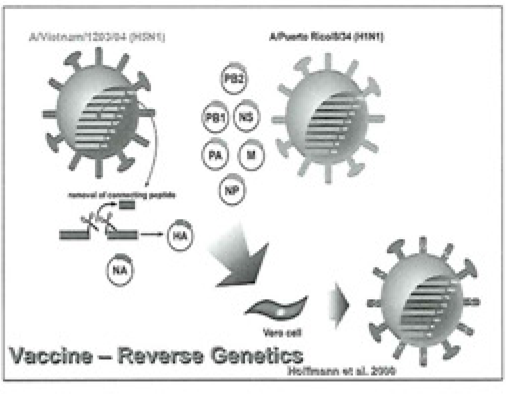


Surveillance to Drug Design

- Reservoirs of influenza A in aquatic birds of the world
- Structure of the neuraminidase
- Design of neuraminidase inhibitors
- The structure of an antibody combining site

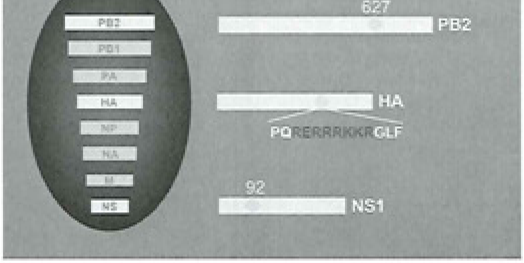
Sustained Development

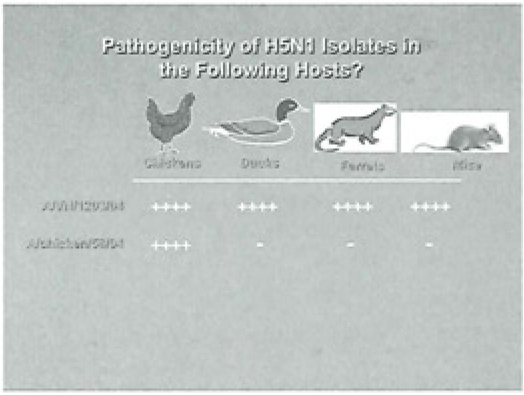
- Development of Reverse Genetics
- Palese – Kawaoka – Hoffmann

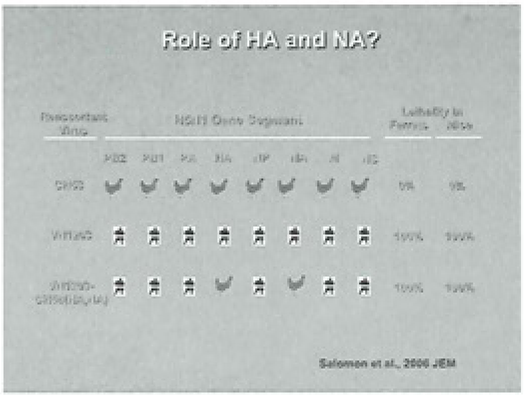


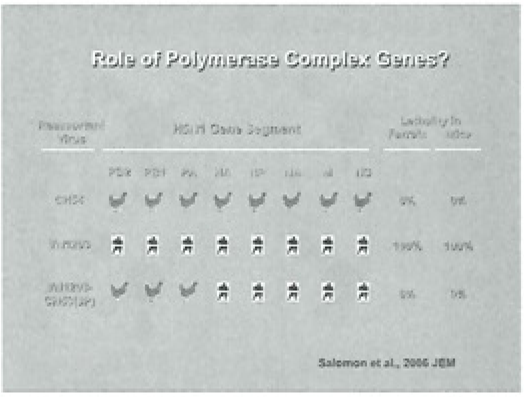
Pathogenesis

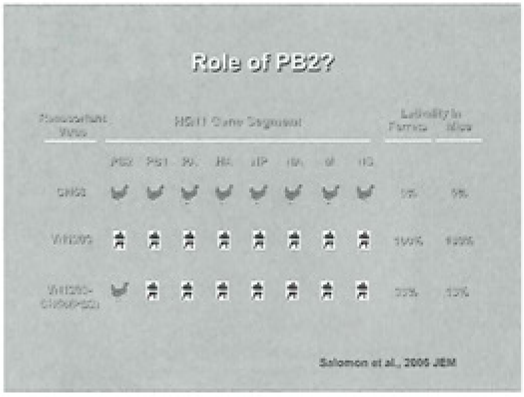
A polygenic trait

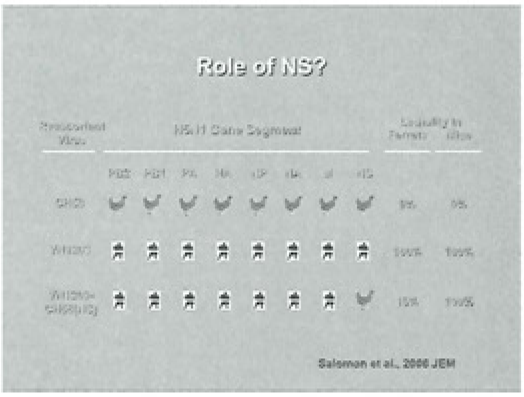


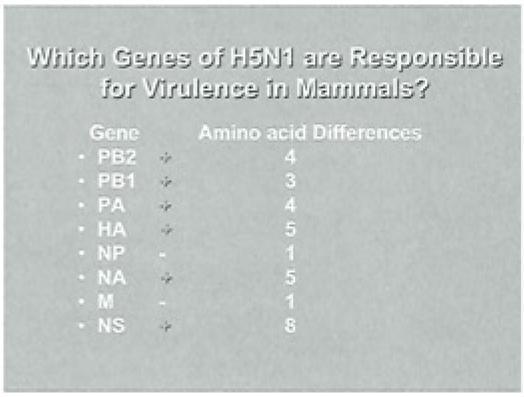

Pathogenicity of H5N1 Isolates in the Following Hosts?
Ferrets
++++ ++++ ++++ ++++
++++ - - -

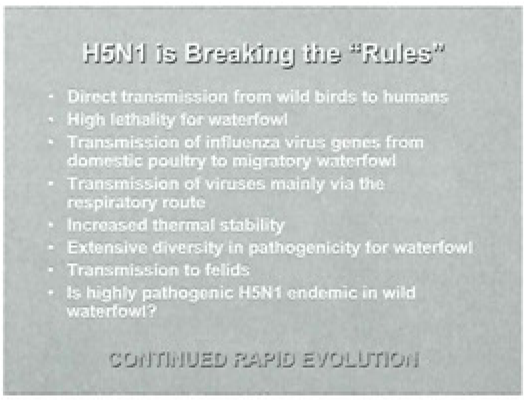

Role of HA and NA?
PB2 PB1 PA HA NP NA M NS
0% 0%
100% 100%
100% 100%
Salomon et al., 2006 JEM


Role of Polymerase Complex Genes?
H5N1 Gene Segment
0% 0%
100% 100%
0% 0%
Salomon et al., 2006 JEM


Role of PB2?
100% 100%
Salomon et al., 2006 JEM


Role of NS?
H5N1 Gene Segment
0% 0%
100% 100%
100%
Salomon et al., 2006 JEM


Which Genes of H5N1 are Responsible for Virulence in Mammals?
Gene Amino acid Differences
• PB2 + 4
• PB1 + 3
• PA + 4
• HA + 5
• NP - 1
• NA + 5
• M - 1
• NS + 8


H5N1 is Breaking the "Rules"
• Direct transmission from wild birds to humans
• High lethality for waterfowl
• Transmission of influenza virus genes from domestic poultry to migratory waterfowl
• Transmission of viruses mainly via the respiratory route
• Increased thermal stability
• Extensive diversity in pathogenicity for waterfowl
• Transmission to felids
• Is highly pathogenic H5N1 endemic in wild waterfowl?
CONTINUED RAPID EVOLUTION


Acknowledgements
Support: AI95357, NIAID, ALSAC
Richard Webby, Elena Govorkova, Erich Hoffmann, Diane Hulse,
The Influenza Support Staff
Influenza Research Group

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3: Monday August 7, 2006 / 3:35pm-4:05pm
Speaker

Are We Prepared for Emerging Zoonoses?

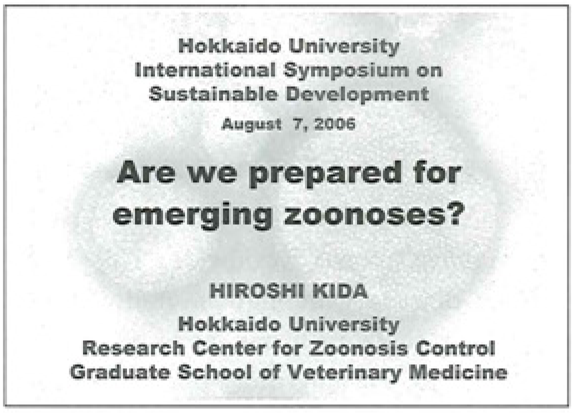
Hiroshi Kida

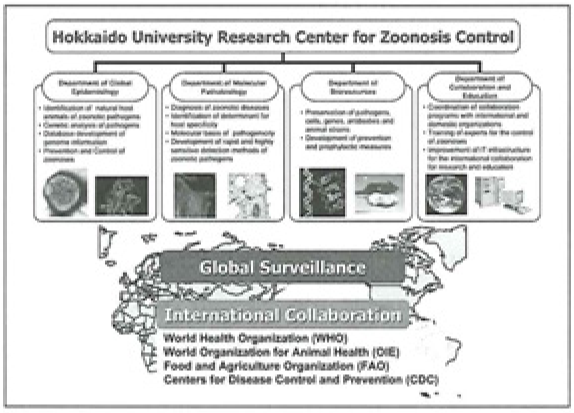
Director, Research Center for Zoonosis Control
Professor, Graduate School of Veterinary Medicine
Hokkaido University
E-mail: kida@vetmed.hokudai.ac.jp

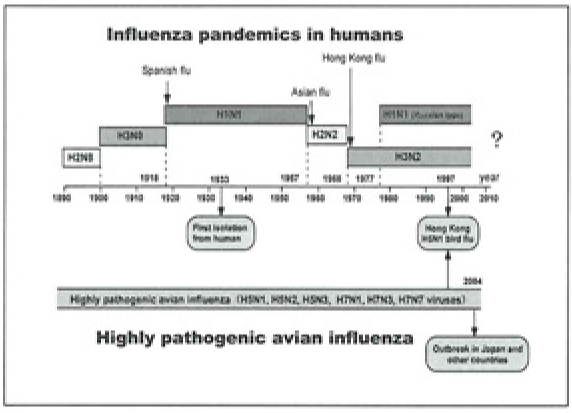
Recent outbreaks of highly pathogenic avian influenza have spread worldwide. This H5N1 virus has jumped the species barrier and caused severe disease with high mortality in humans. A concern is that only the H5N1 virus is assumed to cause next pandemic in humans. Since each of the subtypes of influenza viruses perpetuates among migratory ducks and their nesting lake water in nature and avian viruses of any subtype can contribute genes in the generation of reassortants in pig, none of the 15 HA and 9 NA subtypes can be ruled out as potential candidates for future pandemic strains.

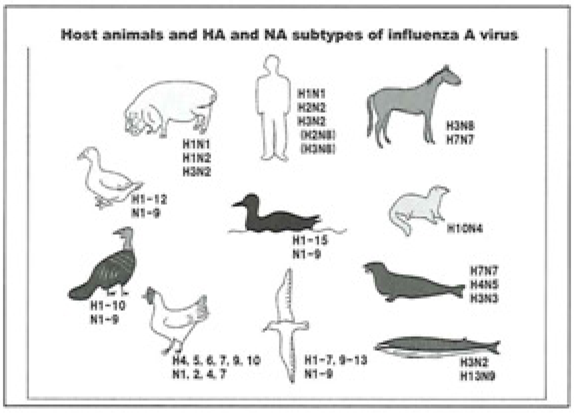
We have carried out global surveillance study of avian influenza and influenza virus isolates of 49 combinations of HA and NA subtypes have been isolated from fecal samples of ducks. So far, 76 other combinations have been generated by the genetic reassortment procedure in chicken embryos. Thus, avian influenza viruses of 125 combinations of HA and NA subtypes have been stocked for vaccine strain candidates and diagnostic use. Their pathogenicity, antigenicity, genetic information and yield in chicken embryo have been analyzed and registered in the database.

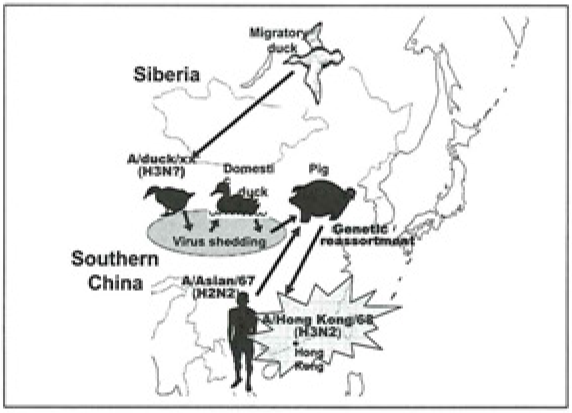
On the basis of the strategy for the control of influenza, Hokkaido University has established "Research Center for Zoonosis Control" in 2005. The long term goals of the center are the prevention and control of emerging zoonoses. To achieve the goals, the aims of the present program are; 1) to elucidate the ecology of zoonotic pathogens, 2) to detect the reservoir host and the route of transmission of each pathogen, 3) define the gene sequences that permit interspecies transmission of agents among animals including humans, 4) to clarify the molecular basis of pathogenisity of each agent for each of animal species, 5) to develop rapid methods for diagnosis of zoonoses and detection of the agents, 6) to establish international networks for global surveillance of zoonoses, 7) to scheme contingency plans for the prevention and control of zoonoses, 8) to provide training courses for personnel who conduct control management at the sites of disease out breaks, 9) to exchange personnel between different laboratories in the world in order to develop new strategies for the control of zoonoses, and 10) to establish "International Collaboration Centers for Zoonosis Control" by 2008.

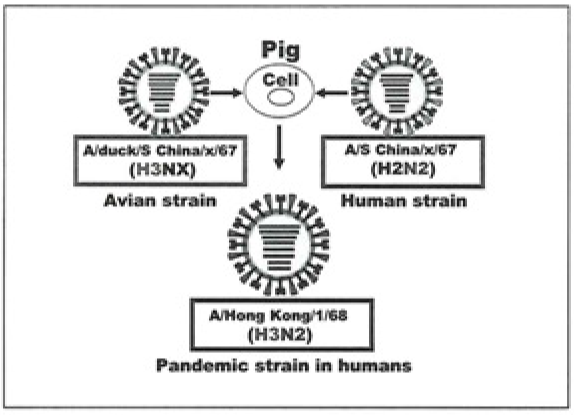












The role of pigs in the emergence of pandemic strains

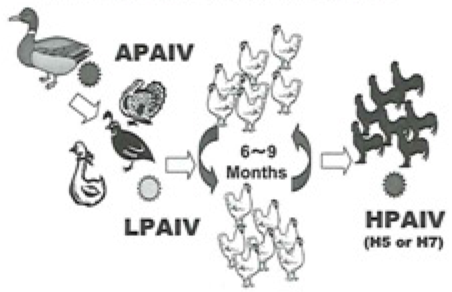
- Pigs are susceptible to avian influenza viruses of each of the HA subtypes.
- Genetic reassortants were generated in the cells lining upper respiratory tract of pig upon concurrent infection with mammalian and avian strains.

H. KIDA, Hokkaido University Graduate School of Veterinary Medicine

Tissue tropism of apathogenic, low pathogenic, and highly pathogenic avian influenza viruses in chicken

Virus strain	Virus infectivity ($logEID_{50}/g$)							
	Trachea	Lungs	Intestine	Kidney	Spleen	[illegible]	Muscle	Blood
Duck/Hok/9/99 (H9N2)	–	–	–	–	–	–	–	–
Chicken/Bj/2/97 (H9N2)	6.3	4.5	–	–	–	–	–	–

Acquisition of pathogenicity of avian influenza virus in chicken



Amino acid sequences at the cleavage sites of influenza A virus HAs

Subtype	Strains	Amino acid sequences
H1	Dk/Alberta/35/76(H1N1)[b]	IQSR GLF
H2	Mal/MT/Y61(H2N2)[b]	IESR GLF
H3	Dk/Menphis/928/74(H3N8)[b]	KQTR GLF
H4	Dk/Czechoslovakia/56(H4N6)[b]	KASR GLF
H5	Ck/Scotland/59(H5N1)[b]	RKKR GLF
H5	Ty/MN/3/92(H5N2)[a]	RETR GLF
H6	Shw/Australia/1/72(H6N5)[b]	IETR GLF
H7	FPV/Rostock/34(H7N1)[b]	KKRKKR GLF
H7	Mal/Alberta/195/89(H7N3)[a]	KKTR GLF
H8	Ty/Ontario/6118/68(H8N4)[b]	VEPR GLF
H9	Ty/Wisconsin/66(H9N2)[b]	RSSR GLF
H10	Ck/Germany/N/49(H10N7)[b]	VQGR GLF
H11	Dk/England/56(H11N6)[b]	IASR GLF
H12	Dk/Alberta/60/76(H12N5)[b]	VQDR GLF
H13	Gl/Maryland/704/77(H13N6)[b]	ISNR GLF
H14	Mal/Gurjev/263/82(H14N5)[b]	KQAK GLF
H15	Shw/Australia/2576/79(H15N9)[b]	IRTR GLF

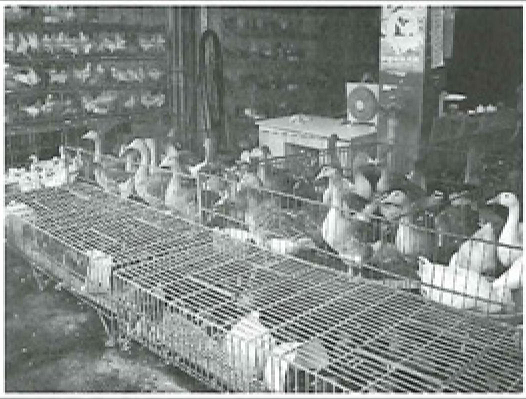
Senne et al, 1996[a], Kovacova et al, 2002[b]

Pathogenicity of influenza virus for chicken

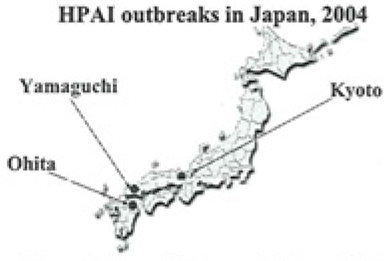
Cleavability of the HA protein into HA1 and HA2 is crucial and consecutive alignment of basic amino acids (R, K) at the cleavage site is related to the pathogenicity for chicken.

Cleavage activation of the HA occurs as a post-tranlational modification by an ubiquitous protease such as furin

→ penetration by fusion into host cell
→ extensive replication → systemic infection

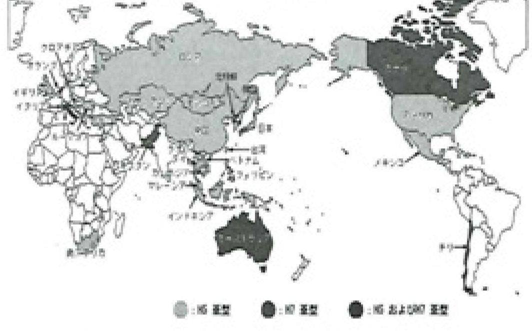


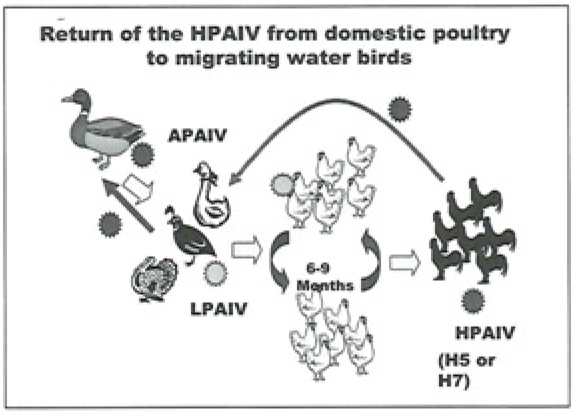
HPAI outbreaks in Japan, 2004

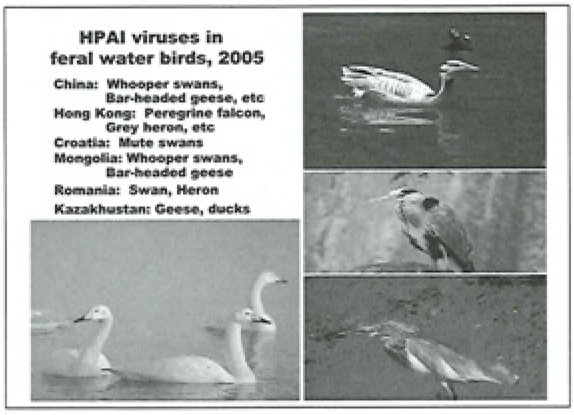


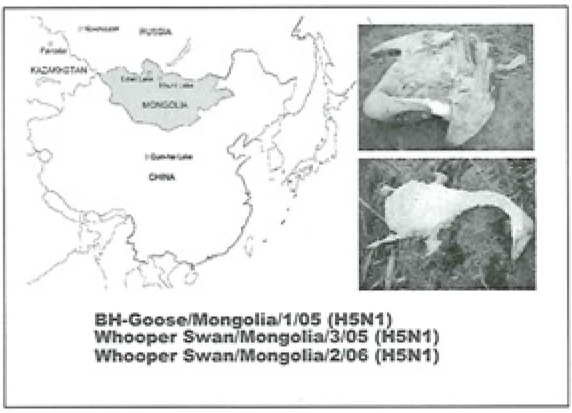
1	Yamaguchi Pref.	1/12/04	34,000 layers	H5N1	HPAI
2	Oita Pref.	2/17/04	13 pet cks	H5N1	HPAI
3	Kyoto Pref.	2/28/04	225,325 layers	H5N1	HPAI
4	Kyoto Pref.	3/ 5/04	15,000 broilers	H5N1	HPAI

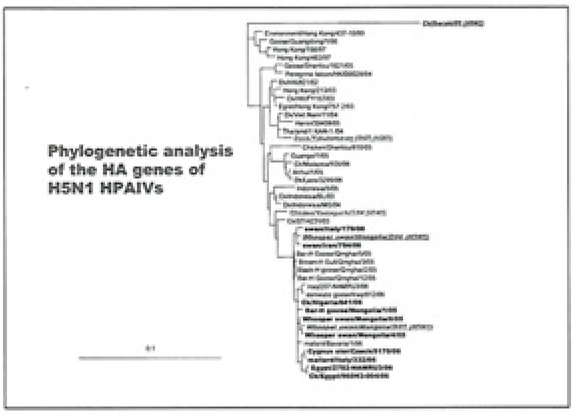
高病原性鳥インフルエンザの発生地(1995～2005年11月)

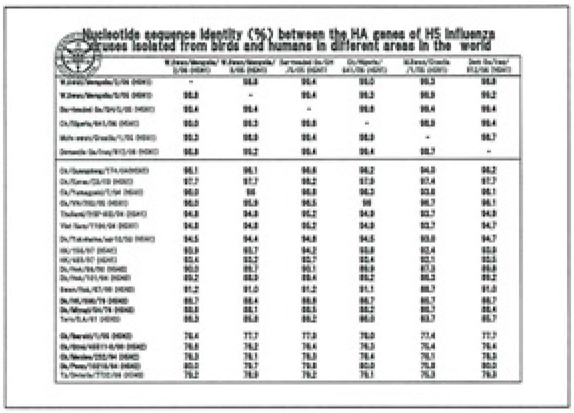


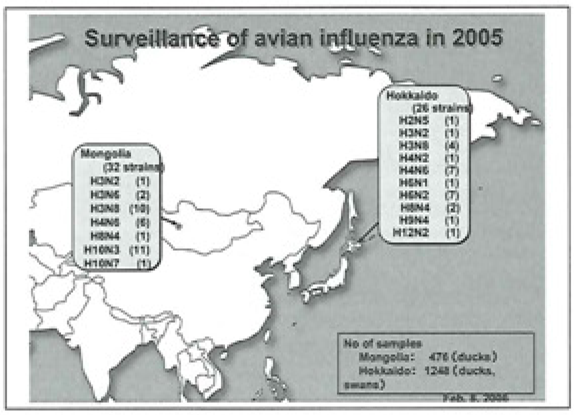

Return of the HPAIV from domestic poultry
to migrating water birds
APAIV
6-9
Months
LPAIV
HPAIV
(H5 or
H7)

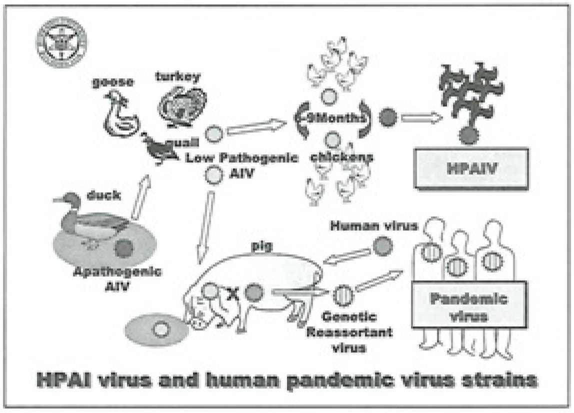

HPAI viruses in
feral water birds, 2005
China: Whooper swans,
Bar-headed geese, etc
Hong Kong: Peregrine falcon,
Grey heron, etc
Croatia: Mute swans
Mongolia: Whooper swans,
Bar-headed geese
Romania: Swan, Heron
Kazakhustan: Geese, ducks

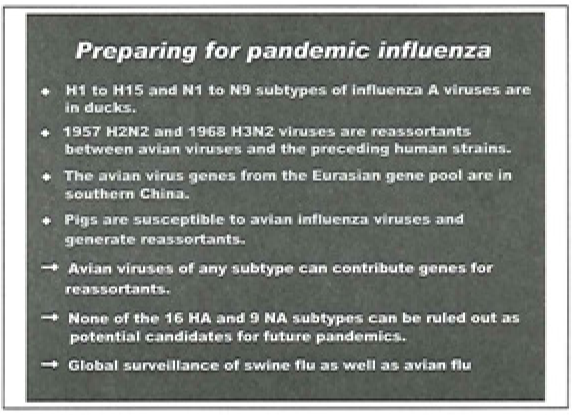

RUSSIA
KAZAKHSTAN
MONGOLIA
CHINA
BH-Goose/Mongolia/1/05 (H5N1)
Whooper Swan/Mongolia/3/05 (H5N1)
Whooper Swan/Mongolia/2/06 (H5N1)


Phylogenetic analysis
of the HA genes of
H5N1 HPAIVs

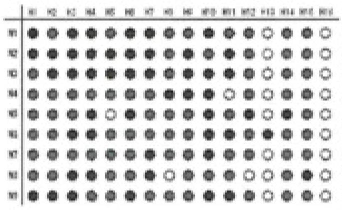

Nucleotide sequence identity (%) between the HA genes of H5 influenza viruses isolated from birds and humans in different areas in the world


Surveillance of avian influenza in 2005
Mongolia
(32 strains)
H3N2 (1)
H3N6 (2)
H3N8 (10)
H4N6 (6)
H8N4 (1)
H10N3 (11)
H10N7 (1)
Hokkaido
(26 strains)
H2N5 (1)
H3N2 (1)
H3N8 (4)
H4N2 (1)
H4N6 (7)
H5N1 (1)
H6N2 (7)
H8N4 (2)
H9N4 (1)
H12N2 (1)
No of samples
Mongolia: 476 (ducks)
Hokkaido: 1248 (ducks, swans)


goose
turkey
quail
6-9Months
Low Pathogenic
AIV
chickens
HPAIV
duck
Apathogenic
AIV
pig
Human virus
Genetic
Reassortant
virus
Pandemic
virus
HPAI virus and human pandemic virus strains


Preparing for pandemic influenza
H1 to H15 and N1 to N9 subtypes of influenza A viruses are in ducks.
1957 H2N2 and 1968 H3N2 viruses are reassortants between avian viruses and the preceding human strains.
The avian virus genes from the Eurasian gene pool are in southern China.
Pigs are susceptible to avian influenza viruses and generate reassortants.
→ Avian viruses of any subtype can contribute genes for reassortants.
→ None of the 16 HA and 9 NA subtypes can be ruled out as potential candidates for future pandemics.
→ Global surveillance of swine flu as well as avian flu

Present status of the library of vaccine strain candidates



Influenza viruses of 49 combinations of the HA and NA subtypes have been isolated from fecal samples of ducks in Alaska, Siberia, Mongolia, Taiwan, China, and Japan (black).

So far, 76 other combinations have been generated by genetic reassortment procedure in the lab (red).

Thus, avian influenza viruses of 123 combinations of HA and NA subtypes have been stocked as vaccine strain candidates. Their pathogenicity, antigenicity, genetic information and yield in chicken embryo have been analyzed, and being databased.

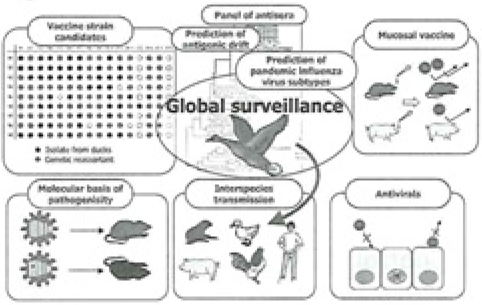
Program of Founding Research Centers for Emerging and Reemerging Infectious Diseases

Research and Education for Zoonosis Control

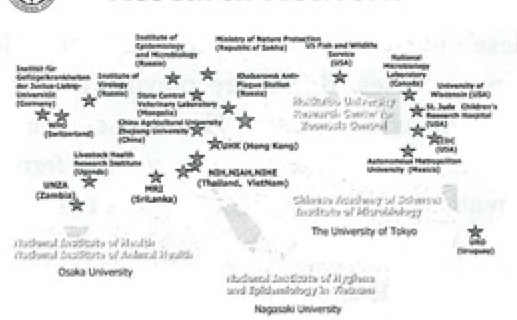
Hokkaido University
Research Center for Zoonosis Control

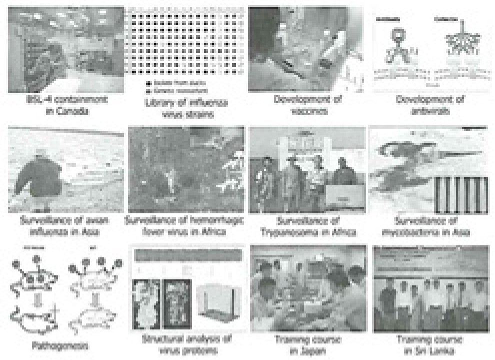
Hiroshi Kida
Principal Investigator

Research and Development Model for Zoonosis Control



Research Network

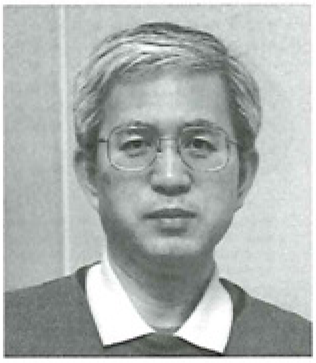




Points of Discussion

1. **Ecology and evolution of influenza viruses: Natural reservoir, perpetuation, host range, interspecies transmission, antigenic and genetic variation of influenza viruses, and mechanism of the emergence of pandemic strains in humans and HPAIV in chickens**
2. **Do the H5N1 HPAIV strains perpetuate in the lakes where migratory birds nest ?**
3. **Is the H5N1 HPAIV alone as a candidate of pandemic strain?**
4. **What is the best measure for the control of avian influenza ?**
5. **Hokkaido University Research Center for Zoonosis Control**

Summary of Plenary Session 3: Emerging Infections and Global Environment



Chaired by **Tsukasa Seya**

Professor
Graduate School of Medicine, Hokkaido University
E-mail: seya-tu@pop.med.hokudai.ac.jp

Speakers:
Robert G. Webster, Professor, Division of Virology, Department of Infectious Diseases, St. Jude Children's Research Hospital, U.S.A.
Hiroshi Kida, Director, Research Center for Zoonosis Control, Hokkaido University

Drs. Kida and Webster mentioned influenza viruses with a variety of H/N combinations. This virus species possesses eight gene segments which are interchangeable in host cells during infection, some of them being virulent to human. The virus has many subtypes consisting of one of fifteen HA and one of nine NA. Some of these subtypes are potential candidates for future pandemic strains. In the case of H5N1 influenza viruses, ducks are playing a crucial role in the continued evolution and spread of this type of avian viruses. The viruses become non-pathogenic during adaptation in ducks but still highly pathogenic in poultry, ferrets, felids and humans. The immediate control of the spread of H5N1 could be achieved through the use of the antiviral neuraminidase inhibitors. Drs. Webster as well as Kida insisted on why vaccines against the viruses should be provided before possible pandemic influenza infection takes place. Dr. Kida introduced "Research Center for Zoonosis Control" founded in Hokkaido University on 2005. The goal of this center is to prevent emerging zoonoses, design vaccines for various influenza viruses and train specialists for control of zoonoses. The center provides the 10 arrays of the program for education of students and researchers. For more information, see the homepage of this center:
http://www.hokudai.ac.jp/gakubu/zoonosiscontrol/index.html.

Hokkaido University International Symposium on Sustainable Development
Plenary Session 4: Monday August 7, 2006 / 4:20pm-4:50pm
Speaker

Understanding and Approach to "Sustainability" Science of Fisheries

Teisuke Miura

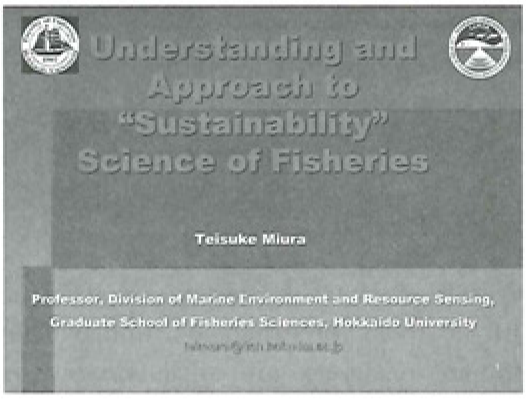
Professor
Division of Marine Environment and Resource Sensing
Graduate School of Fisheries Sciences
Hokkaido University
E-mail: teimiura@fish.hokudai.ac.jp

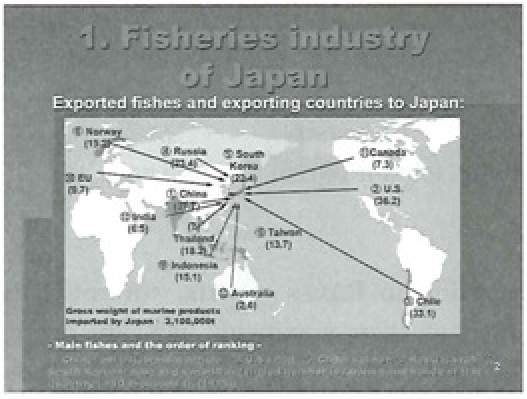
According to FAO's reports, currently, approximately 44% of key fish species are being exploited at their maximum, 16% are overexploited with no room for expansion, and 6% have been depleted. These figures show that world's aquatic resources are unsustainably, not sustainably, used. Japan imports approximately 40% of fishery products consumed in the country. Now, demand for marine products in Japan cannot be met without imports. The international community has started to see that Japan, a major importer of marine products, for example prawns and shrimps, has been indirectly facilitating the destruction of the environment in developing countries.

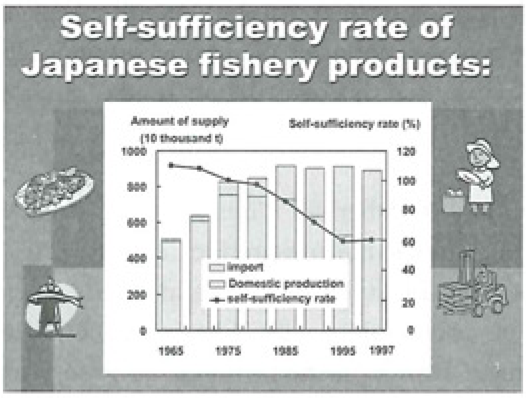
In these circumstances, how should we consider sustainable fisheries? Considerations that we need to make in considering global sustainability of Japan's marine-product supply are: ① the establishment of global supply system; ②the securing of stable supply and safety of imported fishery products; and ③the establishment of partnership with importing countries. This paper, based on "Fisheries Research and Technical Development Strategy," a report that proposes new basic policies for fisheries of the 21st century, introduces the current status and problems of Japan's fisheries industry.

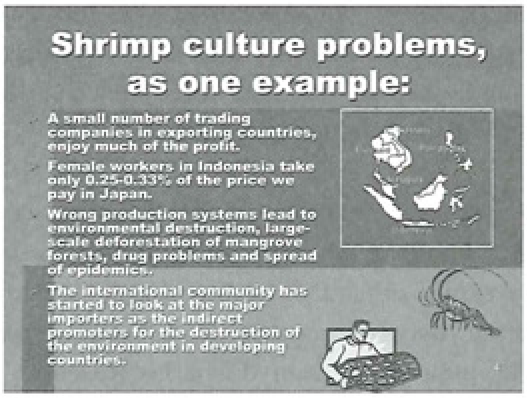
However, there is currently no clear definition of "sustainability of the fisheries industry." In this paper, I attempt to establish it logically. There are various ways to interpret the word "sustainability." Japan for Sustainability (JFS), for example, considers sustainability as from five basic compositions: ①Resource and Capacity, ②Fairness across Time, ③Fairness across Space, ④Diversity, and ⑤Human Will and Networking.

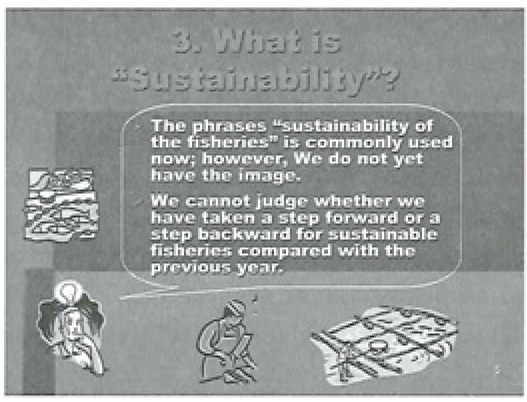
Based on this JFS's concept, the author fist discuses sustainability of the fisheries industry and then examines the "sustainability" science of fisheries-theme of this lecture-more specifically, ①new logic of the "sustainability" science of fisheries, ②educational philosophy of the "sustainability" science of fisheries, and ③problems of the "sustainability" science of fisheries. Also, a framework for practice is proposed using concepts of "backcasting" and "benchmarking."

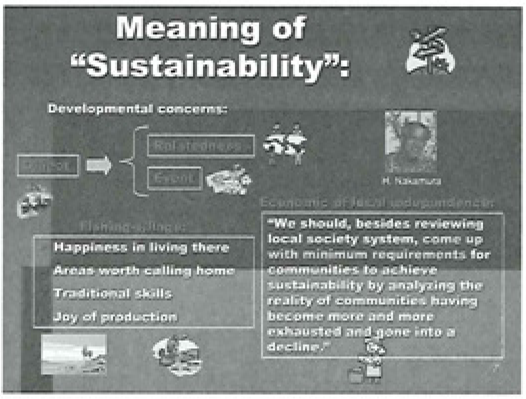










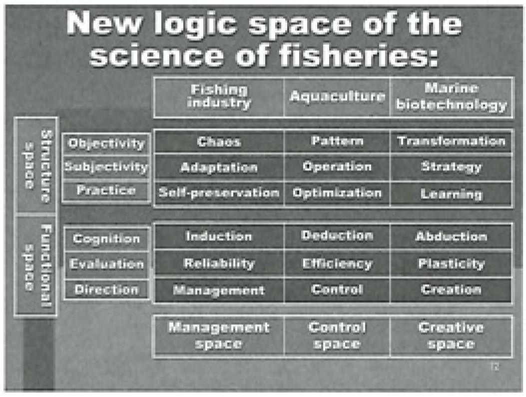

Meaning of "Sustainability":
Developmental concerns:
Relatedness
Event
H. Nakamura
Happiness in living there
Areas worth calling home
Traditional skills
Joy of production
"We should, besides reviewing local society system, come up with minimum requirements for communities to achieve sustainability by analyzing the reality of communities having become more and more exhausted and gone into a decline."
7

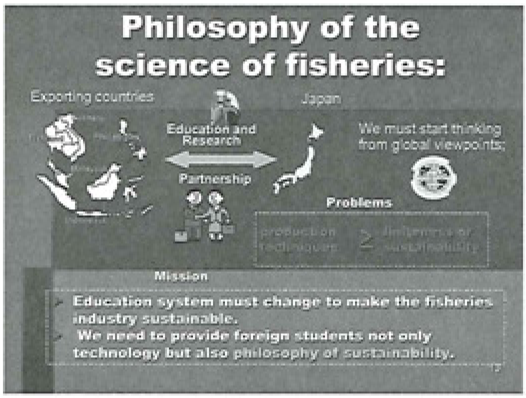

Seven items in relation to "Multifunctionality":
Conservation of the natural environment and ecosystems;
Securing the safety of the people;
Preservation and creation of sound landscapes;
Provision of places for leisure activities to the people;
Passing-on of traditional cultures;
Maintenance of local economy and society; and
Food security.


Five basic compositions of JFS's "Sustainability":
To live socially and economically satisfactory lives within limited global natural resources and carrying capacity, and consider a mind of appreciation and "MOTTAINAI (Waste Not, Want Not)";
To receive the inheritance of previous generation and pass it on to future generation correctly;
To distribute wealth, goods and resources between nations and regions in an equitable way, and there is no exploitation from one to another;
To respect the diversity of individuals, species, culture, which is also of other organisms; and
Individual's will to build a better society, networking through communication with others, flexible and open mutual dialogues and social participation.
9


The context of JFS's "Sustainability":
Natural, global and local environments including the concepts of resource capacity and biodiversity. A fundamental concept of sustainability;
Something which enriches human life and makes the life easier by providing goods and services. An economic activity in general;
Social activity, government, school, community, etc. An aggregation of human life; and
Individual's self-actualization, pursuit of happiness, social participation, and improvement of quality-of-life.
10

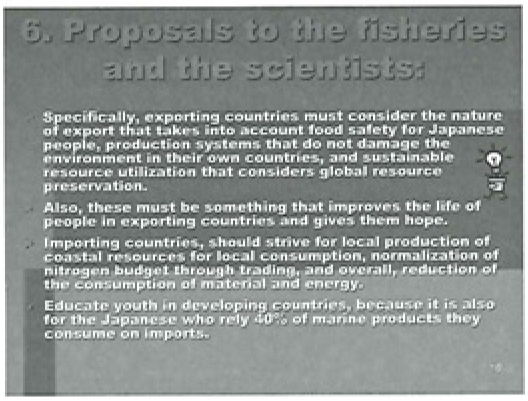

4. Education and research of sustainable fisheries:
To adopt global principles
To adopt universal logic
To understand other academic field more deeply
11

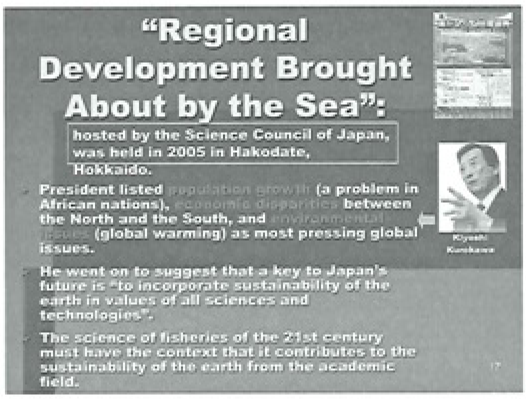

New logic space of the science of fisheries:
Fishing industry
Aquaculture
Marine biotechnology
Structure space
Objectivity
Subjectivity
Practice
Chaos
Pattern
Transformation
Adaptation
Operation
Strategy
Self-preservation
Optimization
Learning
Functional space
Cognition
Evaluation
Direction
Induction
Deduction
Abduction
Reliability
Efficiency
Plasticity
Management
Control
Creation
Management space
Control space
Creative space
12

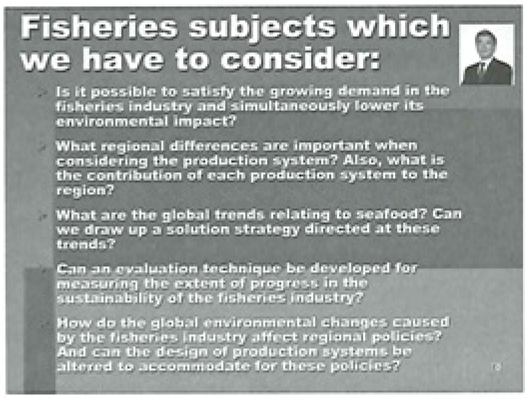

Philosophy of the science of fisheries:
Exporting countries
Japan
Education and Research
Partnership
We must start thinking from global viewpoints;
Problems
Mission
Education system must change to make the fisheries industry sustainable.
We need to provide foreign students not only technology but also philosophy of sustainability.
13

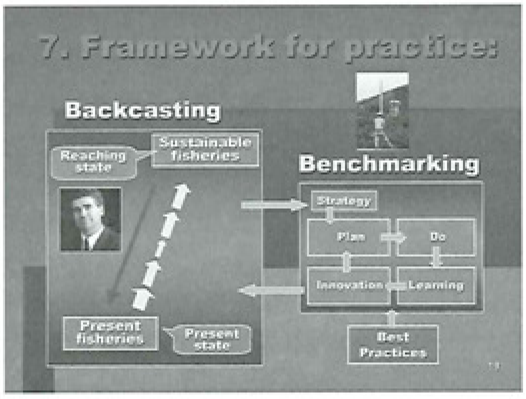

5. Changes in sosioeconomy and Japanese soul:
Postwar history:
Japan had made miraculous advancement during the 20 years between around 1955 and the mid-1970s in pursuit of joining world's economic giants.
The world, instead of praising the Japanese who achieved the rapid economic growth, despised them, calling them "economic animals."
Carried away by the bubble economy which started in the late 1980s, Japanese people lost their innate incorruptible spirits and developed inconstancy and arrogance.
Then, the bubble's implosion took away their emotional pillars and goals.
14

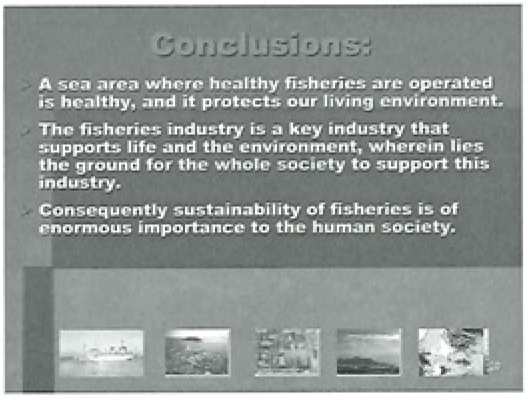

Japanese Spirituality:
Inazo Nitobe served as Undersecretary General of the League of Nations and is the author of "The Soul of Japan."
Gojo-no-toku
(Humaneness)
(Rightness)
(Ritual decorum)
(Wisdom)
(Trustworthiness)
In (samurai code), Gi (Rightness) was considered most important.
This is because Gi, right ways of living as a human, is more difficult than others to attain.
This is an all-time sense of values.
We, as those living in modern age, should ask ourselves anew the meaning of it.
I thinks that basis of all future educational, research and socioeconomic activities should have (Rightness) in them.
With the emotional pillar, I will approach to specific individual problems.
15


6. Proposals to the fisheries and the scientists:
Specifically, exporting countries must consider the nature of export that takes into account food safety for Japanese people, production systems that do not damage the environment in their own countries, and sustainable resource utilization that considers global resource preservation.
Also, these must be something that improves the life of people in exporting countries and gives them hope.
Importing countries, should strive for local production of coastal resources for local consumption, normalization of nitrogen budget through trading, and overall, reduction of the consumption of material and energy.
Educate youth in developing countries, because it is also for the Japanese who rely 40% of marine products they consume on imports.


"Regional Development Brought About by the Sea":
hosted by the Science Council of Japan, was held in 2005 in Hakodate, Hokkaido.
President listed population growth (a problem in African nations), economic disparities between the North and the South, and environmental issues (global warming) as most pressing global issues.
He went on to suggest that a key to Japan's future is "to incorporate sustainability of the earth in values of all sciences and technologies".
The science of fisheries of the 21st century must have the context that it contributes to the sustainability of the earth from the academic field.
17


Fisheries subjects which we have to consider:
Is it possible to satisfy the growing demand in the fisheries industry and simultaneously lower its environmental impact?
What regional differences are important when considering the production system? Also, what is the contribution of each production system to the region?
What are the global trends relating to seafood? Can we draw up a solution strategy directed at these trends?
Can an evaluation technique be developed for measuring the extent of progress in the sustainability of the fisheries industry?
How do the global environmental changes caused by the fisheries industry affect regional policies? And can the design of production systems be altered to accommodate for these policies?


7. Framework for practice:
Backcasting
Reaching state
Sustainable fisheries
Present fisheries
Present state
Benchmarking
Strategy
Plan
Do
Innovation
Learning
Best Practices


Conclusions:
A sea area where healthy fisheries are operated is healthy, and it protects our living environment.
The fisheries industry is a key industry that supports life and the environment, wherein lies the ground for the whole society to support this industry.
Consequently sustainability of fisheries is of enormous importance to the human society.
20

Hokkaido University International Symposium on Sustainable Development
Plenary Session 4: Monday August 7, 2006 / 4:50pm-5:30pm
Speaker

Strategy towards Achievement of Sustainable Agriculture for Food, Energy and the Environment in the Age of the Globalization

Nasir El Bassam

Director
International Research Centre for Renewable Energy (IFEED), Germany
President
International Council of Sustainable Agriculture (ICSA)
E-mail: ifeed@t-online.de

Agriculture is the foundation of all cultures, economic advancement and human dignity. Also, Agenda 21 of the Rio de Janeiro Conference in 1992 put significant emphasis on agriculture as a key for intra-and intergenerational equity.

Today we face immense pressure in the global environment resulting from industrial emissions of greenhouse gases, the continual growth of the world population and the depletion of natural resources. The recognition of the necessity for actions and the intention and the will are vital evolutionary steps towards sustainability.

Food security is often undermined by factors such as water availability, land distribution, poverty, and environmental degradation. Among the major food security threats on the horizon are climate change, the loss of diversity of plant and animal species and the rise of food borne illnesses.

The key concept is to promote the conservation and the sustainable use of natural resources, which allows long term economic growth and enhancement of productive capacity, along with being equitable and environmentally acceptable.

In order to meet challenges, the future energy policies should put more emphasis on developing the potential of energy sources, which should form the foundation of future global energy structure. In this context, the FAO in support of the

Sustainable Rural Environment and Energy Network (SREN) has developed the concept of the Integrated Energy Farms for the optimization, evaluation, and implementation of sustainable food, water and energy production systems in rural communities.

(IR3S), Sappro,Hokkaido Universty, Japan, 7-9 August 2006

Strategy towards Achievement of Sustainable Agriculture for Food, Energy and the Environment in the Age of the Globalization

N. El Bassam
International Research Centre for Renewable Energy
International Council of Sustainable Agriculture (ICSA)
Zum Krähenfeld 3, D-31275 Sievershausen, Germany
Tel.: +49 5175 980580, Mobile +49 170 3254301, Fax :+49 5175 302766 E-Mail :ifeed@t-online.de *www.ifeed.org*

Introduction

Sustainable development has been defined by the World Commission on Environment and Development in, "Our Common Future" (Brundtland, 1987) as a strategy that meets the needs of the present without compromising the ability of future generations to achieve their own requirements.

The key concept is to promote the conservation and the sustainable use of natural resources, which allows long term economic growth and enhancement of productive capacity, along with being equitable and environmentally acceptable.

Sustainable Development Systems
(Gold, M.V. 1999)

Such systems must be:

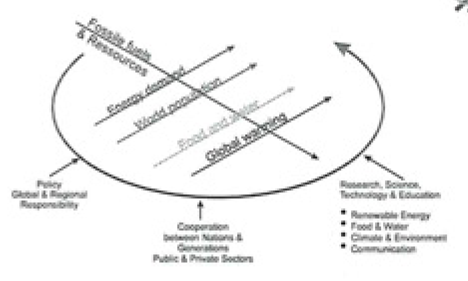
"resource-conserving,

socially supportive,

commercially competitive,

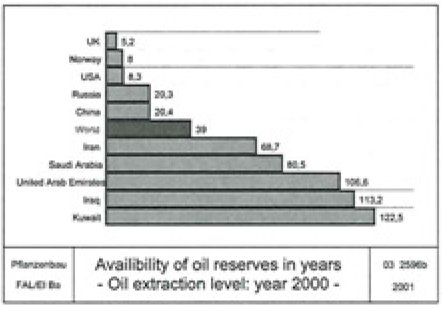
and environmentally sound"

Basic Reasons for unsustainable Development

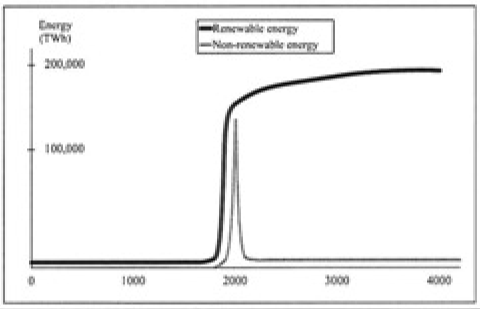


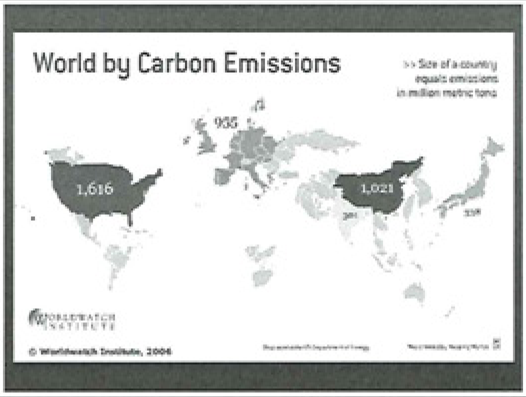
Energy, Environment and Development

1. Primary energy sources are limited and mainly non-renewable and not sustainable
2. Excessive use of fossil fuels causes serious damage to the environment and climate
3. The world, mainly the Developing Countries, is facing a period of uncertainty and changes – depopulation of rural regions and decreasing farmer´s income



Past, present and future energy sources





Environmental Performance Index (EPI)
Overall EPI scores(0-100)

Categories: Health, Biodiversity, Energy, Water, Air, Nat. Res.

Rank	Country	Score
1	New Zealand	88.0
2	Sweden	87.8
5	UK	85.6
9	Malaysia	83.3
14	Japan	81.9
20	Australia	80.1
22	Germany	79.4
28	USA	78.3
94	China	56.2
118	India	47.7
133	Niger	25.7

World Economic Forum 2006

India 2002

Germany 2002

Wildfire, Arizona, USA 2002

Residents depart as the late afternoon sun illuminates the smoke from the approaching Rodeo wildfire Saturday, June 22, 2002, in Show Low, Ariz. Rodeo and the Chedeski wildfires have forced several communities in the area to evacuate.
(AP Photo/Ric Francis)

Agriculture is the foundation of all cultures, economic advancement and human dignity. Also, Agenda 21 of the Rio de Janeiro Conference in 1992 put significant emphasis on agriculture as a key for intra-and intergenerational equity

Availability of Basic Needs - Global Context-

- More than 2 billion people have no access to modern energy resources
- More than 800 million suffer from hunger and malnutrition in Africa, Asia, Latin America and even in Europe and USA
- One and half billion people suffer from a shortage or inadequate supply of water
- Current polices could lead the increasing conflicts over scares resources (energy, water and food)

Poverty is rural

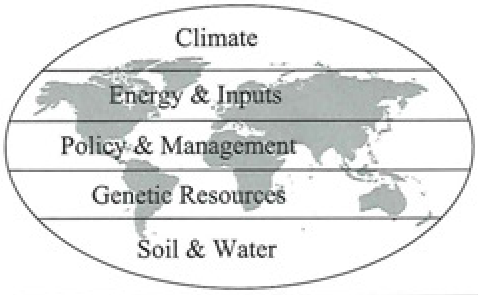
- 2.8 billions of employees earn less than 2 US$ per day
- 1,4 billions of the employees earn less than 1 US$ per day
- Only 300 persons possess more than 3 billions of the world population
- Most of poor peoples are living in rural regions

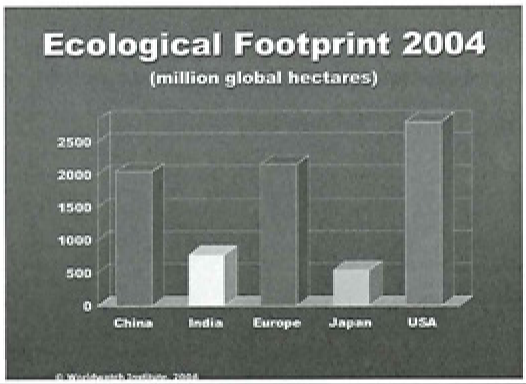
(Davos 2006)

World `s poorest people suffer the most because:

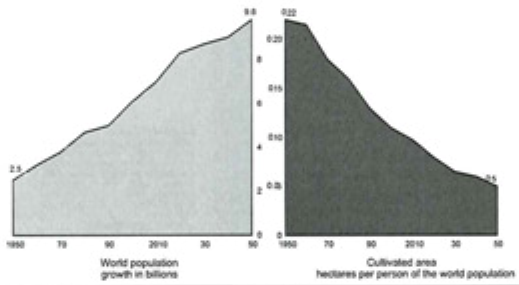
- Their narrow margin of survival
- Lack of access to technologies
- Vulnerability to natural hazards and
- Fragility of the ecosystems in which they are concentrated

Fundamentals of sustainability in agriculture

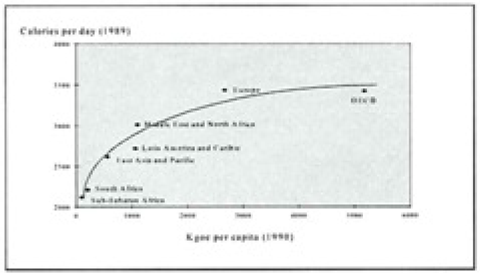




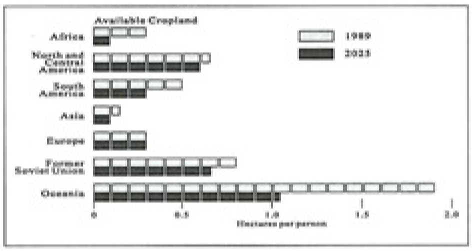
World population growth and respective per capita cultivated area from 1950-2050 (source: Future, 1998).



Correlation between energy input and availability of food as calorie supply (FAO, 1995)



Cropland per person in the year 1989 and estimated for 2025 (World Resource Institute, 1990)

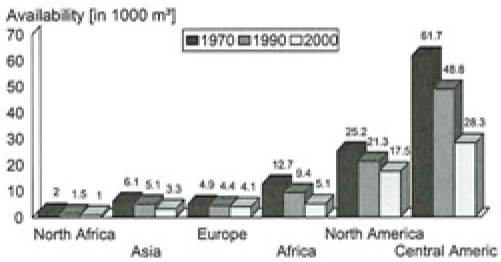


Global Water Availability

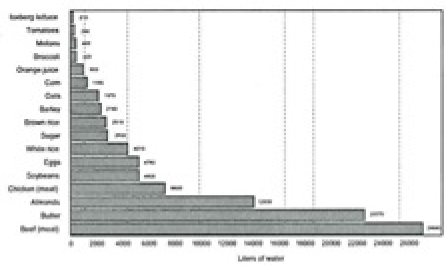
1) Approximately 3% of the world water resources are freshwater. Only 0,69% is available for human needs

2.Huge differences exist in water requirements for the different food production chains (water use efficiency)

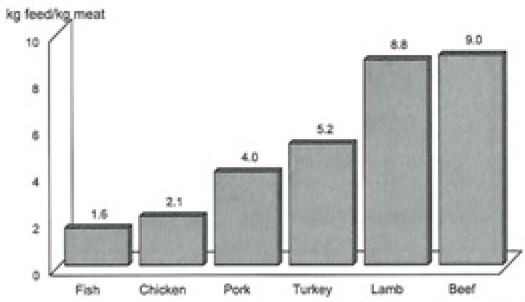
Water availability p.p. in selected areas in the years 1970, 1990 and estimated for 2000 (source: FAO).



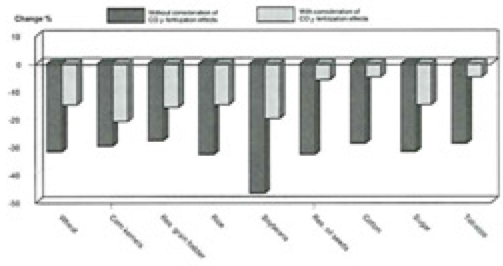
The amount of water in liters necessary to produce one kilogram of food (Water Education Foundation)



Feed requirements for meat production (source: Future, 1998).



Global yield changes of plant products with and without consideration of CO2 - fertilizer effects

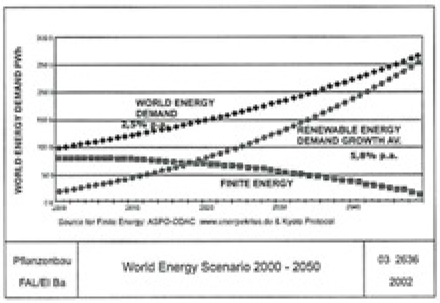


Global Biomass for Food, Energy and Energy & Perspectives

- *Annual primary biomass production: 220 billions DM, 4,500 EJ = 10 times of world primary energy consumption.*

  Biomass used for food: 800 millions DM = 0.4% of primary biomass production.
- *Annual food production corresponds to 140% of the needs of world population.*
- *Biomass currently supplies 14% of the worldwide energy consumption. The level varies from 90% in countries such Nepal, 45% in India, 28% in China and Brazil with conversion efficiency of less than 10%. The potential of improving this effiency through novel technologies is very high.*
- *Large areas of surplus of agricultural in USA, EU, East Europe and former soviet countries and could become significant biomas producing areas (> 200 millions ha).*

- *Microalgae have the potential to achieve a greater level of photosynthetic effiency than most other forms of plant life. If laboratory production can be effectively scaled up to commercial quantities levels of up to 200 mt/ha/yr may be obtained.*
- *The efficiency of photosythetic is less than 1%. An increase in this efficiency (through genetic engineering) would have spectacular effects in biomass productivity: successful transformation of C_4-mechanism (from maize) to C_3-crops (rice). New achievement in accelarating cell division opens opportunities to speed up the growing seasons, resulting in several harvests per year and an overall increase in biomass.*
- *Developments in car technologies is leading to significant reduction in fuel consumption, i.e. less areas will be needed for more cars.*



The Solution:

System Integration

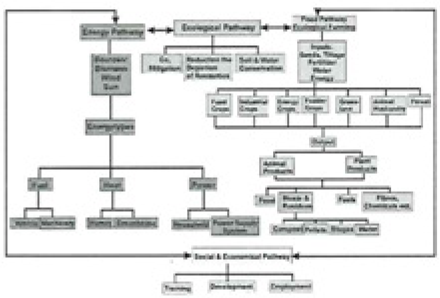
United Nations FAO-SREN Strategy towards Achievment of Susainable Development

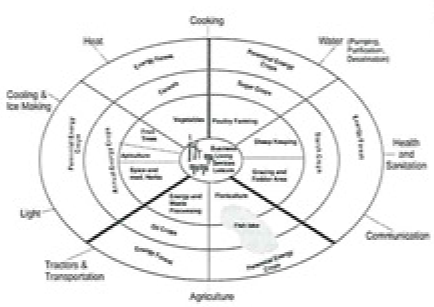
The Concept of the Integrated Energy Communities (IEC)

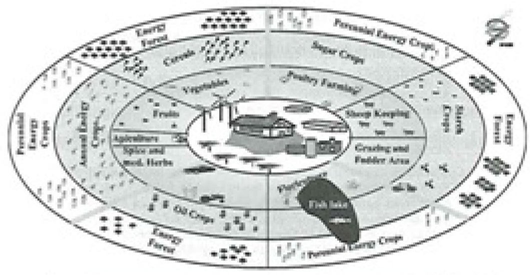
The Concept of Integrated Energy Farms and Communities (IEF)

- Farming system with optimal energetic, water and food autonomy with export possibilities
- Combination of different possibilities of non-polluting renewable energy sources i.e. biomass, wind, micro-hydro and solar for electricity and heat generation.
- The IEF concept is especially qualified for decentralised living areas and islands
- Integrated Energy Farms comprise of compartments for growing food crops, vegetable, fruit trees, annual and perennial energy crops and short rotation forests, along with wind and solar energy units
- The concept should comprise various models for different climatic zones and regions

Pathways of the Integrated Energy Communities for Sustainable Development







Basic Elements of the Integrated Energy Community (IEC) for Sustainable Development

Climate Region	Energy source	Power production (% of total need)	Heat production (% of total need)	Biomass need (t/ha)*	Biomass area (% of total area)
North and Central Europe	Solar	7	15		
	Wind	100	-		
	Biomass	100	105	60	12
South Europe	Solar	12.7	40		
	Wind	100	-		
	Biomass	70	45	36	4.8
North Africa Sahara	Solar	21	90		
	Wind	75	-		
	Biomass	25	25	14	1.2
Equatorial region	Solar	18.5	25.5		
	Wind	45	-		
	Biomass	70	80	45	10

Possible Share of Renewable Energy Sources in Various Climatic Zones
- Farm Activities -

Pflanzenbau
FAL/El Ba
2001

Biomass for Food, Energy and the Environment

- Aleman Grass (*Echinochloa polystachya*)
- Babassu palm (*Orbignya oleifera*)
- Bamboo (*Bambusa spp.*)
- Banana (*Musa x paradisiaca*)
- Black locust (*Robinia pseudoacacia*)
- Brown beetle gras (*Leptochloa fusca*)
- Cassava (*Manihot esculenta*)
- Castor oil plant (*Ricinus communis*)
- Coconut palm (*Cocos nucifera*)
- Eucalyptus (*Eucalyptus spp.*)
- Jatropha (*Jatropha curcas.*)
- Jute (*Crocorus spp.*)
- Leucaena (*Leucaena leucocephala*)
- Neem tree (*Azadirachta indica*)
- Oil palm (*Elaeis guineensis*)
- Papaya (*Carica papaya.*)
- Rubber tree (*Acacia senegal*)
- Sisal (*Agave sisalana*)
- Sorghum (*Sorghum bicolor*)
- Soybean (*Glycine max*)
- *Sugar cane (Saccharum officinarum)*

Representative Energy Plant Species for different climate regions
- Tropical and Subtropical Climate -

Pflanzenbau
FAL/El Ba
2000

- Argan tree (*Argania spinosa*)
- Broom (Ginestra) (*Spartium junceum*)
- Cardoon (*Cynara cardunculus*)
- Date palm (*Phoenix dactylifera*)
- Eucalyptus (*Eucalyptus spp.*)
- Giant reed (*Arundo donax*)
- Groundnut (*Arachis hypogaea*)
- Jojoba (*Simmondsia chinensis*)
- Olive (*Olea europaea.*)
- Poplar (*Populus spp.*)
- Rape (*Brassica napus*)
- Safflower (*Carthamus tinctorius*)
- Salicornia (*Salicornia bigelovii*)
- Sesbania (*Sesbania spp.*)
- Soybean (*Glycine max*)
- Sweet sorghum (*Sorghum bicolor*)

Representative Energy Plant Species for different climate regions
- Aride and Semiaride Climate -

Pflanzenbau
FAL/El Ba
2000

- Cordgrass (*Spartina spp.*)
- Fibre sorghum (*Sorghum bicolor*)
- Giant knotweed (*Polygonum sachalinensis*)
- Hemp (*Cannabis sativa*)
- Kenaf (*Hibiscus cannabinus*)
- Linseed (*Linum usitatissimum*)
- Miscanthus (*Miscanthus x giganteus*)
- Poplar (*Populus spp.*)
- Rape (*Brassica napus*)
- Reed Canary Grass (*Phalaris arundinacea.*)
- Rosin weed (*Silphium perfoliatum*)
- Safflower (*Carthamus tinctorius*)
- Soy bean (*Glycine max*)
- Sugar beet (*Beta vulgaris*)
- Sunflower (*Helianthus annuus*)
- Switchgrass (*Panicum virgatum*)
- Topinambur (*Helianthus tuberosus*)
- Willow (*Salix spp.*)

Representative Energy Plant Species for different climate regions
- Temperate Climate -

Pflanzenbau
FAL/El Ba
2000

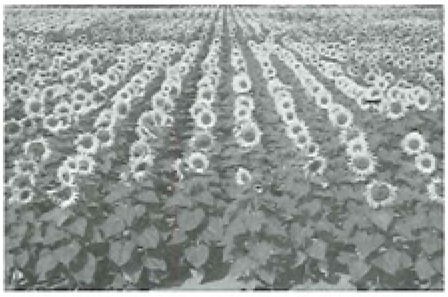
Tall Grasses

Miscanthus giganteus

Willows

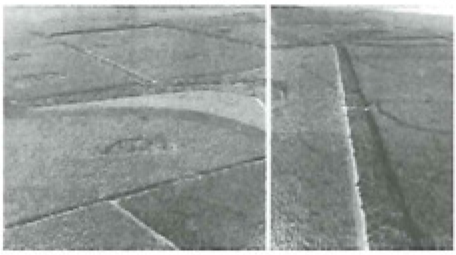
Arundo donax

Fibre and Sweet Sorghum



Bamboo

Biodiversity is an Economical Necessity for Cultivated Forests (South America)



Micro Algae Cultivation

Systems and Technologies for Farms and Communities

Introduction of Renewable Energy to Rural Regions

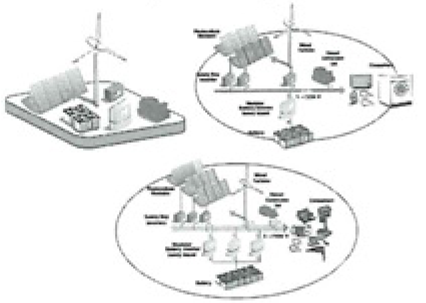
- Key Issues -

- → Appropriat policy (Intention for Development)
- → Availibility
- → Accessbility
- → Acceptability
- → Affordability

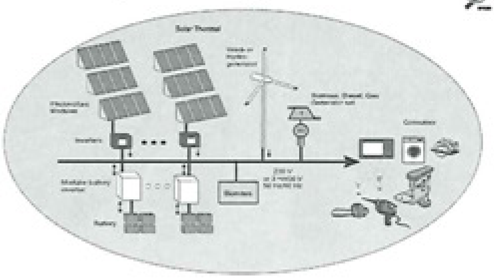
Procedure of Energy Supply

- Needs / Application
- Renewable Energy Resources
  - •Solar
  - •Wind
  - •Biomass
  - •Hydro (Microhydro Geothermal Waves)
- Technologies / Systems / Equipments

Main components of an PV Hybrid System, a single-phase island grid, and three phase island grid

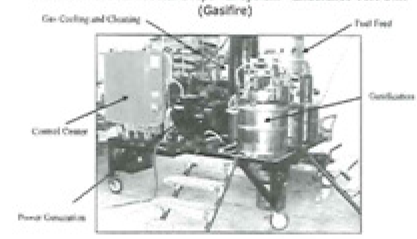


Renewable Energy Technologies - System Integration -



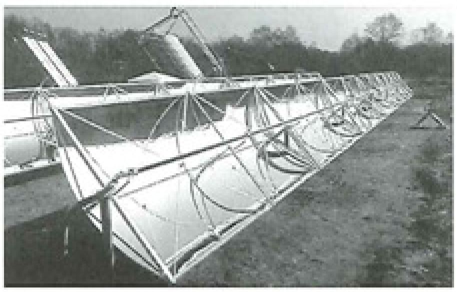
Mobile Power Generator (Solar, Wind, Bio-Diesel)

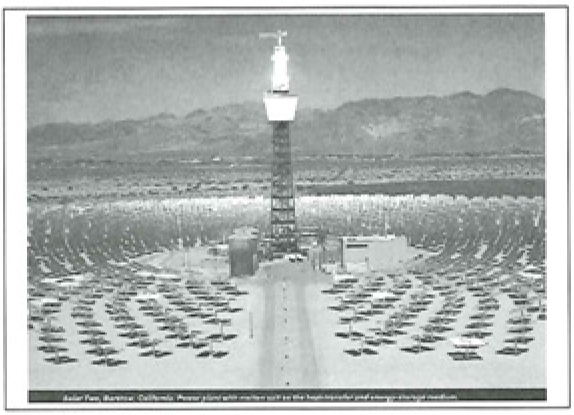
12 1/2 kW Small Modular Biopower System - Endurance Test Unit (Gasifire)

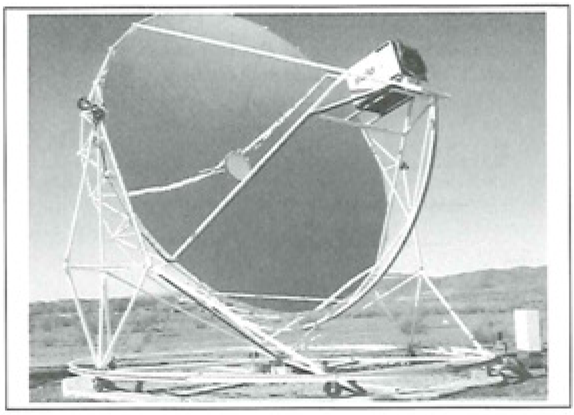


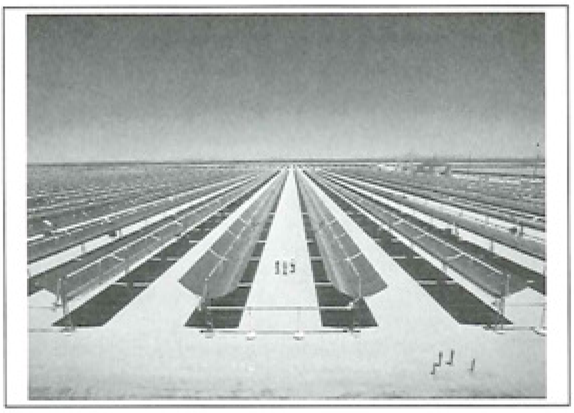
Micro Solar Thermal Power Generator

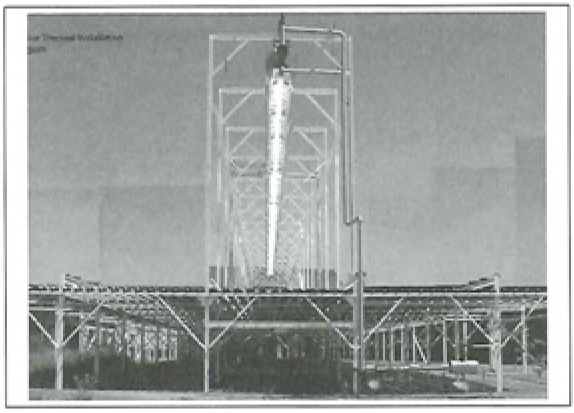
Solar Parabol Power Generator

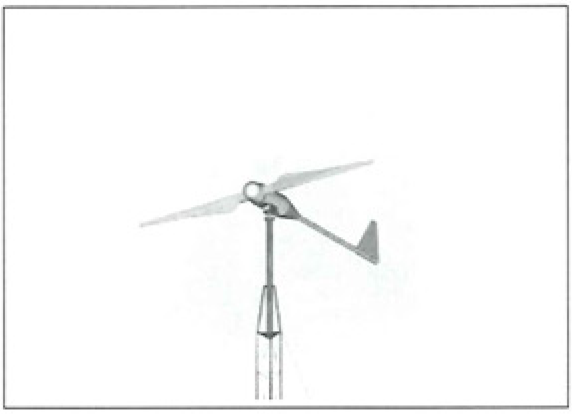




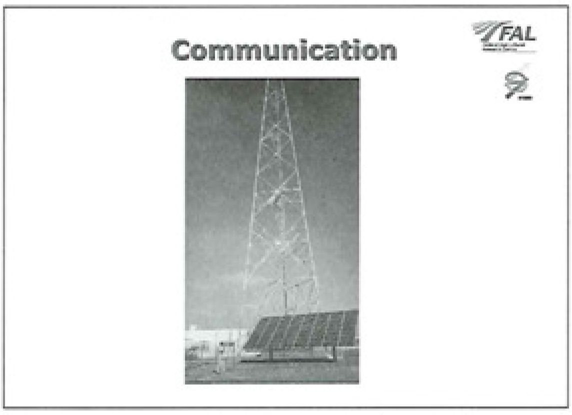


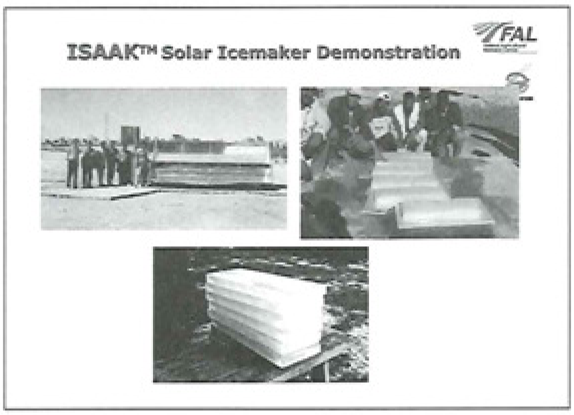


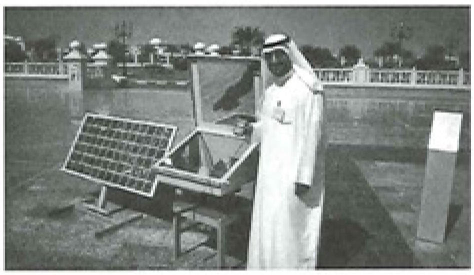





Solar Street Lantern
Solare Straßenbeleuchtung


Communication
FAL


ISAAK™ Solar Icemaker Demonstration
FAL

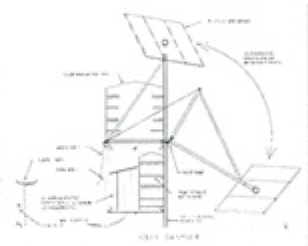


Biomass – Universal – Stove

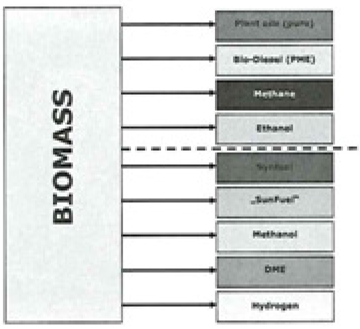
Turbo-Stove BAFOB 5 KW

Multifunctional Stove for Cooking, Baking, Roasting, Barbecue and Heating

The Solarflow System for Water Pumping and Purification



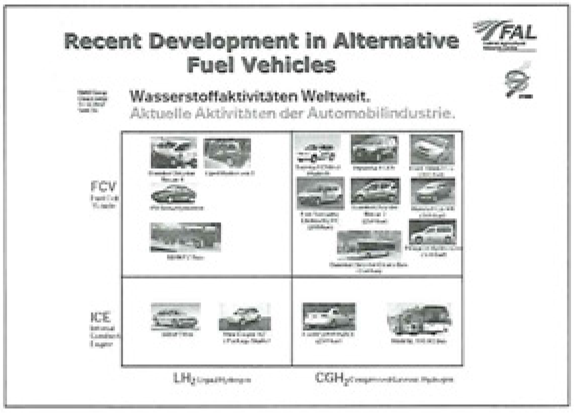
Transport Fuels



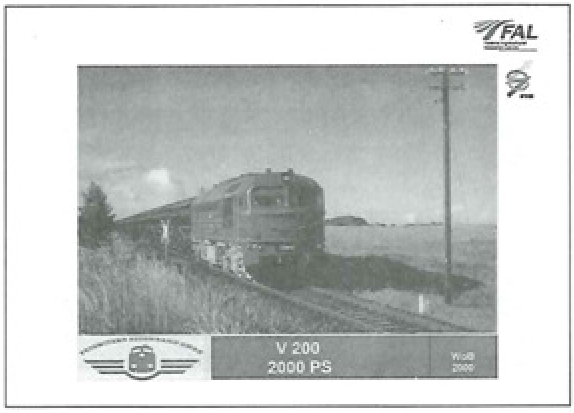
Ölfelder des 21. Jahrhunderts

-Oilfields of the 21st century-

VW Lupo3L



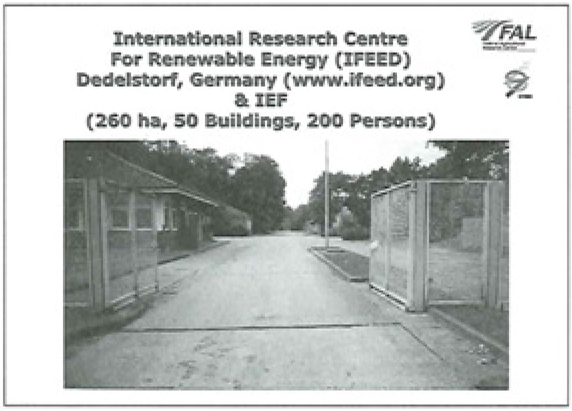
Recent Development in Alternative Fuel Vehicles
FAL
Wasserstoffaktivitäten Weltweit.
Aktuelle Aktivitäten der Automobilindustrie.
FCV
ICE
LH2
CGH2



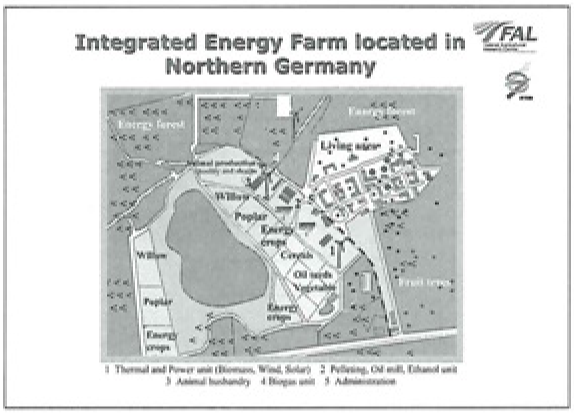
FAL
V 200
2000 PS

FAL
The German Parliament Berlin
Das Reichstagsgebäude in Berlin
Energy Supply: 100% Biomass = 100% Renewable

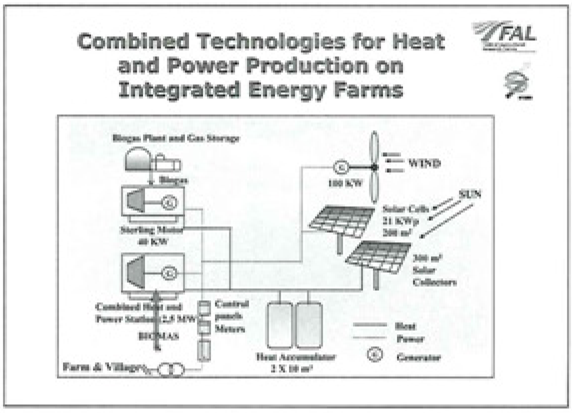
FAL
Implementations



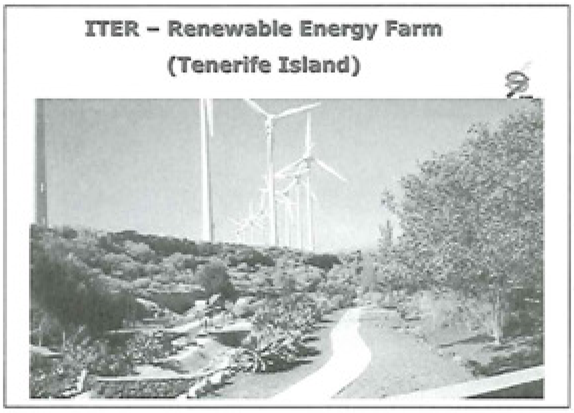
International Research Centre
For Renewable Energy (IFEED)
Dedelstorf, Germany (www.ifeed.org)
& IEF
(260 ha, 50 Buildings, 200 Persons)
FAL



Integrated Energy Farm located in Northern Germany
FAL
Energy forest
Living area
Willow
Poplar
Energy crops
Cereals
Oil seeds
Vegetables
Fruit trees
1 Thermal and Power unit (Biomass, Wind, Solar) 2 Pelleting, Oil mill, Ethanol unit
3 Animal husbandry 4 Biogas unit 5 Administration



Combined Technologies for Heat and Power Production on Integrated Energy Farms
FAL
Biogas Plant and Gas Storage
Biogas
Sterling Motor
40 KW
Combined Heat and Power Station 2,5 MW
BIOMAS
Control panels
Meters
Farm & Village
100 KW
WIND
SUN
Solar Cells
21 KWp
200 m²
300 m²
Solar Collectors
Heat Accumulator
2 X 10 m³
Heat
Power
Generator



ITER – Renewable Energy Farm
(Tenerife Island)

Desert Renewable Energy Farm

Project Adolhpshof, Germany

Conclutions

Dialogue, cooperation and research are the tools to overcome the major challenges of humanity and to ensure the sustainability for current and future generations.

new developments and technologies supporting sustainable systems should be transferred to the end users ensuring linkage between basic research and applications.

We as must bear the responsibility to understand the earth as an integrated whole.

We have to evaluate the impacts of our actions on the global environment in order to ensure sustainability and to avoid future disruption to natural life cycles.

We are one earth, one humanity and one future. We have to change our way of thinking from:

"I, HERE and NOW" to:

"WE, EVERYWHERE for TODAY and TOMORROW".

Finally, it is our responsibility to foster public education and outreach programs to promote awareness of ecological, biological and organic production systems at all levels of society.

We should act now while we still have the choices

Global Economic Powers (Davos 2006)

1. USA
2. Japan
3. Germany
4. China
5. France

Publications:

- *Energy Plant Spieces- Their Applications and Impact on Environment and Development. James&James Science Publishers, 1998*
- *Integrated Renewable Energy for Rural Communities- Plannining Guidlines, Technologies and Implementation. Elsevier Publishers, 2004*

"When things are investigated, the knowledge is extended.

When knowledge is extended, the will becomes sincere .

When the will is sincere, the mind is correct.

When the mind is correct, the self is cultivated."

Confucius

Thanks to the Hokkaido Universty!

Thank you for your attention !

www.ifeed.org

E-mail: ifeed@t-online.de

Speaker

The Sustainability of Bio-production Systems

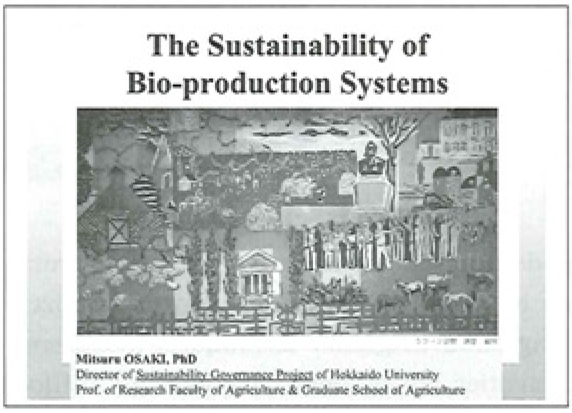
Mitsuru Osaki

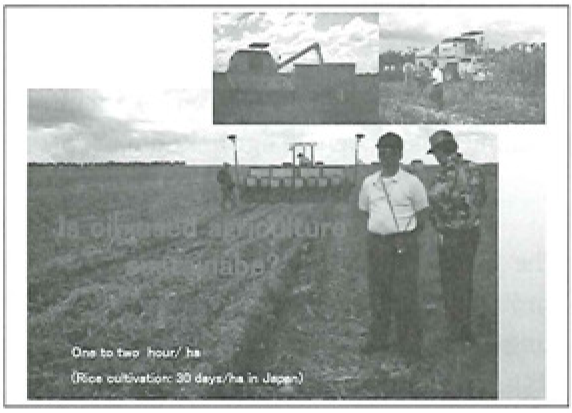
Director, Sustainability Governance Project, Hokkaido University
Professor, Research Faculty of Agriculture, Hokkaido University
E-mail: mosaki@chem.agr.hokudai.ac.jp

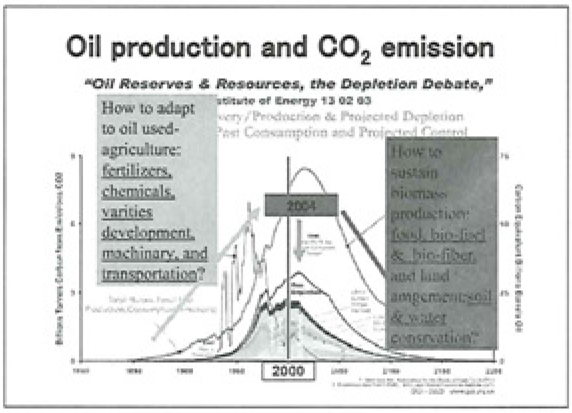
The present high productivity levels enjoyed by modern agronomy have largely been attained through intensive land management practices such as the vigorous application of fertilizers, fungicides, pesticides and herbicides, improved tillage and irrigation techniques, mono cropping, mechanization, and so on. However, these activities are becoming increasingly difficult to sustain due to 1) soil degradation and environmental pollution, 2) reduced oil production, and 3) climate changes. In this paper, I would like to discuss how to guarantee the sustainable development of human societies by proposing new biomass production fields, for which highly detailed models must be constructed via a systems simulation approach, and by developing sustainable cultivation methods as follows.

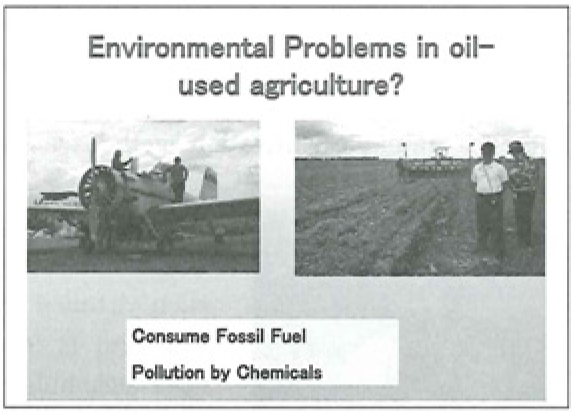
(a) Development of integrated and detailed models for sustainable biomass production: There are three compelling reasons why such detailed models are necessary for achieving sustainability. The first is to integrate the fragmented pieces of knowledge we have accumulated so far. The second is the process of establishing goals - namely, how the systems models may contribute heuristically. The third is using model simulations to evaluate levels of sustainability. Highly detailed models of food and biomass production systems must involve every activity related to the production and utilization of biomass, namely rhizosphere and phytosphere control, pest and disease management, ways of utilizing unavailable and/or wasted biomass, pollution monitoring, economic issues, and so on.

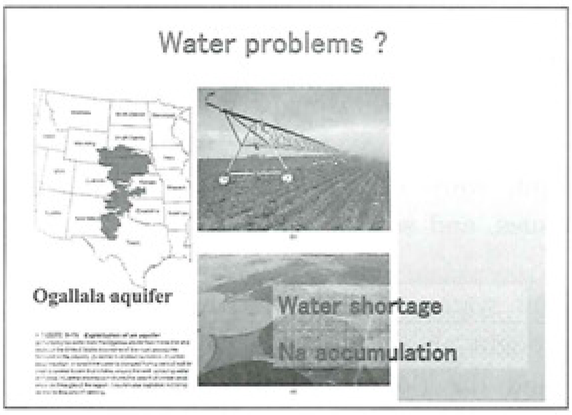
(b) Development of monitoring and risk management systems for food production fields: We are currently facing several important problems brought about by highly developed technology. Severe problems with residual chemicals and the flow of pesticides and chemical fertilizers exist in both agricultural and natural systems. For these reasons, we need to develop new monitoring systems and provide the governance to regulate them.

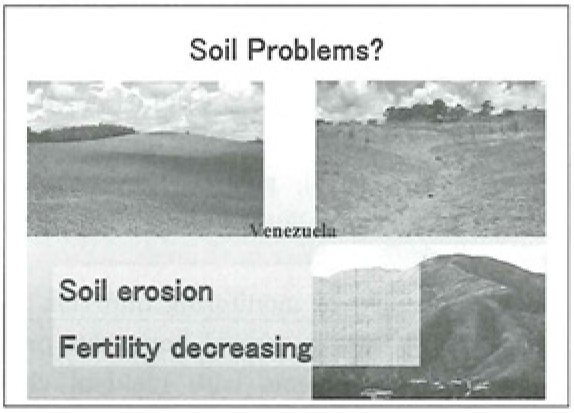


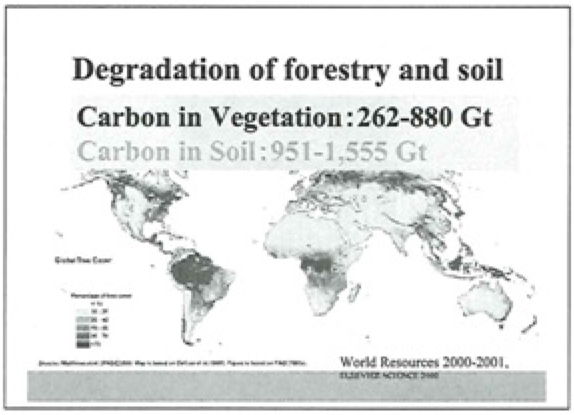


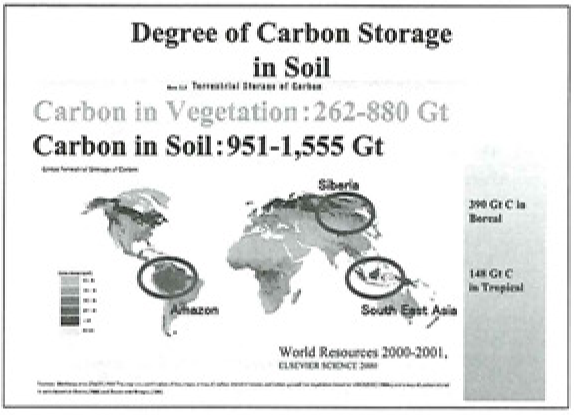


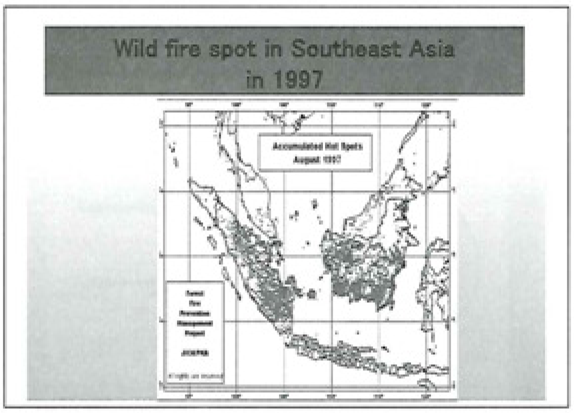


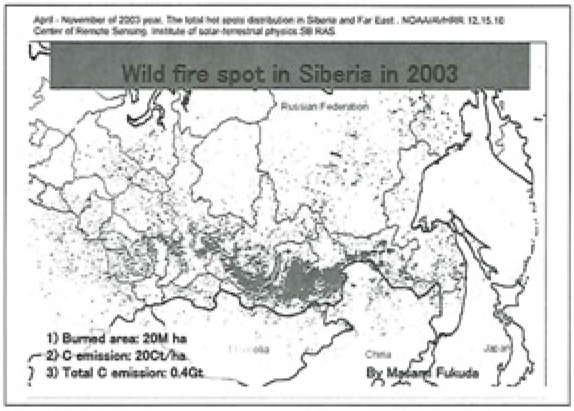


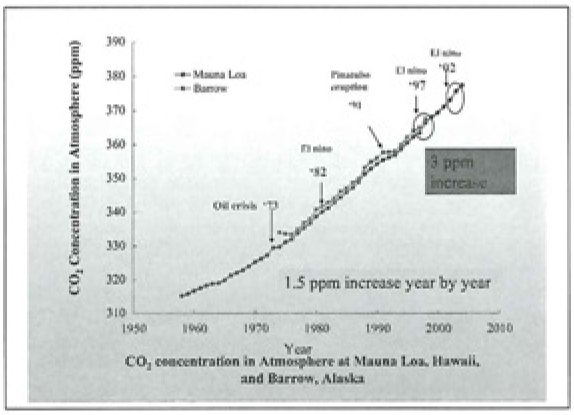


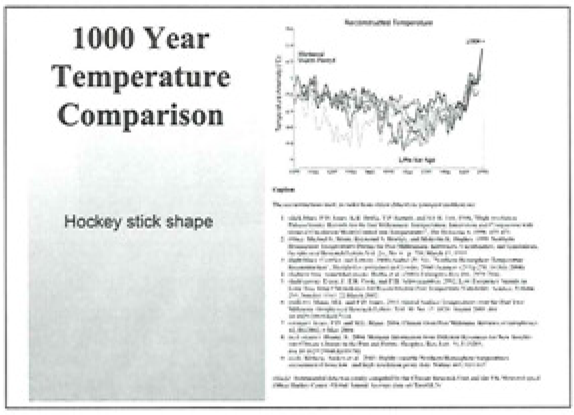

Degradation of forestry and soil
Carbon in Vegetation:262-880 Gt
Carbon in Soil:951-1,555 Gt
World Resources 2000-2001,

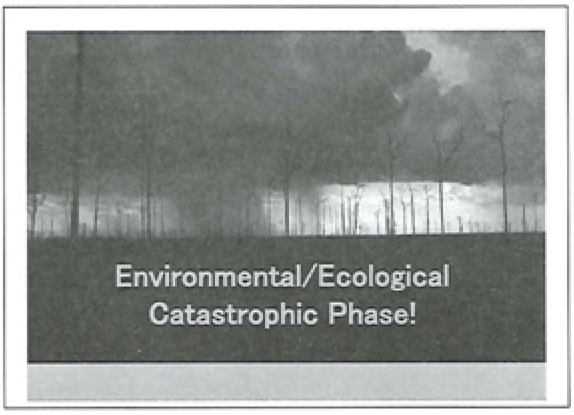

Degree of Carbon Storage in Soil
Carbon in Vegetation:262-880 Gt
Carbon in Soil:951-1,555 Gt
Siberia
Amazon
South East Asia
World Resources 2000-2001,

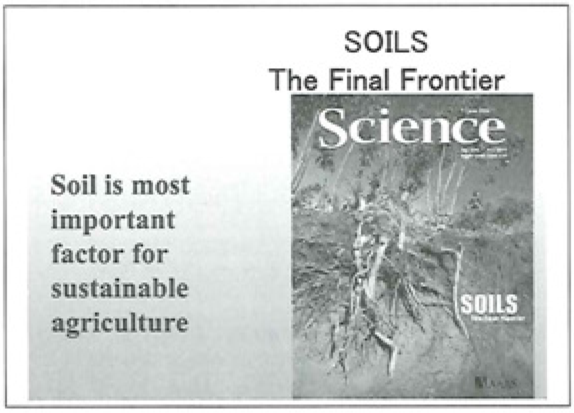

Wild fire spot in Southeast Asia in 1997
Accumulated Hot Spots
August 1997

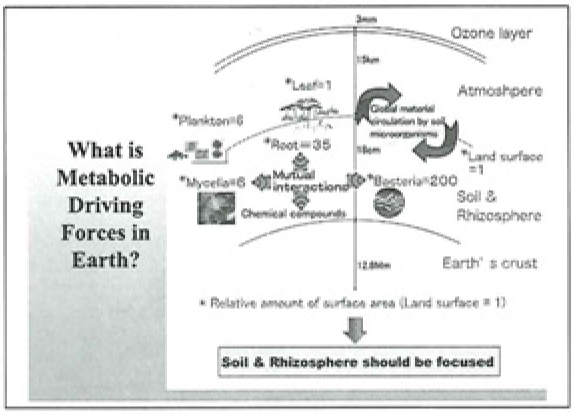

Wild fire spot in Siberia in 2003
Russian Federation
1) Burned area: 20M ha
2) C emission: 20Ct/ha
3) Total C emission: 0.4Gt
China
By Masami Fukuda

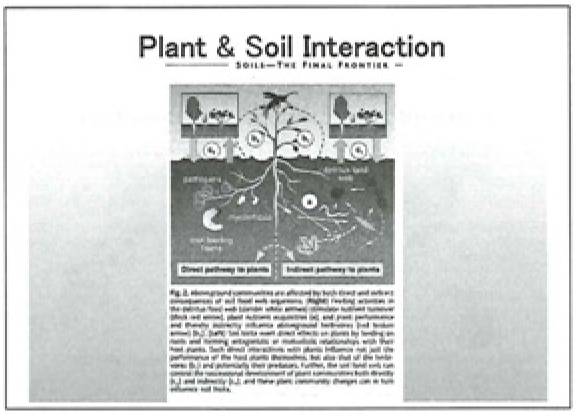

CO$_2$ Concentration in Atmosphere (ppm)
Mauna Loa
Barrow
Oil crisis '73
El nino '82
Pinatubo eruption '91
El nino '97
El nino '02
3 ppm increase
1.5 ppm increase year by year
Year
CO$_2$ concentration in Atmosphere at Mauna Loa, Hawaii, and Barrow, Alaska

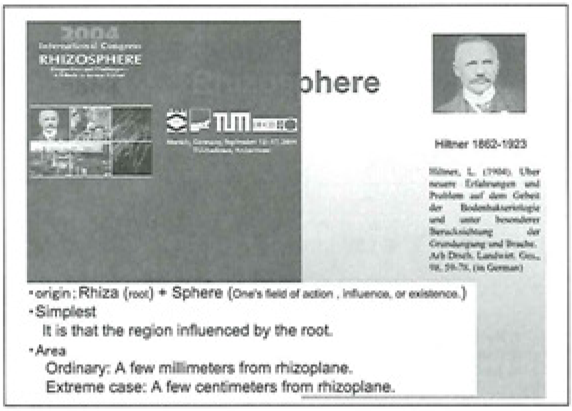

1000 Year Temperature Comparison
Hockey stick shape
Reconstructed Temperature
Little Ice Age

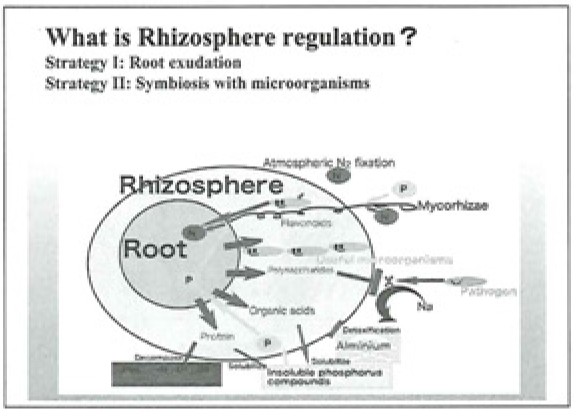

Environmental/Ecological Catastrophic Phase!

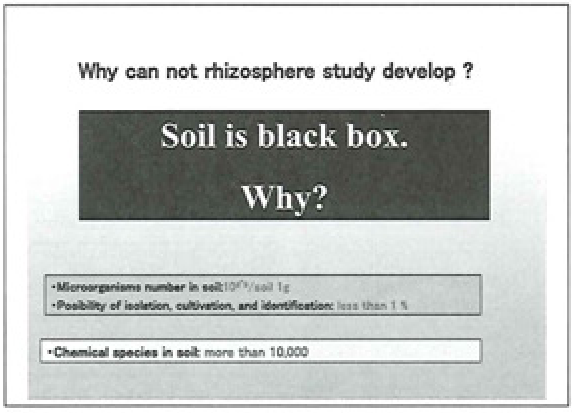

SOILS
The Final Frontier
Soil is most important factor for sustainable agriculture
Science
SOILS

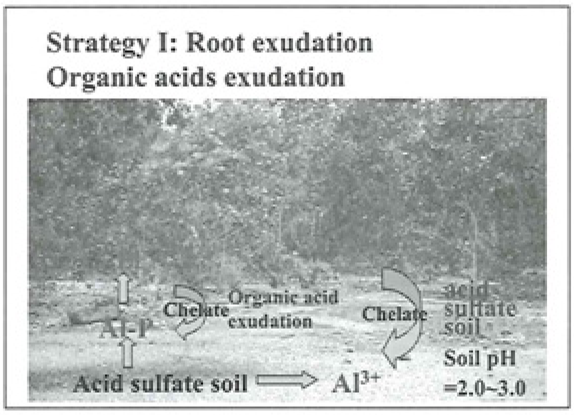

What is Metabolic Driving Forces in Earth?
3mm
Ozone layer
13km
*Leaf=1
Atmoshpere
Global material circulation by soil microorganisms
*Plankton=6
*Root=35
18cm
*Land surface =1
*Mycelia=6
Mutual interactions
*Bacteria=200
Chemical compounds
Soil & Rhizosphere
12,800km
Earth' s crust
* Relative amount of surface area (Land surface = 1)
Soil & Rhizosphere should be focused

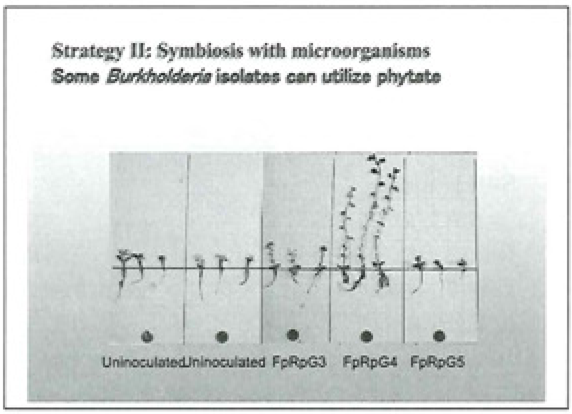

Plant & Soil Interaction
SOILS—THE FINAL FRONTIER
Direct pathway to plants
Indirect pathway to plants

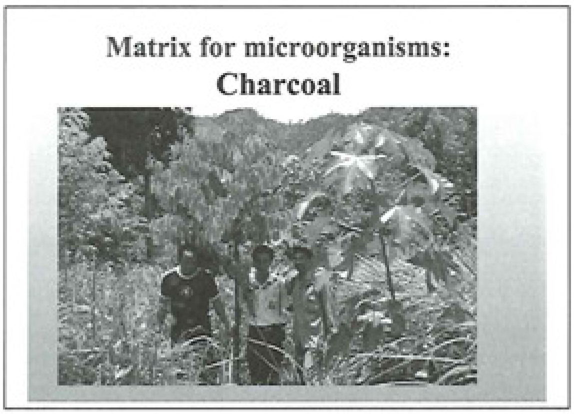

2004 International Congress
RHIZOSPHERE
phere
Hiltner 1862-1923
Hiltner, L. (1904). Über neuere Erfahrungen und Probleme auf dem Gebiet der Bodenbakteriologie und unter besonderer Berücksichtigung der Gründungung und Brache. Arb Dtsch. Landwirt. Ges., 98, 59-78. (in German)
・origin: Rhiza (root) + Sphere (One's field of action , influence, or existence.)
・Simplest
It is that the region influenced by the root.
・Area
Ordinary: A few millimeters from rhizoplane.
Extreme case: A few centimeters from rhizoplane.

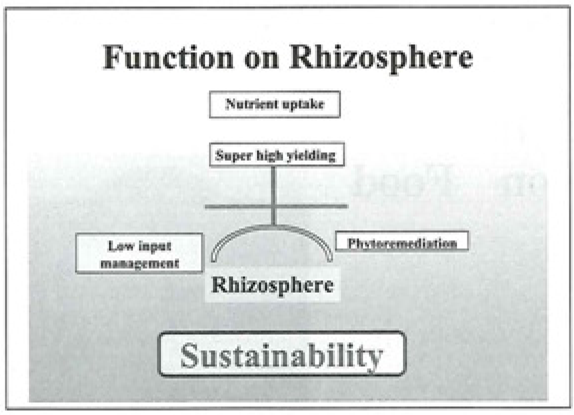

What is Rhizosphere regulation？
Strategy I: Root exudation
Strategy II: Symbiosis with microorganisms
Atmospheric N2 fixation
Rhizosphere
Mycorrhizae
Root
Flavonoids
Useful microorganisms
Polysaccharides
Pathogen
Organic acids
Detoxification
Aluminum
Protein
Solubilize
Insoluble phosphorus compounds

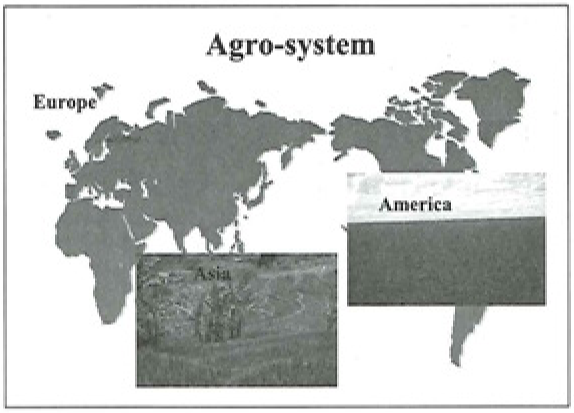

Why can not rhizosphere study develop ?
Soil is black box.
Why?
・Microorganisms number in soil: 10^(7-9)/soil 1g
・Posibility of isolation, cultivation, and identification: less than 1 %
・Chemical species in soil: more than 10,000

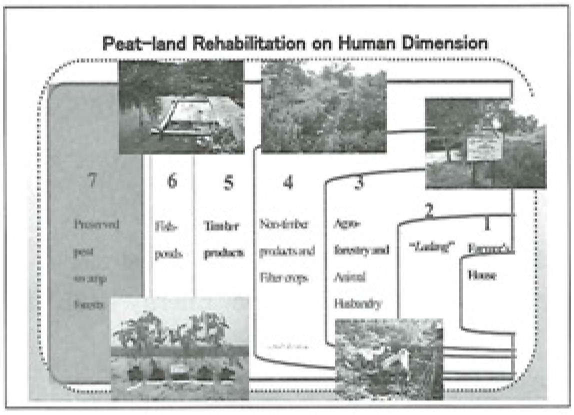

Strategy I: Root exudation
Organic acids exudation
Organic acid exudation
Chelate
Chelate
Al-P
acid sulfate soil
Soil pH =2.0~3.0
Acid sulfate soil
Al3+

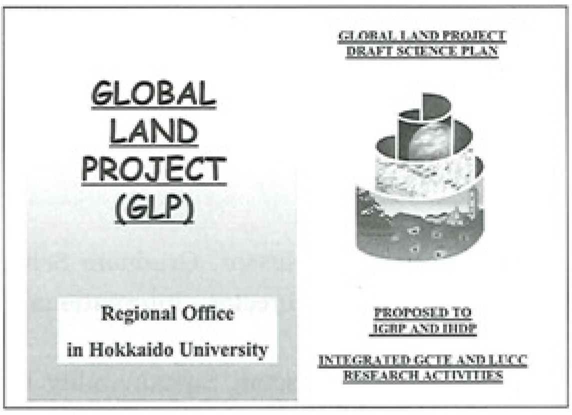

Strategy II: Symbiosis with microorganisms
Some Burkholderia isolates can utilize phytate
Uninoculated
Uninoculated
FpRpG3
FpRpG4
FpRpG5

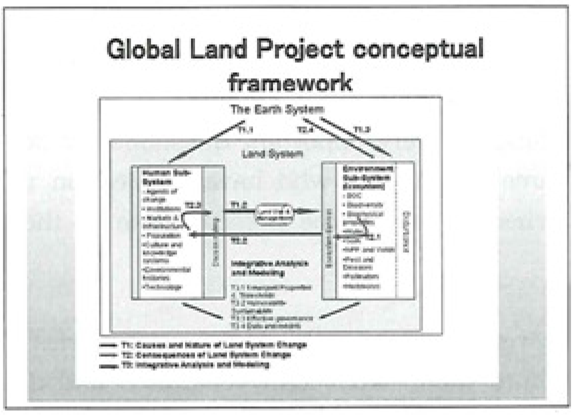

Matrix for microorganisms:
Charcoal

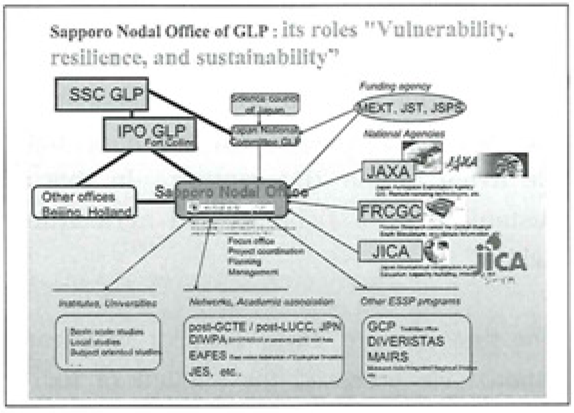

Function on Rhizosphere
Nutrient uptake
Super high yielding
Low input management
Phytoremediation
Rhizosphere
Sustainability

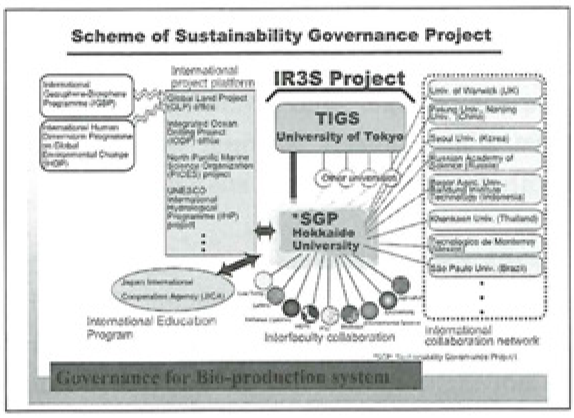

Agro-system
Europe
America
Asia

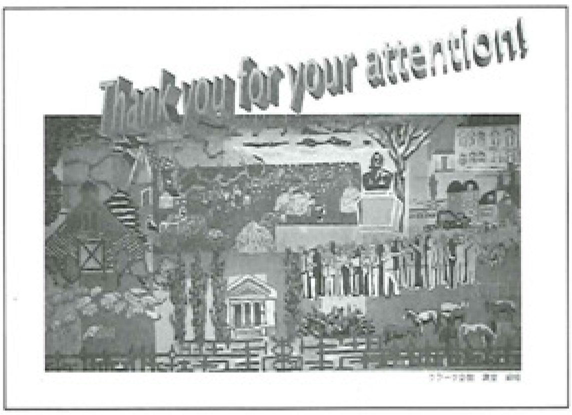

Peat-land Rehabilitation on Human Dimension
7
Preserved peat swamp forests
6
Fish-ponds
5
Timber products
4
Non-timber products and Filter crops
3
Agro-forestry and Animal Husbandry
2
"Ladang"
1
Farmer's House


GLOBAL LAND PROJECT DRAFT SCIENCE PLAN
GLOBAL LAND PROJECT (GLP)
Regional Office
in Hokkaido University
PROPOSED TO IGBP AND IHDP
INTEGRATED GCTE AND LUCC RESEARCH ACTIVITIES

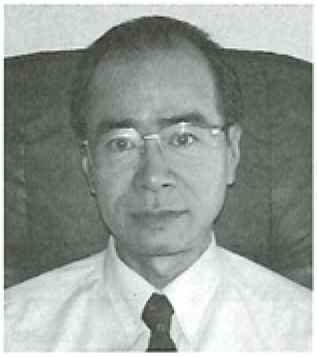

Global Land Project conceptual framework
The Earth System
Land System
Integrative Analysis and Modeling
T1: Causes and Nature of Land System Change
T2: Consequences of Land System Change
T3: Integrative Analysis and Modeling


Sapporo Nodal Office of GLP : its roles "Vulnerability, resilience, and sustainability"
SSC GLP
IPO GLP
Fort Collins
Science council of Japan
Japan National Committee GLP
Funding agency
MEXT, JST, JSPS
National Agencies
JAXA
FRCGC
JICA
Other offices
Beijing, Holland
Sapporo Nodal Office
Focus office
Project coordination
Planning
Management
Institutes, Universities
Networks, Academic association
Other ESSP programs
Basin scale studies
Local studies
Subject oriented studies
post-GCTE / post-LUCC, JPN
DIWPA
EAFES
JES, etc.
GCP
DIVERISTAS
MAIRS


Scheme of Sustainability Governance Project
International project platform
IR3S Project
TIGS
University of Tokyo
Other universities
*SGP
Hokkaido University
Univ. of Warwick (UK)
Seoul Univ. (Korea)
Khonkaen Univ. (Thailand)
São Paulo Univ. (Brazil)
Japan International Cooperation Agency (JICA)
International Education Program
Interfaculty collaboration
International collaboration network
Governance for Bio-production system


Thank you for your attention!

Summary of Plenary Session 4: Sustainability Governance on Food and Bio-resources



Chaired by **Yutaka Saito**

Deputy-Director
Sustainability Governance Project (SGP),
Hokkaido University
E-mail: yutsat@res.agr.hokudai.ac.jp

Speakers:
Teisuke Miura, Professor, Graduate School of Fisheries Sciences, Hokkaido University
Nasir El Bassam, Director, International Research Centre for Renewable Energy (IFEED), Germany
Mitsuru Osaki, Director, Sustainability Governance Project (SGP), Hokkaido University

Can we maintain our present lifestyles for the next 50-100 years to come? What will become of our resources, food and environment if society continues its present practices of mass production, mass consumption and mass disposal? These are very important questions for people living in the 21st century. In this section, three researchers who have studied on the sustainability of fisheries and agriculture were invited to review the present state of these fields.

The first speaker, Prof. Teisuke Miura addressed several current problems facing fisheries in Japan. He accessed the amount of fish imported into Japan from many countries and discussed how we must focus more attention on conserving the fisheries resources of exporting countries. Furthermore, the shrimp culturing that has resulted from strong Japanese demand has lead to poverty and the coastal destruction of many South East Asian countries. He proposed that by making the fisheries industry more sustainable, such problems could be resolved. To do this however, education systems must adapt, namely we need to provide foreign students not only with technology, but also with the philosophy of sustainability.

The second speaker, Prof. N. El Bassam addressed the necessity of new bio-resource industries as a strategy that can meet the needs of the present without compromising the ability of future generations to achieve their own requirements. He said that primary energy sources are limited and mainly non-renewable and not sustainable. Furthermore, the world, primarily developing countries, is facing a period of uncertainty and change - depopulation of rural regions and decreasing farmer incomes. Thus, he concluded it is our responsibility to foster public education and outreach programs to promote awareness of ecological, biological and organic production systems at all levels of society.

The last speaker, Prof. Mitsuru Osaki discussed the importance of carbon storage in soils, and outlined the seriousness of wild fires in the peat lands of South-east Asia and Siberia. Furthermore, he advocated the importance of the soil rhizosphere for sustainable agriculture, and how further researches in this field will advance safe agriculture without the need for chemical fertilizers. In addition, he introduced the purpose of the Hokkaido University Sustainability Governance Project and Global Land Project, both of which were established to create "sustainability sciences".

Hokkaido University International Symposium on Sustainable Development
Wednesday August 9, 2006 / 9:00am-9:30am
Keynote Speaker

Education for Sustainable Development: If Not the Solution, At Least a Start

Sheldon Shaeffer

Director
UNESCO Asia and Pacific Regional Bureau for Education, Bangkok, Thailand
E-mail: s.shaeffer@unescobkk.org

—Prof. Kishinami, Chairperson—

Good morning ladies and gentlemen. I'd like to call the morning session to order. The title of this session is the Role of Higher Education and International Collaboration for Sustainable Development. My name is Kishinami, the chairman of this session. Let me introduce to you Professor Yamagishi who is the co-chairman of this session, and she is a professor at the Centre of Research and Development in Higher Education at Hokkaido University. We'll be responsible for this session, and would like to ask you for your kind cooperation. According to the program today, let me introduce to you Dr. Sheldon Shaeffer, who's a Director of the UNESCO Asia and Pacific Regional Bureau for Education. His keynote speech is entitled "Education for Sustainable Development: If Not the Solution, At Least a Start". Dr. Shaeffer studied history and international development education at Stanford University. He has a B.A. in history, an M.A. in anthropology, and a Ph.D. in international development education. After working in several positions in education, he started to work for international organizations in 1980, including the International Development Research Center in Ottawa and UNICEF Headquarters in New York, and has been assigned to the current position in UNESCO since 2001. As you know, UNESCO is a leading organization among the United Nations institutions for education for sustainable development. Dr. Shaeffer's responsibility covers not only the education for sustainable development, but also educational and cultural activities of UNESCO in 45 countries and regions in the Asia Pacific. Dr. Shaeffer, Please.

—Dr. Sheldon Shaeffer—

Ladies and gentlemen, I'm very happy to be here today. I'd especially like to thank Prof. Kishinami and Prof. Yamagishi for chairing this session this morning. Also my thanks to Prof. Hondoh, who invited me to come here, and has the wonderful title of Global Manager of this initiative at this university, and last but not least, Prof. Tambo and the colleagues on this panel. My task this morning is to review for you the initiative in terms of education for sustainable development, especially focusing on a UN initiative, which is the Decade of Education for Sustainable Development. As was said in the introduction, I am Director of the UNESCO Asia and Pacific Regional Bureau for Education, which is in Bangkok and covers 45 countries across Asia and the Pacific, in the areas of education, culture, social science, and communication. I noticed, looking through the titles of the papers and some of the abstracts, that there was a considerable focus on issues relating to population, food security, water, energy, disease, climate change, and many of the other issues that we have to face when we think about what is going to happen in terms of our future. We at UNESCO are also interested in another kind of statistic, which I'd like to talk about now.

Linguists around the world generally estimate now that there are something like 6,000 languages currently spoken in the world. The estimate is that, given the current rate of language death, by 2050 there will only be about 600 left. About 10% of the languages as we know them now will be left in another 45-or-so years. And of course, with language go history, tradition and culture. We think this kind of threat to languages and cultures is something that also has to be considered very seriously when one is looking at this question of what a sustainable future looks like.

What I'd like to do here is to go through what is generally seen to be the standard definition, going back to the Brundtland Report on the World Commission on Environment and Development of 1987, that "sustainable development is development that can meet the needs of the present without compromising the ability of future generations to meet their own needs". Sustainable development therefore requires this very difficult balancing of environmental, societal, and economic considerations in the pursuit of development, and also an improved quality of life, again, not only for this generation but for future ones. However, it also tries to promote not only the ideals of environmental preservation - for example, environmental restoration, and poverty alleviation - but also a wider range of issues which be considered in trying to guarantee a sustainable future, includes such as issues of gender equity, just and peaceful societies, human rights and cultural diversity. So the idea is that sustainable development has to start with the immediate and pressing environmental and economic issues that face us now and will face us in the future, but also has to look at a much wider range of issues.

Education for sustainable development tries to use a partnership approach. It engages multiple sectors, not only scientists, economists and others who might be interested in an academic sense, but also many others, including media and, of course, the private sector. An issue to me when looking at a workshop or at a conference like this, with an audience like this, is how many representatives of the media and of the private sector have also been included or involved. It tries to use this partnership approach and tries to utilize all forms and methods of public awareness raising, education, and training. It's not only an issue of the formal school system, but of many other kinds of non-formal and informal education. It tries to encourage people to understand the complexities of, but also the synergies between, the issues that threaten sustainability in the future, and also asks people to try to understand their own values and those of the society in which they live. It's trying to say to people that problems exist, and that we are part of those problems; we are involved in those problems, and we have to examine not only our knowledge and our skills but also our values in relation to what can be done in the future.

If one looks at what education for sustainable development is trying to do, it's really focusing on a learning process, not only the teaching of the facts themselves, but learning that tries to focus on such things as reforming the structure and nature of basic education; to what extent and how should the content of education and the methods change to try to ensure that the students and the learners and the system can understand these issues better. It tries to reorient existing education programs, trying to improve them and reorient them towards more developmental-oriented issues; it tries to develop public awareness about what sustainability actually means, and it tries to build capacity not only within education systems, but also in all of ESD partners.

According to the nature of education for sustainable development - as it has been defined not only in the Johannesburg conference of several years ago, but also in subsequent discussions at the United Nations about the Decade of Education for Sustainable Development - there are considered to be three pillars. There's a pillar of society: an understanding of the social institutions - governments, schools, families, communities, religious organizations - and of their roles in change and in development. Of course, an important pillar is the environment - an awareness of the natural resources that many of you were speaking about yesterday, and also of how fragile the physical environment often can be. There's also an economic component - a sensitivity to the limits but also the potential of economic growth, and the impact of this on society and on the environment. Again, discussions were held on this yesterday. There's also a very important underlying component; a cultural one that really looks at how people behave, what they believe, how they act, which is different in every society one belongs to, as an underlying critical dimension underneath all the important pillars. This is, I'm afraid, something we often don't look at.

When one looks at education for sustainable development, there are many core issues that are reflected in the education programs: conservation of natural resources, climate change, the transformation of rural societies, sustainable urbanization, disaster prevention and mitigation, which has become much more visible and important in this region since the tsunami. There are, of course, economic issues, poverty reduction, the issue of greater corporate responsibility and accountability, and a market economy that is more benign in terms of sustainability than it often has been in the past. Then there are socio-cultural issues again, issues that I think we probably don't look at hard enough or carefully enough in terms of what is necessary for a sustainable future includes fulfilment of human rights, a guarantee of peace and human security, gender equality, good health, good governance of the systems that are in charge of the development process, a greater reinforcement of intercultural and international understanding, and, from our point of view especially, the preservation of cultural and linguistic difference and diversity.

When we look at education for sustainable development, and try to promote it within education systems across the region, we see it as having a number of different characteristics. It should focus on how to create a more interdisciplinary and holistic approach to the issue. It should be values-driven - knowledge is important, specific skills are important, but underlying it also is an analysis of, and a change of, values. If you look across education systems in the Asia Pacific region now, and look at what the curricula include, you'll see any number of values-based programs - education for international understanding, and global understanding, moral education, peace education, democracy education, citizenship education, life skills education, and many more. What I think we are trying to say is that all of these different kinds of values-based education really have to be seen underneath a larger umbrella or a larger conceptual framework about the values necessary for sustainable development. This kind of education for sustainable development tries to focus on critical thinking, problem solving individually but also collectively. It's multi-methodological in nature; it tries to involve participation in local decision making in the classroom and in the community; and, of course, it tries to be very much relevant to the local environment.

One conclusion of the meeting in Johannesburg, and this was a proposal of the Japanese government at that conference, was to create a UN Decade of Education for Sustainable Development. This was later confirmed in the General Assembly of the United Nations, with UNESCO as a coordinating agency. The vision of the Decade as proclaimed and as agreed to in the General Assembly is to try to lead to a world where everyone has the opportunity to benefit from education and also to learn the values, behaviors, and lifestyles required for a sustainable future, and for positive societal transformation. It's that kind of productive last piece of it that I think is especially important.

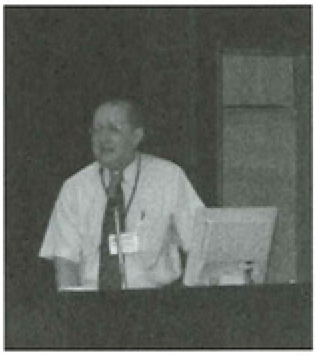
The Decade is trying to facilitate networking and linkages, exchanges, and interaction among stakeholders - the kind of thing happening at this meeting - at least among more academic-oriented people. It's trying to foster an increased quality of teaching and learning in general in education systems around the world; it's trying to help countries in this process make progress toward and attain the MDGs through ESD efforts; and it's trying to provide countries with new opportunities to incorporate education for sustainable development into education reform efforts. Many countries in the region and the world periodically undertake education reform activities, curriculum reform, and teacher-training reform activities. The issue is how, at that moment in a country's education development history, one promotes the ideals and the methods of something like education for sustainable development. That, I think, is the important task.

There's a lot of work trying to focus on advocacy - trying to get people in all sectors to understand the issues; consultation and ownership; partnership and networks; capacity-building and training; research; development and innovation; the use of information and communication technology in education for sustainable development; and of course, monitoring and evaluation. As we speak there is another meeting being held elsewhere in Japan, with UNESCO and many other partners including the IUCN, trying to establish what are appropriate indicators to measure whether, in fact, in the course of the Decade and beyond, any progress has been made at all in terms of promoting the ideals of the Decade. Now you can see here how higher education can fit into these many different kinds of strategies.

There is what is called the International Implementation Scheme for the Decade; there is also an Asia Pacific regional strategy. This is based on a situation analysis done a couple of years ago as to what the state of and the understanding of sustainable development is in the region, but also include a specific strategy for ESD, with a working paper that tries to guide the implementation. It's an open document continuously being revised, and it's trying to focus on collaboration and networking around the core issues, trying to clarify the roles of the different stakeholders - again, the media, private sector, international agencies, civil society organizations, non-government organizations and others. And it's trying to focus on stronger coordination, and monitoring and evaluation mechanisms. This strategy was based on consultation with literally dozens of stakeholders around the region from many different audiences. In this region there is a Regional United Nations Interagency Committee, which is looking at the issue, with members including the United Nations University, the United Nations Environment Program, the Asia Pacific Centre of Education for International Understanding, the Asia/Pacific Cultural Centre for UNESCO in Tokyo and many others, and there's also an Asia Pacific Regional Consultation Group - more of an expert group - that is trying to promote the ideals of the Decade.

If we look at ESD in higher education - things that perhaps could be done - the important issue is how do we try to ensure that issues related to sustainable development are incorporated in all higher education curricula and research agendas? To what extent can we ensure these issues are incorporated not only into faculties of science, especially environmental science, but also in terms of economics, business, journalism, and social and human sciences? The whole range of faculties within a university should have some kind of discussion around these issues, in terms of teaching and in terms of research. We would think it especially important that faculties focusing on teacher education and teacher education institutions, whether it is pre-service or in-service, especially in areas like social science, geography, etc., are focused on issues of sustainability. To what extent are training teachers across the region now being introduced to any of the broad-ranging issues that relate to education for sustainable development? Trying to develop model teacher-training programs and associated materials based on especially innovative ESD activities, showing how the different components - social, economic, environmental and cultural - can be linked, is also important. There are already good models of this. There is a CD-ROM that was developed within UNESCO a couple of years ago that tries to bring together the best of these materials, and of course that has to be continually updated, which is one of the purposes of the work that's now being done. We are trying to look at the best of the models in terms of how ESD can be integrated into classrooms and into schools. That's one thing I think also can be done in terms of higher education. The idea is not to try to establish in every education system in the world a new subject called Education for Sustainable Development, which would, if you were lucky, be one hour a week. The idea, if at all possible, is to try to see how the values related to education for sustainable development can be integrated across the subjects of a school curriculum, including the reorientation of business and journalism schools, and even the establishment of sustainable campuses. I've just read about the National Taiwan Normal University, where a very serious attempt is being made by the university itself in trying to make its campus environmentally sustainable.

There are other specific programs that can be looked at, and you may have heard of the United Nations University; ESD-focused institutes; Masters and Ph.D. programs in ESD; the UNU post-graduate program at Tongji University, supported by the United Nations Environment Program. This is a leadership program at the Institute of Education for Sustainable Development that tries to take Ministry of Education and other leaders from around the region and put them through a training program looking at some of the research, technical and management skills needed to promote education for sustainable development. This UNU post-graduate education program funds Ph.D. and postdoctoral fellowships, promotes education for sustainable development and the Decade, and includes research and cases studies on Regional Centers of excellence. This program at UNU is a very interesting one. I think the term Regional Centre is a bit of a misnomer; it doesn't quite describe what these are. These are centers found in coherent sub-regions, cities, islands, river valleys and others; they are centers in a particular geographic or demographic logical region which are trying to promote within that region sound sustainable development activities. So these are regional centers of excellence, of which there are many in the region and of which there will be many more. This program is trying to examine factors for success and the development of curricula for priority topics at ESD. So there are increasingly across the region, especially in East Asia, specific dedicated institutes and programs related not only to sustainable development but also in fact, to education for sustainable development.



Finally, I think there are other issues related to inter-disciplinary, inter-institutional studies and programs on ESD. The question of longitudinal studies to evaluate the impact of ESD programs is critical-something I think higher education institutions are probably especially appropriate to carry out, along with the further development of conceptual and theoretical frameworks for ESD. There are still a lot of issues as to what it actually is and means and looks like. One view is that it's going to look quite different in every context in different countries in different regions, but trying to understand this better from a conceptual and theoretical point of view is a very important one. Then, of course, it is essential to identify and evaluate the best kind of pedagogy teaching/learning methods for promoting the ideals of education for sustainable development.

There's much more information to be found. We have in UNESCO Bangkok a website on ESD. There is also going to be a large conference in Bangkok at the end of December, looking at education for sustainable development.

Let me close by just saying in the UN system there are probably too many Decades. If you were to see a list, which we get periodically, of all the UN Days and UN Years and UN Decades, it's quite daunting. I would say every week or so out of Paris Headquarters there is some speech or statement by the Director General in commemoration of one or another UN Day, Year or Decade. There are probably too many of them, and they are often too easily adopted by the United Nations. Unfortunately, it's very easy to launch a Decade, that's done all the time. But it's much more difficult to try to ensure systematic implementation and follow-through in the course of such a long time as a decade. Obviously, the work of trying to promote education for sustainable development is the work of much more than a decade. But we feel that the issues are of great enough importance that, taken much more seriously, this Decade of Education for Sustainable Development is something we simply have to do.

I look forward very much to working with many of you in trying to further the ideals and the goals of this decade. Thank you very much.

－Prof. Kishinami－

Thank you very much for your excellent presentation. Are there any questions or comments?

－Questioner1－

Thank you very much for an excellent presentation. One of the points that you brought up was sustainable development to be incorporated into higher educational curricula and research. There was a decision by the government in Sweden in 2000 that this should happen. Unfortunately, it hasn't happened in the 6 years since the decision, and it hasn't happened for a number of reasons. Probably two of the main reasons are ones you've mentioned in your presentation. One is the dilemma between advocacy and scientific credibility. I think we wrestle with that all of the time, both in the academic community and research community. Where is that balance? If you go too far along the advocacy line, you lose your scientific credibility, and it makes a lot of scientists uncomfortable. The other problem or challenge is at what point can you become multi-disciplinary? Because that's really required for sustainable development, but then you must be firmly founded in some discipline before you branch out, and that's another point of debate. And the limitation for incorporating sustainable development into curricula is that people are unwilling to give up their "disciplinaryness" to become multi-disciplinary. I wonder if you have any comments or advice for the further panel discussion on those issues.

－Dr. Sheldon Shaeffer－

Looking just within the UN system, it's what we're trying to promote, of linkages between, for example, the UN Environmental Program, that would be discussing some of the more scientific issues, a considerably fuzzier agency like my own. Trying to see what is the best way or an appropriate way is to try to assure - if not a marriage - at least a cohabitation of advocacy and scientific pieces. As you say, if one is only promoting advocacy without being firmly based on the experiences locally or globally in terms of what science is telling us, or if scientists are doing their studies out of context of the larger messages that should come out of that scientific knowledge, then I think we are on the wrong track. At least within our own system, both in Bangkok and globally, this kind of linkage between the two worlds is something that we are trying to work for. I think in a program like the United Nations University program and these Regional Centers, more at the grassroots level, that can also be done. I've also been involved with a number of multi-disciplinary initiatives in different places around the world, and they are very difficult, the idea always being that if you put everyone on the same floor, they'll all talk to each other. Well that doesn't work, even if you leave the doors open. I think that is also going to be very much context specific. I could imagine some institutions that are very strong in terms of environmental issues from a scientific perspective, who should attempt to reach out and bring into that strong base, social, human, cultural and other kinds of issues. I can imagine those centers that are especially strong in terms of some of the ethical issues or the social, historical or cultural issues, wanting to try to bring in as resource people those who represent very different perspectives. I think you are absolutely right. Trying to build something that is multi-disciplinary when the disciplines are not strong in themselves just isn't going to work. I've seen that fail all over the place. I would add one other reason why this example like in Sweden often doesn't work; it's because there isn't this understanding, or as we say "ownership", of the issue at the bottom of the system. There are interesting activities around the region, especially through non-government organizations, which are really starting at the village and the community level; getting villages and communities to reflect on and do their own broadly defined environmental audits to try to see what actually can be done. I think that's where you also have to start. A Decade from the United Nations isn't going to get you very far unless you focus at that grassroots level.

—Prof. Lawrence Mysak—

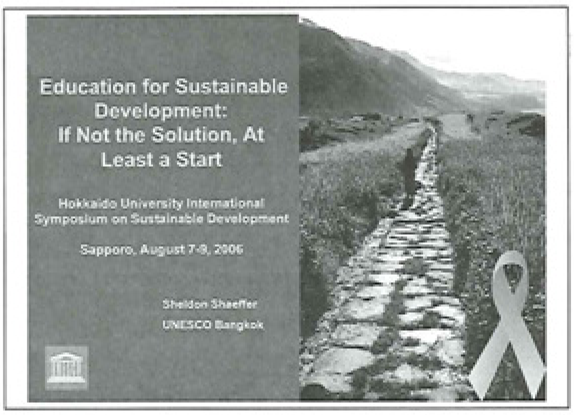
That was a very nice presentation. My name is Lawrence Mysak from McGill University. I'm an environmental scientist and I spoke on Monday on Long-term Climate Change Past and Future. I noticed from your CV that you spent a number of years in Ottawa working for IDRC and maybe other organizations. I know at that time, in the '80s or '90s, there was an attempt to promote things like sustainable development through bringing together research funding projects that involved both the Social Sciences and Humanities Research Council and the Science Research Council, respectively. I guess my question to you is, of course, putting out dollars often is a way of bringing together people from the two sides, or cultures in C.P. Snow's words. How successful do you think that funding was in the past - and maybe it's still going on today but I've not heard too much about it in recent years?

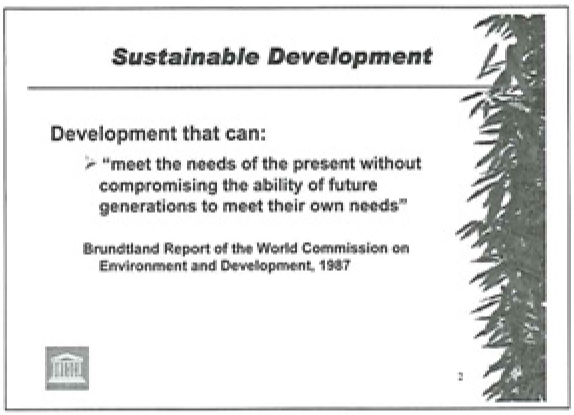
—Dr. Sheldon Shaeffer—

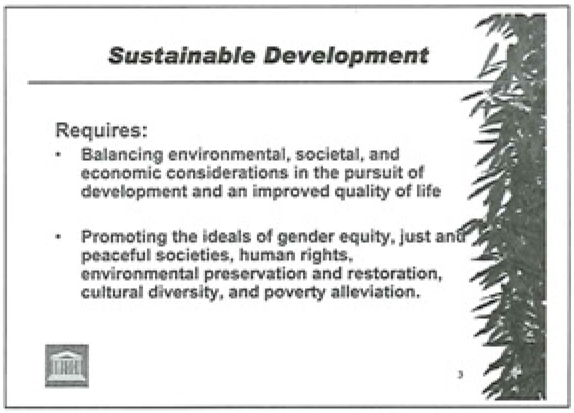
I was in IDRC for about 10 years in the education and population program, and saw those programs rise and fall, if you will. I don't think it was because I was there that it fell, but one might argue differently. There was at the time a very strong science/technology environment program that tried to link-in across the many other sectors. These things, I'm afraid, in bilateral and multilateral agencies, as perhaps in universities, come and go, and they get replaced by other issues such a social policy and governance. I used to work in the Ford Foundation, a strong education program that now has nothing left because other issues seemed to take over and become more important. The interesting thing is if you were to actually go to countries in the developing world that were the venues for the activities funded out of Canada, you'll probably find much more visible residues of the activities than you'll find in Canada itself. In fact I just heard two days ago from a former IDRC colleague that one of the original staff members of that particular very strong unit has been asked by IDRC to do an analysis of the history of what happened, in terms of science/technology and energy, with the possibility of reviving or restarting a program. You have to see it as a kind of pendulum, and try to oversee not what are the fads at the higher levels of the system, but what can actually be done at the bottom of the system, in terms of building the institutions. They might in fact last long beyond whatever our activities might be at the international level.

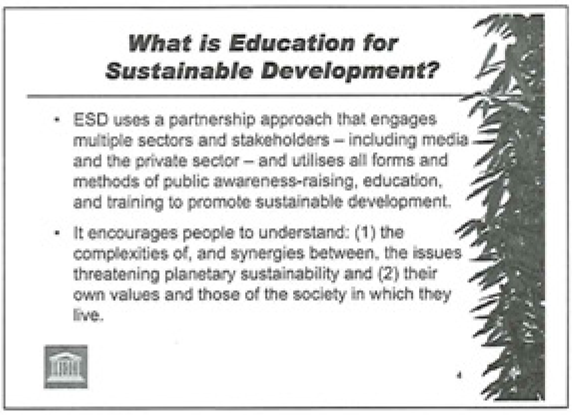
—Prof. Kishinami—

Thank you very much, Dr. Shaeffer.









Domains of Education for Sustainable Development

ESD is about learning rather than teaching and therefore requires:

- Reforming the structure and nature of basic education
- Reorienting existing education programmes
- Developing public awareness about what sustainability means
- Building capacity within education systems and across all other ESD partners

5

Education for Sustainable Development (ESD)

Three Pillars of Sustainable Development

- **Society** – an understanding of social institutions and their role in change and development
- **Environment** – an awareness of natural resources and the fragility of the physical environment
- **Economy** – a sensitivity to the limits and potential of economic growth and its impact on society and on the environment

with **Culture** – ways of behaving, believing, and acting which differ according to context, history and tradition -- as an underlying and critical dimension

6

Core Issues

Environmental Issues

- Conservation of natural resources
- Control of climate change
- Transformation of rural societies and environments
- Sustainable urbanization
- Disaster prevention and mitigation

7

Core Issues

Economic Issues

- Poverty reduction
- Corporate responsibility and accountability
- A "benign" market economy

8

Core Issues

Socio-Cultural Issues

- Fulfillment of human rights
- Guarantee of peace and human security
- Gender equality
- Good health (e.g., HIV/AIDS prevention)
- Good governance
- Reinforcement of intercultural/international understanding
- Preservation of cultural diversity

9

Key Characteristics of ESD

- Interdisciplinary and holistic
- Values-driven
- Focused on critical thinking and problem solving
- Multi-methodological
- Participatory in decision-making
- Locally relevant

10

UN Decade of Education for Sustainable Development (DESD)

VISION

A world where everyone has the opportunity to benefit from education and learn the values, behaviours, and lifestyles required for a sustainable future and for positive societal transformation.

11

UN Decade of Education for Sustainable Development (DESD)

" The UN Decade of Education for Sustainable Development (DESD) is the overarching framework, but, from the outset, we must not confine ourselves to an over-narrow view of what 'education' means in this regard. In effect, it embraces knowledge and how it is shared in a global context where the operative word is 'interdependence' – between humankind and nature; between nations and cultures and between the present and the future."

Koichiro Matsuura, Director-General of UNESCO
remobilisation ceremony on 21 October 2005

12

UNESCO'S Role in Implementing DESD

- Building capacity
- Promoting international cooperation
- Leading coordination at the international level
  - ➢ Catalyse new partnerships
  - ➢ Encourage monitoring and evaluation
  - ➢ Encourage research on ESD
  - ➢ Bring together important stakeholders
  - ➢ Share good ESD practices
- Ensuring intersectoral cooperation within UNESCO

13

International Implementation Scheme (IIS)

Contents:
- Overview of ESD and the Decade
- Goals and objectives of the Decade
- Relation to other international initiatives
- Strategies for implementation
- Roles of stakeholders
- Monitoring and evaluation

14

Objectives of the Decade

- Facilitate networking, linkages, exchanges, and interaction among stakeholders in ESD
- Foster an increased quality of teaching and learning in Education for Sustainable Development
- Help countries make progress toward and attain the Millennium Development Goals (MDGs) through ESD efforts
- Provide countries with new opportunities to incorporate ESD into education reform efforts

15

Strategies for Implementation

- Vision-building and advocacy
- Consultation and ownership
- Partnership and networks
- Capacity-building and training
- Research, development and innovation
- Use of ICTs
- Monitoring and evaluation

16

Asia-Pacific Regional Strategy for ESD

Working Paper
- A guide to ESD implementation in the region
- An open document adaptable for revision
- Focused on collaboration and networking
  - ➢ Around the core issues for ESD
  - ➢ By clarifying the roles of stakeholders
  - ➢ Through stronger coordination, monitoring and evaluation mechanisms
- Based on consultation with different stakeholders

17

DESD in Asia-Pacific

Asia-Pacific Regional UN Interagency Steering Committee
- Coordinates ESD efforts among UN agencies
- Advocates for ESD
- Promotes communication and networking

Asia-Pacific Regional Consultative Group
- Comprises experts representing stakeholder groups/geographic interests
- Promotes research and knowledge exchange
- Activates networks and projects

18

DESD Outcomes: Evidence-based monitoring and assessment frameworks established

- Provide assistance to develop and publish national ESD guidelines
- Support development of M&E processes
  - ➢ Set targets for the Decade
  - ➢ Divide responsibilities for M&E
  - ➢ Ensure appropriate mechanisms for monitoring and reporting
  - ➢ Develop a prototype DESD monitoring system

19

ESD and Higher Education

- Sustainable development incorporated in all HE curricula and research agendas
- Reorientation of teacher education (especially in terms of social science, science, geography, etc.) towards issues of sustainability
- ESD model teacher training programmes and associated classroom and teacher training materials based on innovative ESD curricula and showing linkages among ESD components
- Reorientation of other higher education institutions, e.g., business and journalism schools
- Establishment of "sustainable" campuses; e.g., National Taiwan Normal University

20

ESD and Higher Education

- ESD institutes and Master's and Ph.D. programmes (e.g., United Nations University postgraduate programme, UNEP-Tongji Leadership Programme)
- United Nations University postgraduate education programme in Education for Sustainable Development
  - funds Ph.D. and postdoctoral fellowships
  - promotes Education for Sustainable Development and the Decade of ESD
  - includes research and cases studies on Regional Centers of Excellence for ESD
  - examines factors for success and the development of curricula for priority topics for ESD

21

ESD and Higher Education: Research and Development

- Inter-disciplinary, inter-institutional studies and programmes on ESD
- Longitudinal studies to evaluate the impact of ESD programmes
- Development of conceptual and theoretical frameworks for ESD
- Identification and evaluation of appropriate ESD pedagogy

22

For more information on ESD in the Asia-Pacific region:

Visit our website

www.unescobkk.org/esd

Or email us

esd@unescobkk.org

Or attend our conference

- "Learning Together for Tomorrow: Education for Sustainable Development"
- 6-8 December, Queens Park Hotel, Bangkok, Thailand
- **Email:** apeidconf@unescobkk.org
- **Web:** www.unescobkk.org/education/apeid/conference

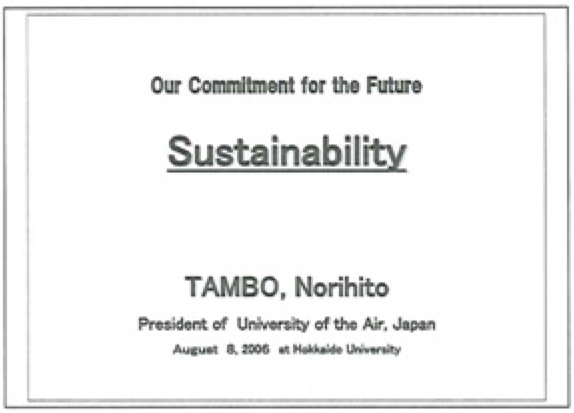
23

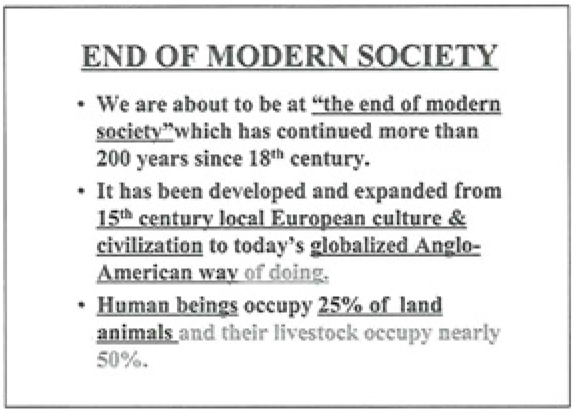
Hokkaido University International Symposium on Sustainable Development
Panel Discussion: Wednesday August 9, 2006 / 9:30am-11:30am
Coordinator

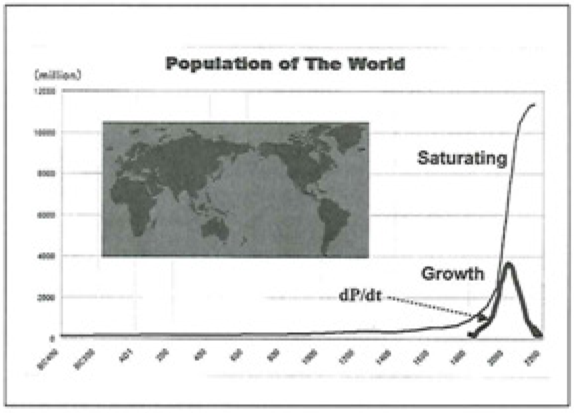
Our Commitment for the Future Sustainability

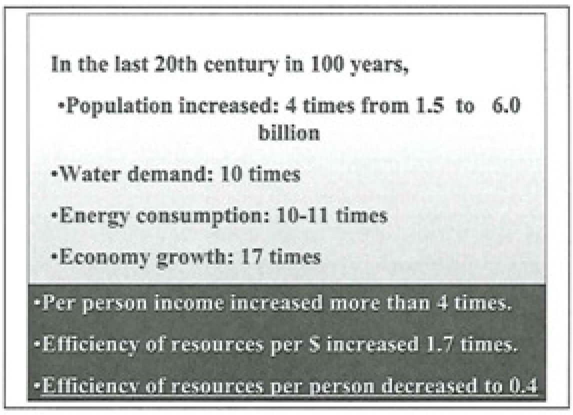
Norihito Tambo

Professor and President
University of the Air, Japan
E-mail: tambo@u-air.ac.jp



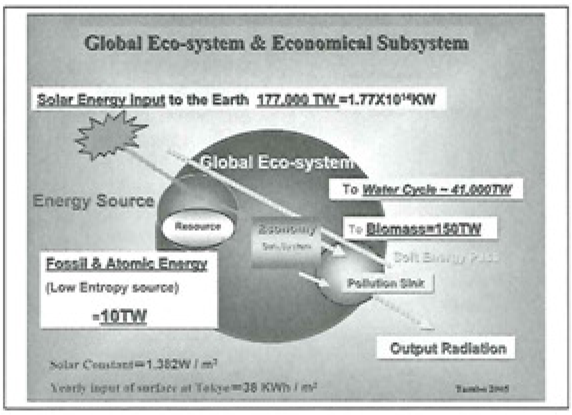


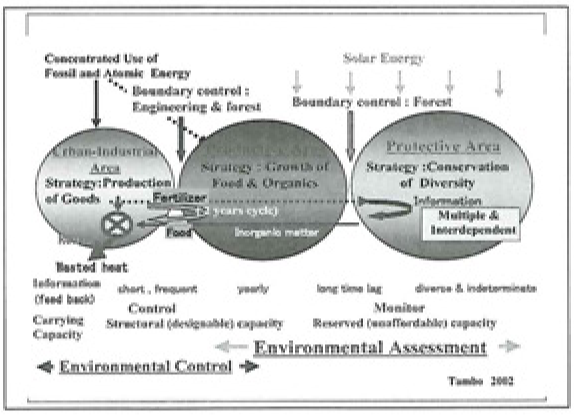


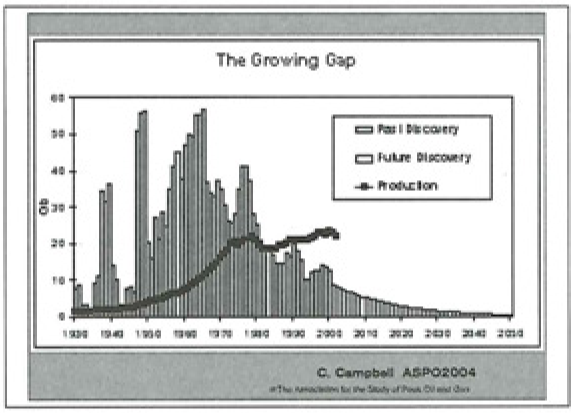


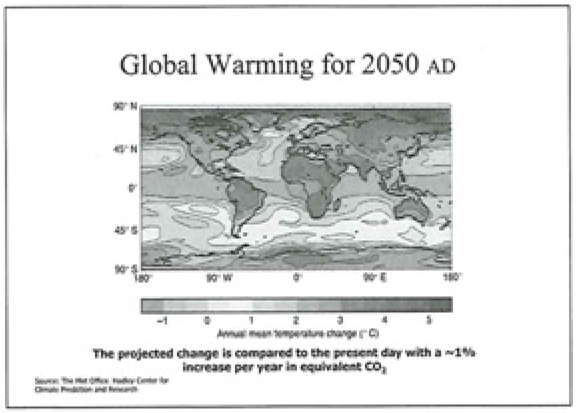
MODERN SOCIETY
Science-based Industrial Society

- Modern industry: Simple but large scale industry based on modern science being supported by long distance rapid bulk transportation *with abundant fossil energy & school (departmentalized)education system.*
- Growing society: Growth of individual industry causes increase of total social welfare as the summation of activities.
- Global limit of growth: *Environmental restrictions forced to finish the growth.*





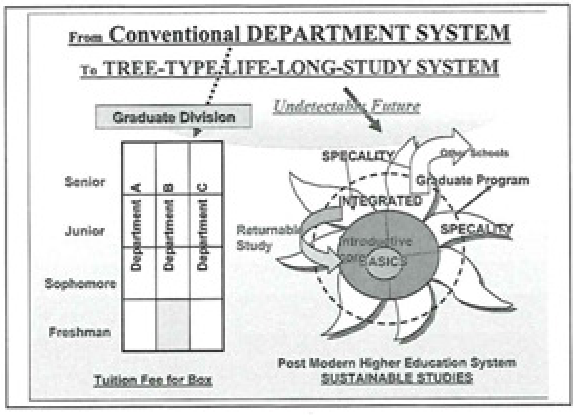




GLOBAL ENVIRONMENTAL PERIOD

- Difficulty to occupy RESOURCES and SPACE for INDIVIDUAL *(parallel &departmentalized)* ACTIVITIES with/for growth
- NEED for INTEGRATION: in order to *reduce total consumption* of resources, energy and space under the inflating POPULATION PRESSURE and EASY LIFE MODE *to recover SUSTAINABLE SYMBIOSIS on the earth*

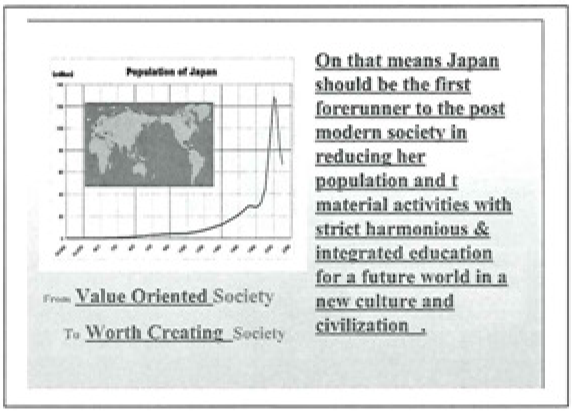
SOUTH TO NORTH PROBLEM IS A KEY ITEM

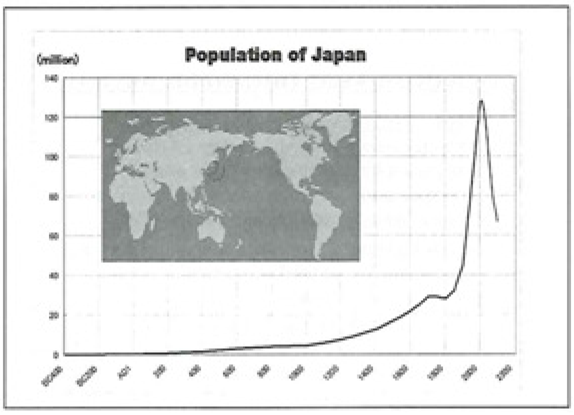


learn Sustainability of the GLOBE

- *Development of South Countries to the economic levels of USA, EU and Japan may need 3 or 4 of the EARTH.*

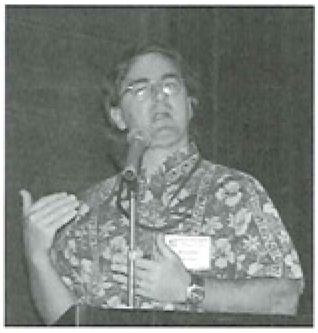
  We have only ONE EARTH unfortunately.
- *Inevitably it requests to reduce MATRIAL & ENERGY CONSUMING ACTIVITIES of DEVELOPED AREA and total POPULATION with a deep philosophy and clever technology for extended period of time.(education and action)*


Population of Japan
On that means Japan should be the first forerunner to the post modern society in reducing her population and t material activities with strict harmonious & integrated education for a future world in a new culture and civilization .
From Value Oriented Society
To Worth Creating Society


Population of Japan
(million)
140
120
100
80
60
40
20
0

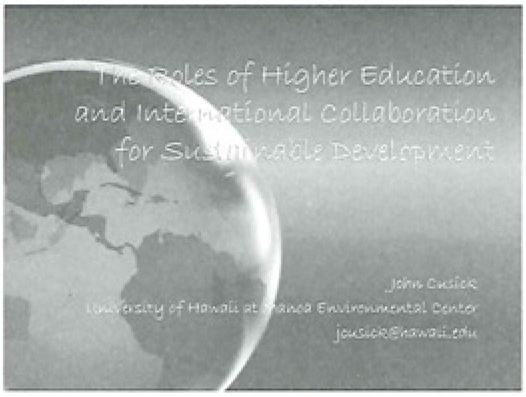
Hokkaido University International Symposium on Sustainable Development
Panel Discussion: Wednesday August 9, 2006 / 9:30am-11:30am
Panelist

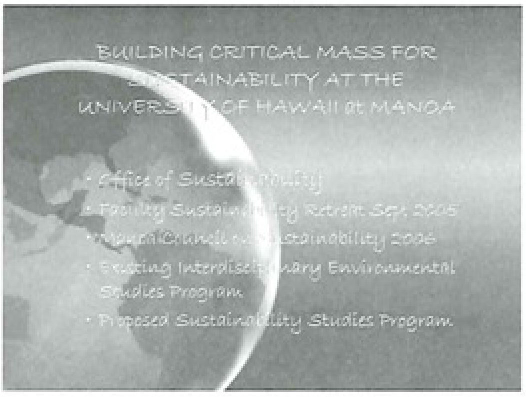
The Roles of Higher Education and International Collaboration for Sustainable Development

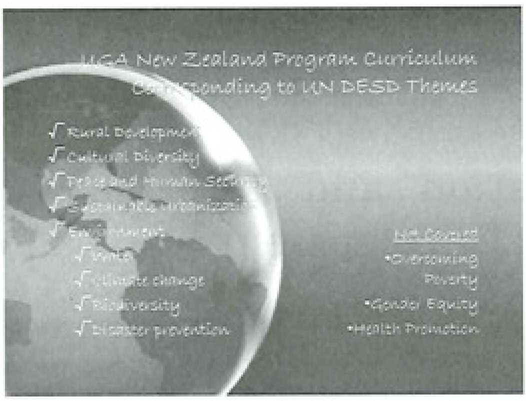


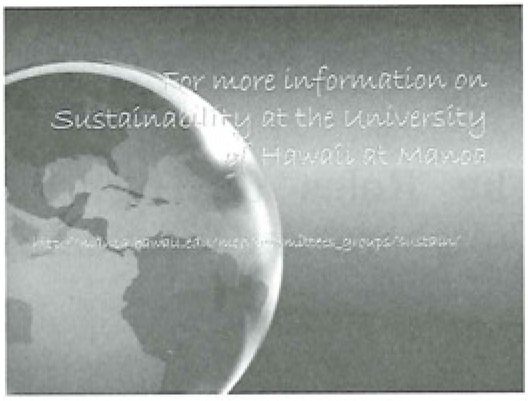
John Cusick

Assistant Specialist
Environmental Center
University of Hawai'i at Manoa, U.S.A.
E-mail: jcusick@hawaii.edu






UGA New Zealand Program Curriculum
Corresponding to UN DESD Themes
√ Cultural Diversity
√ Climate change
√ Disaster prevention
Not Covered
•Overcoming Poverty
•Gender Equity
•Health Promotion

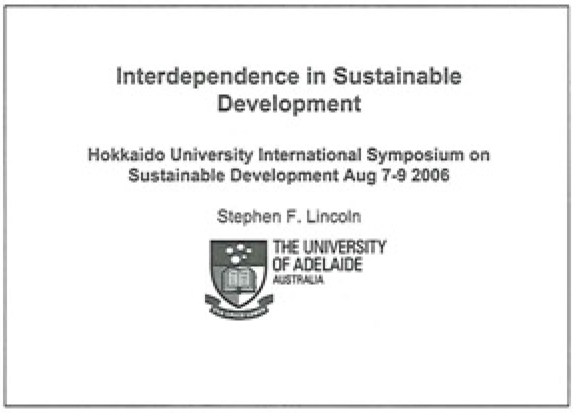

For more information on
Sustainability at the University
of Hawaii at Manoa

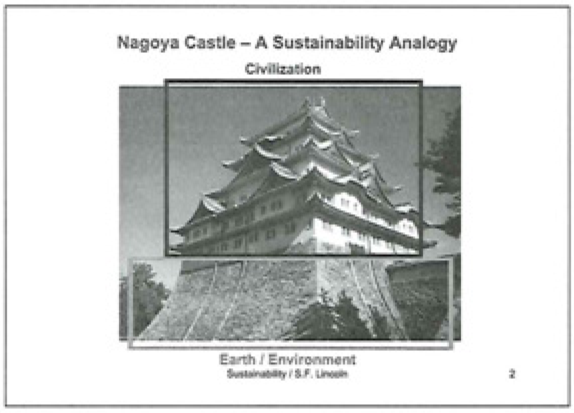
Hokkaido University International Symposium on Sustainable Development
Panel Discussion: Wednesday August 9, 2006 / 9:30am-11:30am
Panelist

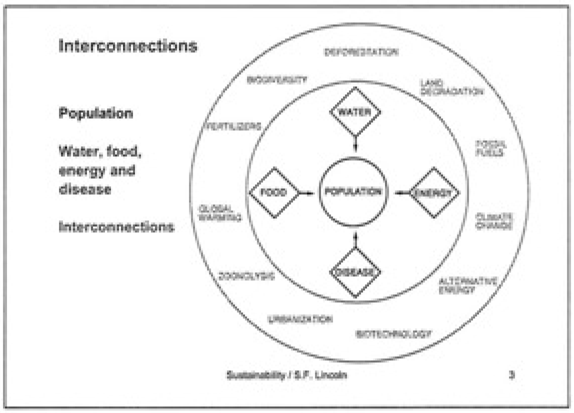
Interdependence in Sustainable Development

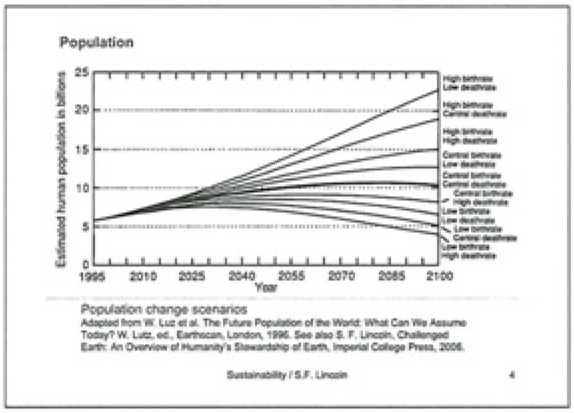
Stephen Lincoln

Professor
Discipline of Chemistry
School of Chemistry and Physics
University of Adelaide, Australia
E-mail: stephen.lincoln@adelaide.edu.au

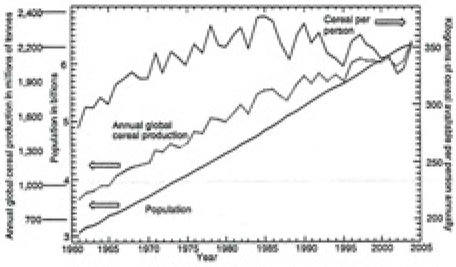








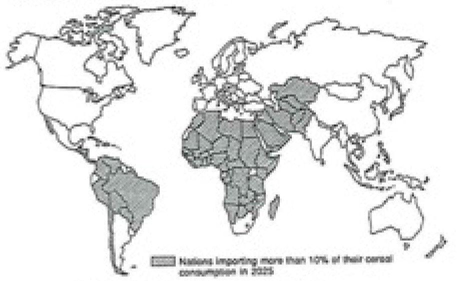
Population and Cereal Supply



Based on FAO Statistical Data Base. http://apps.fao.org

Sustainability / S.F. Lincoln 5

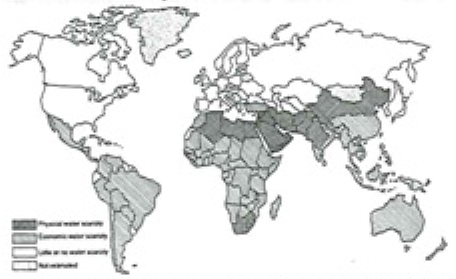
Predicted Food Shortage 2025



Data from the International Water Management Institute

Sustainability / S.F. Lincoln 6

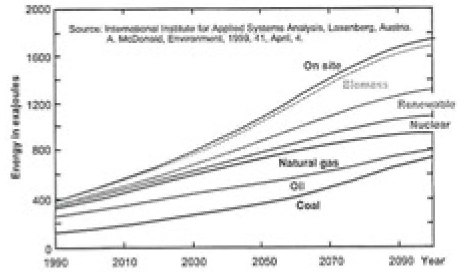
Predicted Water Scarcity 2025



Data from the International Water Management Institute. See also S. F. Lincoln, Challenged Earth: An Overview of Humanity's Stewardship of Earth, Imperial College Press, 2006

Sustainability / S.F. Lincoln 7

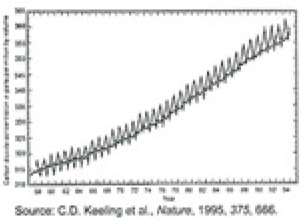
Projected Global Energy Consumption



Sustainability / S.F. Lincoln 8

Growth of Tropospheric Carbon Dioxide Levels

- Northern hemisphere levels (Mauna Loa, Hawaii) show large seasonal variation.
- Southern hemisphere levels (South Pole) show small seasonal variations six months out of phase with North.
- Growth of CO_2 levels parallels increase in anthropogenic CO_2 output.



Source: C.D. Keeling et al., *Nature*, 1995, *375*, 666.

Sustainability / S.F. Lincoln 9

Extreme Weather Events

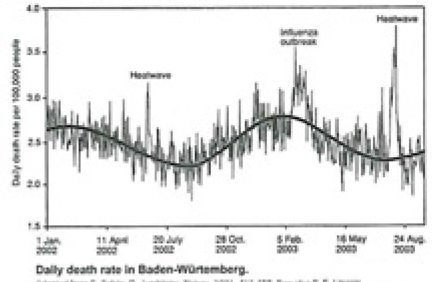
Image courtesy of NASA

Hurricane Katrina, August 2005

Global warming may be causing climate change and extreme weather events

Sustainability / S.F. Lincoln 10

Health – Climate Change and Disease



Daily death rate in Baden-Würtemberg.

Adapted from C. Schär, G. Jendritzky, Nature, 2004, 432, 559. See also S. F. Lincoln, Challenged Earth: An Overview of Humanity's Stewardship of Earth, Imperial College Press, 2006

Sustainability / S.F. Lincoln 11

Research at the University of Adelaide

Climate Change and Sustainability Research Centre:

Integrates:

- Research Cluster in Energy
- Research Cluster for Integrating Sustainability
- Research Cluster for Water

Sustainability / S.F. Lincoln 12

Specific Aspects and People at the University of Adelaide

This list is not exhaustive

Paleoclimate and Biodiversity
Profs. Alan Cooper, Bob Hill, Martin Williams, Steve Donnellan

Ecosystem Restoration and Sustainable Landscapes
Assoc/Prof. David Paton, Dr David Jones

Sustainable Farming
Prof. David Coventry

Urban Habitats
Profs. Chris Daniels, Terry Williamson

Email address: first name.surname@adelaide.edu.au

Specific Aspects and People at the University of Adelaide

Global Change and Coastal Management
Prof. Nicholas Harvey

Population Trends
Prof. Graeme Hugo

Geothermal Energy
Prof. Richard Hillis, Dr Martin Hand

Geosequestralion of CO_2
Prof. John Kaldi

Email address: first name.surname@adelaide.edu.au

Specific Aspects and People at the University of Adelaide

Metal Activated Conversion of CO_2
Dr Mark Buntine, Prof. John Bowie, Prof. Michael Bruce

Nano- and Green Chemistry
Prof. Stephen Lincoln

Alternative Energy and Greenhouse Research
Prof. Keith King, Dr Gus Nathan

Email address: first name.surname@adelaide.edu.au

There is a wide range of undergraduate degrees which contain components teaching aspects of sustainability, climate change and allied areas which feed into research.

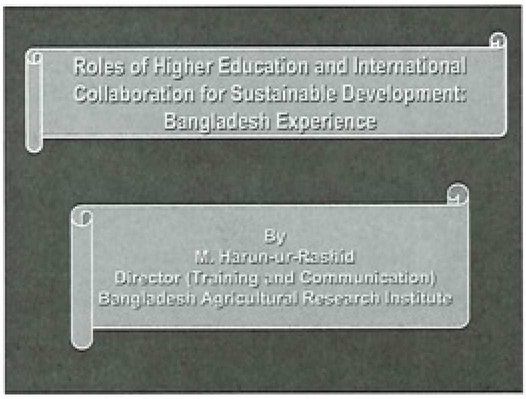
Earth

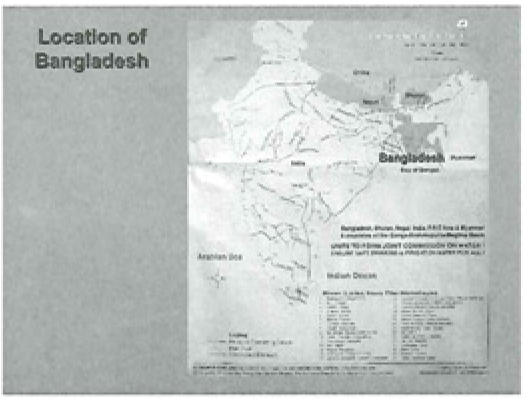
Hokkaido University International Symposium on Sustainable Development
Panel Discussion: Wednesday August 9, 2006 / 9:30am-11:30am
Panelist

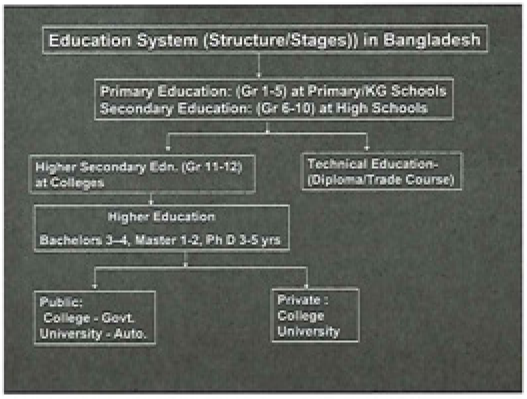
Roles of Higher Education and International Collaboration for Sustainable Development: Bangladesh Experience

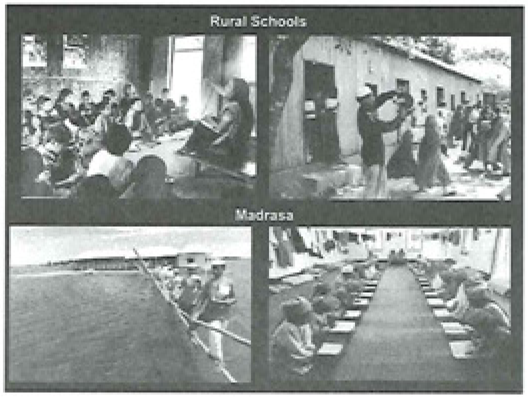
M. Harun-ur-Rashid

Director
Training & Communication Wing
Bangladesh Agricultural Research Institute (BARI), Bangladesh
E-mail: dir.tnc@bari.gov.bd









Higher Education: Major Fields

- General (Arts, Commerce, Science, Social Science)
- Engineering
- Agriculture
- Medical
- Religious

Higher Education & Sustainable Development

Components of Ideal Higher Edn.:

- Course work/ Class room Teaching
- Research & Development
- Outreach/Field/Extension Programs
- Exchange program

Features of Sustainable Development:

- Beneficial/Productive
- Accepted by community/stakeholders
- Scientifically/Technologically sound
- Environment friendly
- Replicable

Sustainable Development of Agriculture

- Satisfactory/high agril. production through the application of scientific/technical knowledge
- Low rate of degradation of farm environment
- Conserve natural resources & biodiversity
- Minimal use of external inputs

Higher Education Administration & Sustainable Development

Parameters	General	Engi-neering	Agri-culture	Medical	Reli-gious
Quality of Education	Medium – good	Good	Medium–good	Medium–good	Poor?
Applied Research & Development	Poor–good	Medium	Medium–good	Hospital oriented	Nil
Outreach/Community Linkage Program	Poor	Poor	Medium	Hospital oriented	Nil
Hands- on experience	Poor–medium	Poor – medium	Medium-good	Good (Internship)	Nil
International Collaboration	Poor–good	Poor - good	Poor–good	Poor–medium	Nil
Party Politics	High	Low	High	Medium	V. High

Higher Education Administration & Sustainable Dev. (Contd.)

Parameters	General	Engi-neering	Agri-culture	Medical	Religious
Education cost	G- low P- high	G- low P- high	Low	G-low P-V.high	V. low
Governance	Poor-good	Good	Poor–good	Medium-good	Dict.
Cont. Education	Inadequate	Inadequate	Inadequate	Nil	Nil
Curri/SD	Poor-good	Good	Good	Good	V. poor
Contribution to SD	Low-medium	Medium-high	Medium-high	Medium-high	V. low

Major Problems in Higher Education

1. Lack of good governance and forward looking vision – in many
2. Party politics (both teacher & students) thus biased decisions – in many
3. Lack of coordination among the depts. & the universities
4. Inadequate international collaboration & exchange program
5. Lacks in outreach/community linkage programs

Major Problems in Higher Education (Contd.)

6. Less out door activities- being in the fields allows one to get "hands-on experience" and see the things physically
7. Inadequate resource mobilization in education
8. Lack of facilities for advance Res. and technological development
9. Inadequate continuing education
10. Weak accreditation system

Trends in Government Expenditure on Education (% of GDP)

Fiscal Year	Revenue Expenditure	Development Expenditure	Total Expenditure
1973-1980 av.	0.63	0.27	0.9
1981-1985 av.	0.73	0.23	1.0
1976-1990 av.	1.03	0.30	1.3
1991	1.06	0.16	1.2
1992	1.14	0.21	1.4
1993	1.34	0.47	1.8
1994	1.36	0.66	2.0
1995	1.30	1.06	2.4
1996	1.30	0.83	2.1
1997	1.30	0.90	2.2
1998	1.39	0.77	2.2

Source: BBS and various budget documents quoted in World Bank (1999)

Percentage Distribution of Revenue Expenditure on Education by Sub-Sector

Fiscal Years	Primary	Secondary	Technical	University	NEF	Others	Total
1991/92	48.2	36.8	2.4	8.5	-	4.1	100
1992/93	44.6	40.6	2.3	7.9	-	4.6	100
1993/94	45.4	42.3	2.3	8.2	-	1.8	100
1995/96	43.8	42.6	2.1	8.0	-	3.6	100
1996/97	43.5	42.9	2.1	7.9	-	3.6	100
1997/98	43.0	46.5	1.5	7.4	-	1.6	100
1998/99 (B)	41.6	48.4	1.4	7.1	-	1.5	100

Source: Revised budget estimates as quoted in World Bank (1999)

Percentage Distribution of Development Expenditure on Education by Sub-Sector

Fiscal Years	Primary	Secondary	Technical	University	NEF	Others	Total
1991/92	40.1	23.5	7.3	22.3	-	6.8	100
1992/93	66.0	23.5	2.1	7.1	1.2	3.1	100
1993/94	68.2	18.9	1.9	9.3	0.9	0.8	100
1994/95	52.6	41.0	0.4	0.8	2.7	2.5	100
1995/96	45.6	43.6	0.6	3.7	2.9	3.6	100
1996/97	24.2	57.4	1.7	10.9	4.7	1.1	100
1997/98	26.8	45.2	2.2	13.3	9.2	3.3	100
1998/99 (B)	47.3	32.4	3.3	5.3	8.6	3.1	100

Source: Revised budget estimates as quoted in World Bank (1999)

Major Problems in Sustainable Development

1. Political/short term decisions
2. Lack of good governance
3. High unemployment rate
4. Misappropriation of funds
5. Decreased international collaboration
6. Lack of fund

Conclusions

1. Sustainable development and modernization require professionals with broad based education, skills, knowledge and positive attitudes. Education with background of research & development, and outreach programs can help achieve those. International collaboration can help in this regards.
2. To make education more applicable, productive and development more sustainable and global Bangladesh needs more international collaboration.

Conclusions (contd.)

3. With international collaboration, quality & standards of education and research & development are better and capacity building and technology/information generation/exchange etc, become easier and quicker.
4. With international collaboration, agricultural education and research are quite developed/advanced. Though cultivable land in Bangladesh is decreasing by 1% and population increasing by 1.5% (2.5 million people added annually), but food situation is still better now than decades ago. This was possible by the leadership of agricultural graduates with development oriented education. For further progress international collaboration is necessary.

Conclusions (contd.)

5. Madrasa (religious) education is not playing significant role for sustainable development– science, social science and development aspects are almost absent here. International collaboration is more needed in RE to make it scientific and productive.
6. Cooperation and collaboration among academic disciplines, institutes and nations are essential for sustainable development.
7. Bangladesh has huge unemployed graduates with international collaboration they can be utilized in sustainable development.

Conclusions (contd.)

8. Reforms in curricula – focusing on environment, sustainable development, entrepreneurship development, good governance, etc are necessary.
9. To conclude, we can say that, higher education, international collaboration and sustainable development are interwoven in one thread and these three things should be addressed equally and simultaneously.

Panelist

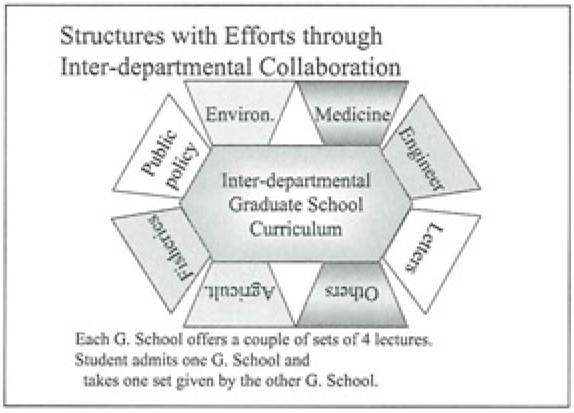
Hokkaido University Inter-departmental Study in Sustainability

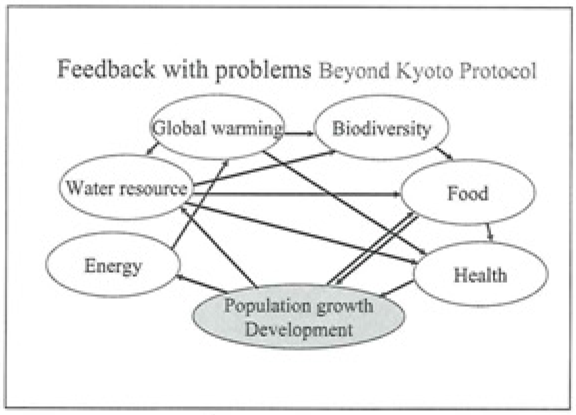
Motoyoshi Ikeda

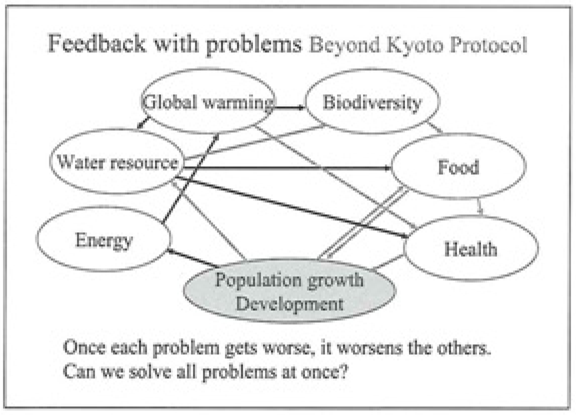
Professor
Division of Environmental Science Development
Faculty of Environmental Earth Science
Hokkaido University
E-mail: mikeda@ees.hokudai.ac.jp

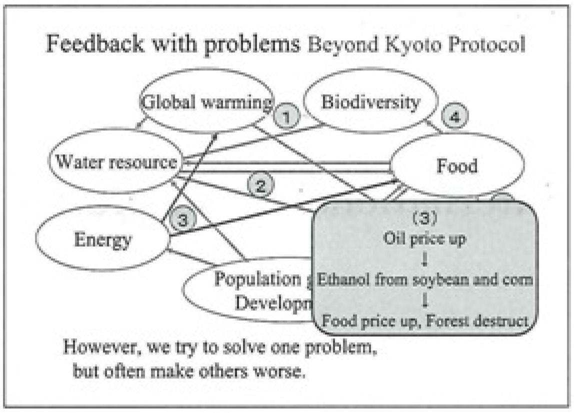
Hokkaido University Inter-departmental Study in Sustainability

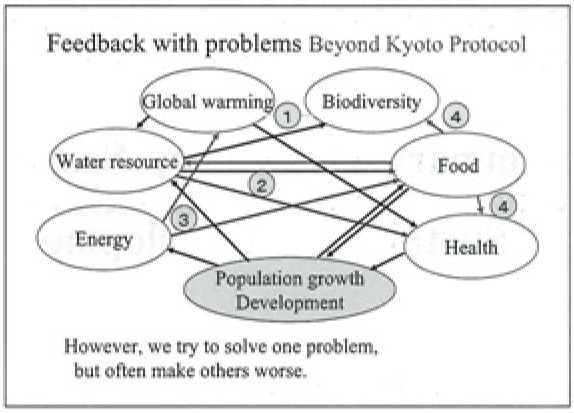
- Individual Graduate Schools offer sets of lectures and play a role of co-supervisor on the other schools' students.
- We offer lectures to the other universities through e-learning system and exchange students as well.
- Dual degree is still difficult to implement.

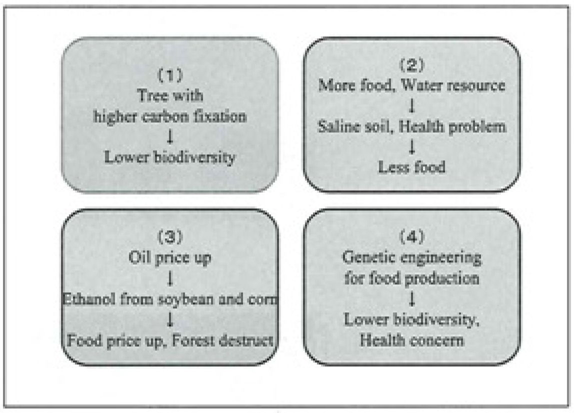


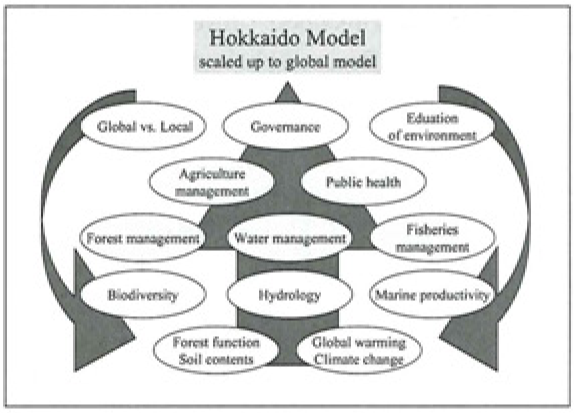





Feedback with problems Beyond Kyoto Protocol
Global warming
Biodiversity
Water resource
Food
Energy
(3)
Oil price up
↓
Ethanol from soybean and corn
↓
Food price up, Forest destruct
However, we try to solve one problem,
but often make others worse.


Feedback with problems Beyond Kyoto Protocol
Global warming
Biodiversity
Water resource
Food
Energy
Health
Population growth
Development
However, we try to solve one problem,
but often make others worse.


(1)
Tree with
higher carbon fixation
↓
Lower biodiversity
(2)
More food, Water resource
↓
Saline soil, Health problem
↓
Less food
(3)
Oil price up
↓
Ethanol from soybean and corn
↓
Food price up, Forest destruct
(4)
Genetic engineering
for food production
↓
Lower biodiversity,
Health concern


Hokkaido Model
scaled up to global model
Global vs. Local
Governance
Eduation
of environment
Agriculture
management
Public health
Forest management
Water management
Fisheries
management
Biodiversity
Hydrology
Marine productivity
Forest function
Soil contents
Global warming
Climate change

Summary of Plenary Session 1: Roles of Higher Education and International Collaboration in Sustainable Development

Chaired by **Takeshi Kishinami**

Vice President, Hokkaido University
E-mail: kisinami@coin.eng.hokudai.ac.jp

Co-chaired by **Midori Yamagishi**

Professor, Center of Research and Development in Higher Education, Hokkaido University
E-mail: midoriy@high.hokudai.ac.jp

Keynote Speaker:
Sheldon Shaeffer, Director, UNESCO Asia and Pacific Regional Bureau for Education, Bangkok
"Education for Sustainable Development: If Not the Solution, At Least a Start"

Panel Discussion: Roles of Higher Education and International Collaboration for Sustainable Development
Coordinator:
Norihito Tambo, President, University of Air, Japan
Panelists:
John Cusick, Assistant Specialist, Environmental Center, University of Hawai'i i at Manoa, U.S.A.
Stephen Lincoln, Professor, School of Chemistry and Physics, University of Adelaide, Australia
M. Harun-ur-Rashid, Director, Training & Communication Wing, Bangladesh Agricultural Research Institute (BARI), Bangladesh
Motoyoshi Ikeda, Professor, Faculty of Environmental Earth Science, Hokkaido University

While the urgency and the need for action on Sustainable Development is well recognized in many countries, there have been a great many of discussions on effective models and strategies for achieving this goal. There is no universal model of education for sustainable development (ESD). This session is designed to focus on the role of higher education in a cross-national context in the implementation of sustainable development.

The session began with a keynote address by Dr. Sheldon Shaeffer, Director of UNESCO Bangkok. Dr. Shaeffer outlined the vision of the UN Decade of ESD which UNESCO is promoting as a leading agency. He emphasized the importance of a partnership approach and the cultural component of sustainable development. A panel discussion presided by Dr. Tambo, the president of the University of Air, followed. Dr. Tambo raised the issue of sustainability and stressed the need of our commitment to the future. Each of the four panelists from higher education representing Australia, Bangladesh, Japan, and the USA, reported the current situation regarding ESD at his institution and the possibilities for future international collaboration on sustainable development (See copies of ppt. files). The issues and concerns related to ESD in undergraduate and graduate programs were discussed jointly with the audience on the floor.

Panelists provided several examples of multidisciplinary activities and innovative curricula involving sustainable development. The awareness of ESD, however, appears to be high among researchers predominantly in science and engineering fields. It was repeatedly brought up by the floor that more needs to be done in terms of connecting other sustainable development-related fields, particularly social sciences and humanities. Such issues as moral, ethical, fairness, social values, and attitudes towards consumption were assured to be included as the vital parts of ESD. In addition, high expectations were shown towards international collaboration. Benefits of various forms of collaboration were discussed; projects and case studies jointly coordinated by developed and developing countries, study-abroad programs, field trips, and eco-tours. An innovating interdisciplinary course on the Mekong Delta, offered in general education at the U. of Maryland, was briefly mentioned by the floor. The two-semester course was designed and taught by a mixed group of faculty members in the natural and social sciences with a focus on sustainability in the Mekong Delta. It provided students with the opportunity for an interdisciplinary examination of the region (history, culture, water and energy needs etc.) and related sustainability issues (a dam-building project, ecological and human threats of dam-building.). Furthermore, a three week study abroad program in China and Vietnam was offered to students so that they might examine what they had learned in the classroom in the actual world.

There was a feeling in this session that the biggest barrier to the promotion of ESD is the discipline-based system in academia. It is often the case among universities that the discipline (i.e. department) is the unit which allocates the resources and incentives. Therefore, multidisciplinary undergraduate programs such as those focusing on sustainable development, which involves the integration of the environment, the economy and society, are at a considerable disadvantage when it comes to getting resources, unless strong leadership exists. Dr. Tambo strongly argued that the departmental system, which dominates in the era of the modern university, needs to be replaced with an alternative system which is capable of solving the problems we face today. As is stated by Dr. Shaeffer in his address, this session concluded that the promotion of ESD requires a fundamental reform in the structure and nature of education, and that international collaboration among institutions of higher education must facilitate the development of new curricula which will help students to find new solutions to environmental, economic and social problems.

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3:Wednesday August 9, 2006 / 1:15pm-1:45pm
Keynote Speaker

Interaction between the Amur River Watershed and the Sea of Okhotsk in the Model of Sustainable Development

Petr Y. Baklanov

Director
Pacific Institute of Geography,
Far Eastern Branch of the Russian Academy of Sciences, Russia
E-mail: pbaklanov@tig.dvo.ru

A sustainable development of a region is its stable development during a long period of time in the economic, social and ecological spheres. This principal thesis is generally accepted in scientific literature. According to it, a region in the model of sustainable development should be considered and embraced as an integral natural and economic system (Fig. 1)

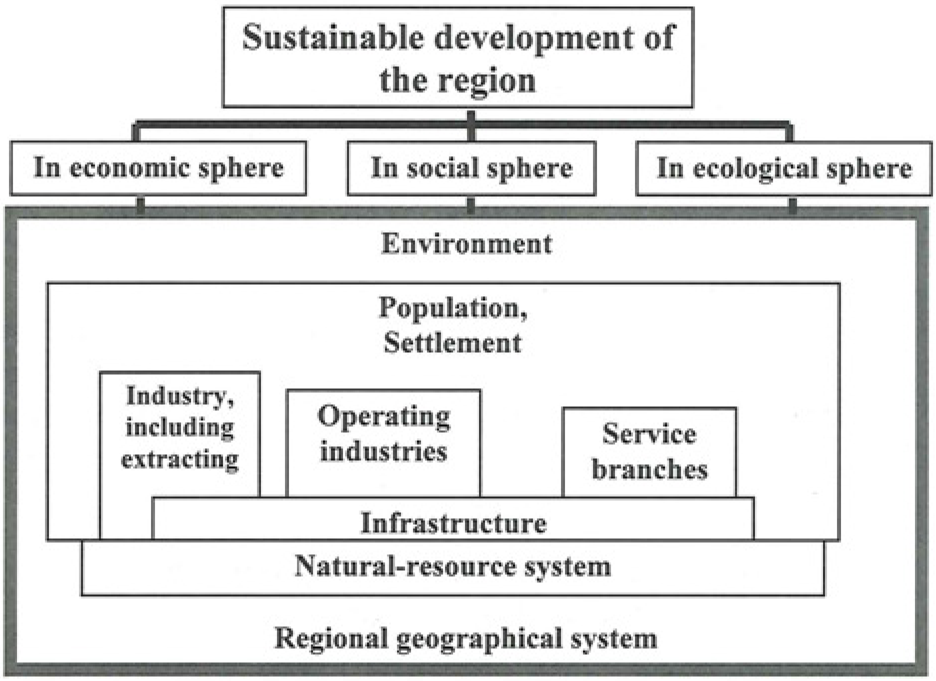


Figure 1. A region in the model of sustainable development

Basic principles of regional analysis in the model of sustainable development are distinguished as follows:

- A region, as an object of sustainable development should be considered as an integral natural and economic system;
- Assessment of dynamics of the region and covering of long periods of time should be taken in;
- Analysis of qualitative characteristics of dynamics, development of the region should be done.

A vision of economic, social and ecological qualities of a regional development has been introduced by the author (Baklanov, 2001).

The economic quality of a regional development is ability of the region due to its own resources to produce such a gross income, which can provide high levels of consumption and accumulation in the region for a long time.

The social quality of a regional development is ability of the region due its own demographic potential and social infrastructure to provide stable population in the region and to maintain high standards of life quality in the region during a long period of time.

The ecological quality of a regional development is ability of the region to maintain its natural-resource potential and high qualities of environment during a long period of time.

A sustainable development of the region is its development with high qualities of a regional development maintained for a long period of time (tens of years). Selection of the main parameters - indices and calculation of criteria and limitations of sustainable development is the major phase in creation of the model of sustainable development of the region (Fig. 2).

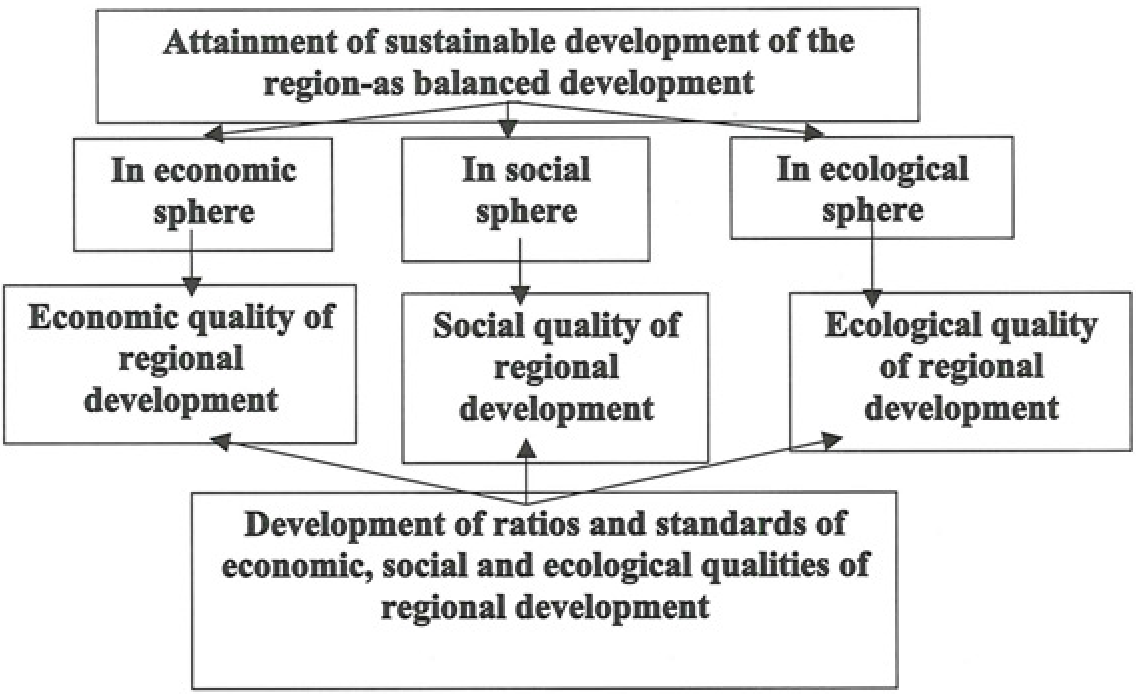


Figure 2. A scheme of sustainable development of the region.

First, the main indices of the region development in economic, social and environmental spheres are selected as indicators I_1, I_2 and so on. Then, the optimum values of these indicators as standards S_1, S_2 and so on are calculated.

- Setting standards - optimum values of the indicators

  $S_1, S_2, S_3............S_n$

- Then, assessment of deviation of the actual indicators from the standards:

  $S_1 - I_1 = K_1$

  $S_2 - I_2 = K_2$

  K_1, K_2 etc. are criterions of sustainable development.

The assessment of various characteristics, indicators of actual state of the Amur-Okhotsk region has been done. The regions of Amur River and the Sea of Okhotsk are considered here as a model of a sustainable development (Fig. 3).

Figure 3. The Sea Of Okhotsk watershed including Amur River basin.

As a whole, the basin of the Sea of Okhotsk includes the basin of Amur River. Taking into account the large size of the Amur River basin and its considerable influence on the resource and environmental state of the Sea of Okhotsk, this geosystem can be considered as composed from two interacting tiers (Fig. 4).

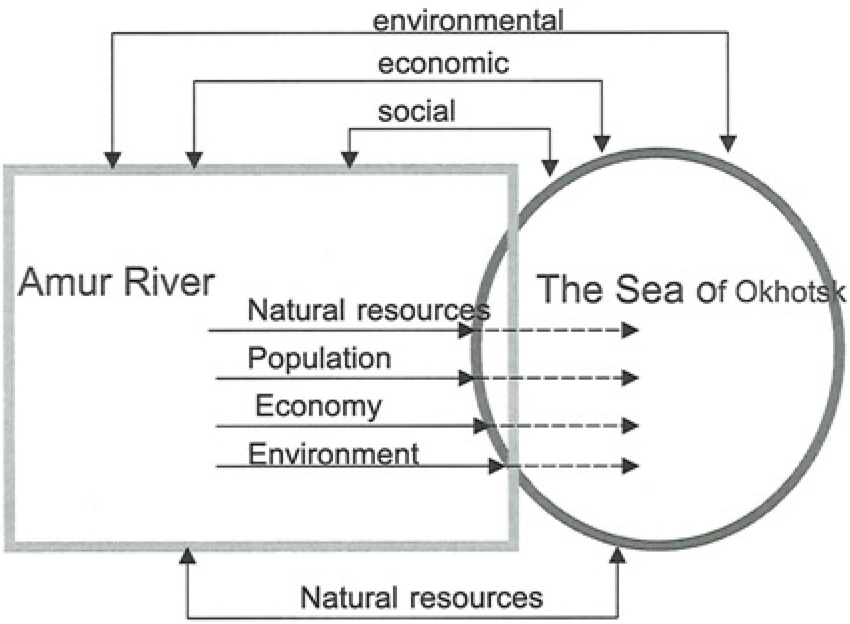


Figure 4. the Amur-Okhotsk two-tier geosystem.

The Amur River basin (the first tier) is an integrated geosystem (ecosystem). Different parts of the basin territory are related each other with natural processes, namely: surface water drainage, geochemical and ecological ones. Technogenic contaminations of some areas transfer to other areas through the Amur River tributaries. For instance, an emergency dumping of considerable volume of nitrobenzene to Sungari River in the People's republic of China in the end of the 2005 year entailed a contamination of waters and sediments of Amur River and its banks. By this reason, the basin geosystem should be studied and assessed as entire and integrated ones. If they are crossed by the state boundary, they become trans-boundary territories. The geosystems of Amur River and the Sea of Okhotsk are such geosystems namely. Nevertheless, it is expedient to carry out their survey, assessment and general organization of nature management within them according to the agreed international programmes (Baklanov, Ganzey, Kachur, 2005). Under relative independence of the Amur River and the Sea of Okhotsk basins, they are interacting between each other, first of all by means of fluid and solid river flow, atmosphere transfer, and other processes and links. The Japanese-Russian Amur-Okhotsk Project is devoted to the assessment of some of these relations (Fig. 4).

Below is the main characteristic - indicators of the Sea of Okhotsk basin (Fig. 5)

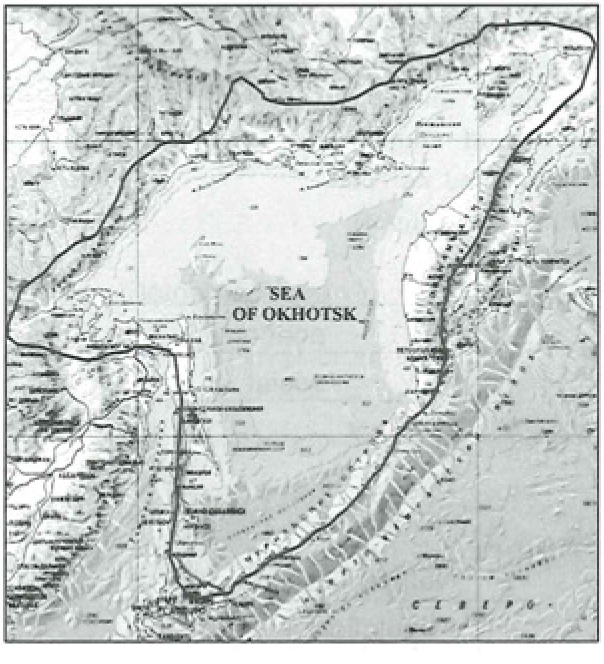


Figure 5. The Sea of Okhotsk basin
Blue line- borders of the Sea of Okhotsk Basin without Amur River Basin.
(from The Atlas Of Commercial Invertebrates And Algae Of The Russian Far East Seas. I. Arsamastsev ed., 2001)

We assessed an availability and combination of natural resources in separated districts of the Sea of Okhotsk. The following map was compiled in result of it (Fig. 6).

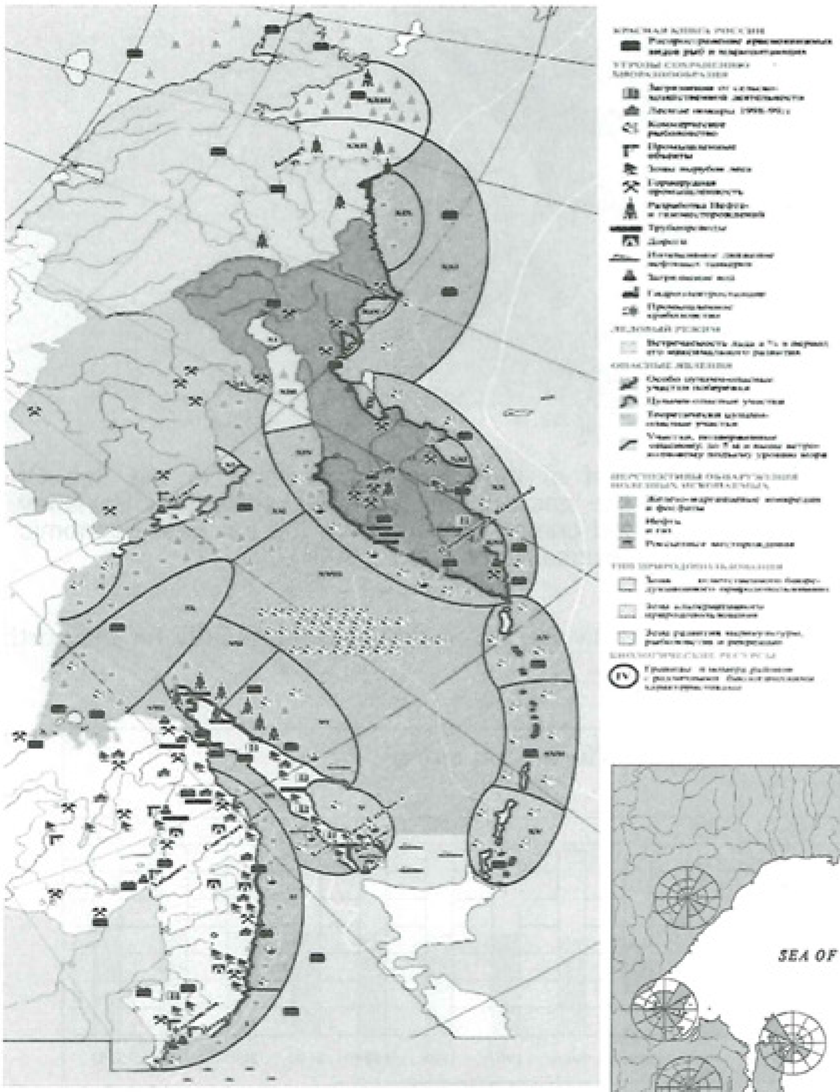


Figure 6a. Biological resources zoning
(from Nature management in the coastal zone. Vladivostok. 2003)

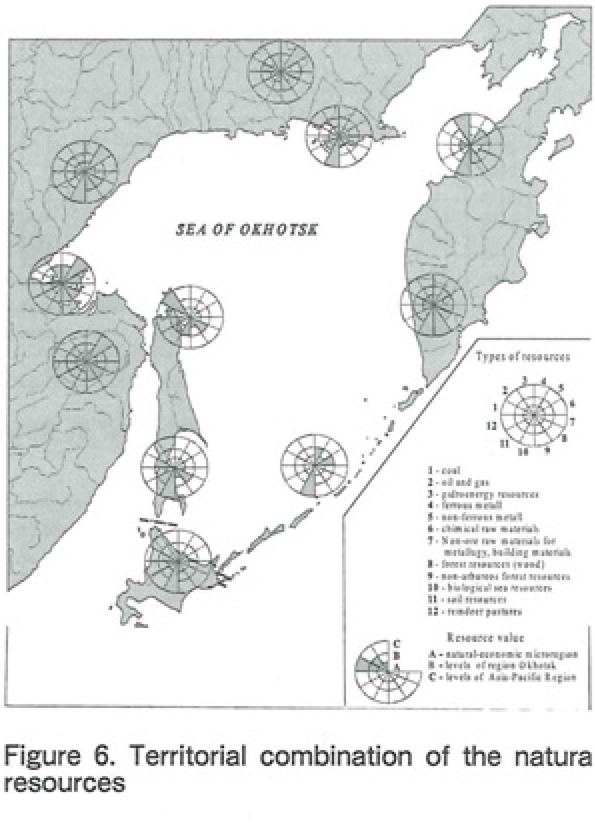


Figure 6. Territorial combination of the natura resources

The vast perspectives of this region are associated with availability of significant deposits of oil and gas resources on the shelf (Fig. 7).

Figure 7. Areas of perspective development of the oil and gas fields in the Sea Of Okhotsk Basin (1 - perspective fields of the gas and oil (from Alekseev A.V., Baklanov P.Ya., et al. Development strategy of fuel and energy resources for the Far East Economic Region up to 2020. DalNnauka Publishing House, Vladivostok, 2001).

At present, oil and gas are extracted in Yakutia and on SakhalinIsland, mainly on the north-eastern shelf (Fig. 8,9).

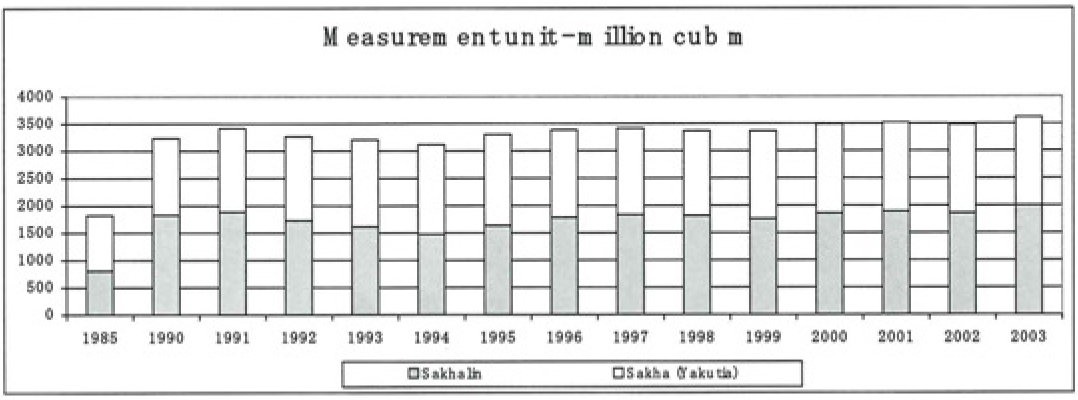


Figure 8. Gas Production Dynamics in the Russian Far East (from The Regions of Russia. Moscow, 2005).

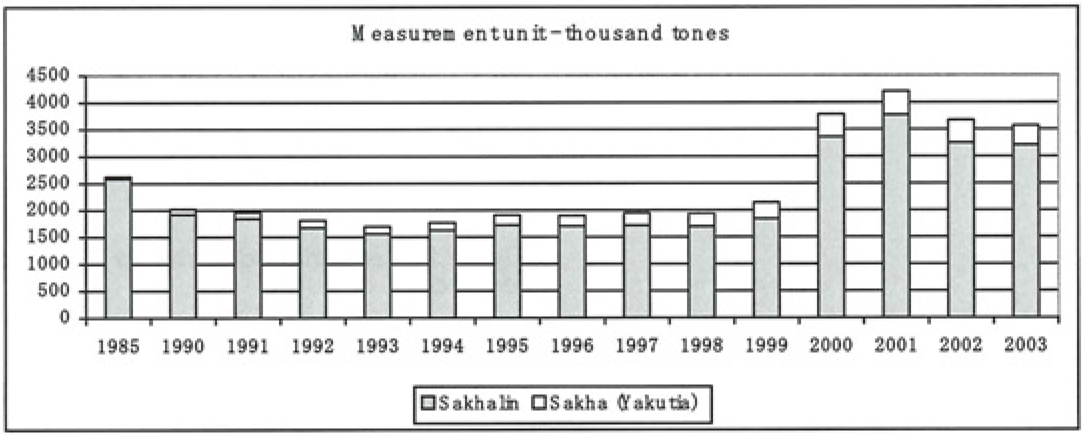


Figure 9. Oil Production Dynamics in the Russian Far East (from The Regions of Russia. Moscow, 2005).

Extraction of oil and gas resources will grow in future (Fig. 10). Construction of oil and gas processing factories, wide development of oil and gas pipelines network are also possible there. At the same time, it means an increasing of possible technogenic impacts on ecosystems of Amur River and the Sea of Okhotsk.

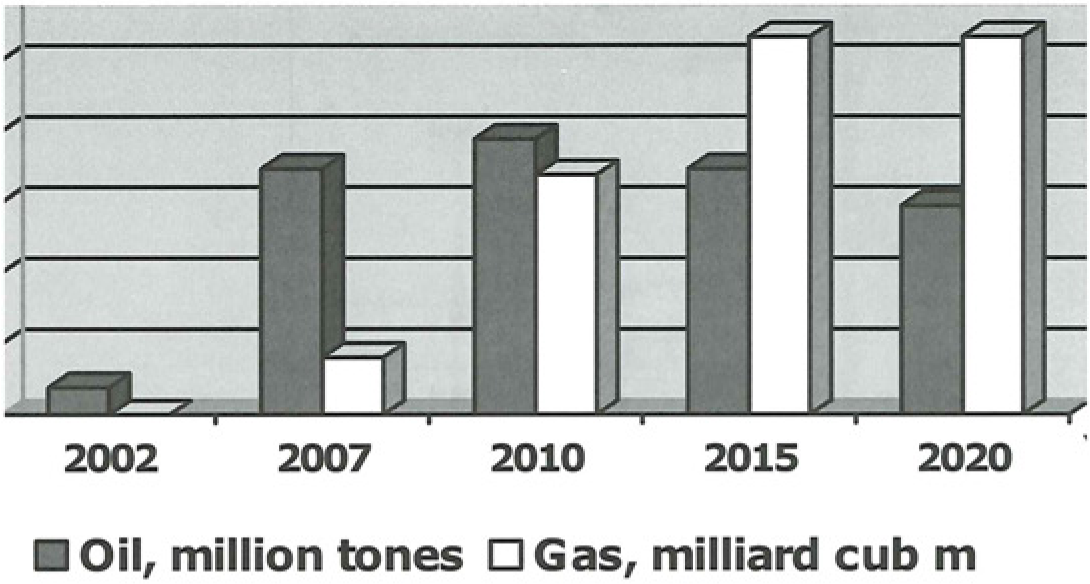


Figure 10. Predicted volumes of oil and gas production by Sakhalin-1 and Sakhalin-2 Projects (from The development strategy 2001)

Rather small population, over 1 million people live in the basin of the Sea of Okhotsk (Table 1).

Table 1. Population In Sectors Of The Sea Of Okhotsk Basin (thousands of people, 2000)

Sectors of the Sea of Okhotsk basin	Population in sector, people
Sakhalin +Kurils	335.000
Magadanskii	125.000
Khabarovskii	407.000
Kamchatkii	24.000
Japanese (Hokkaido Island)	310,000

(source – author's calculations)

Correspondingly, there is small density of population (Fig. 11). It stipulates moderate anthropogeneous contamination of the Sea of Okhotsk with communal discharge and waste.

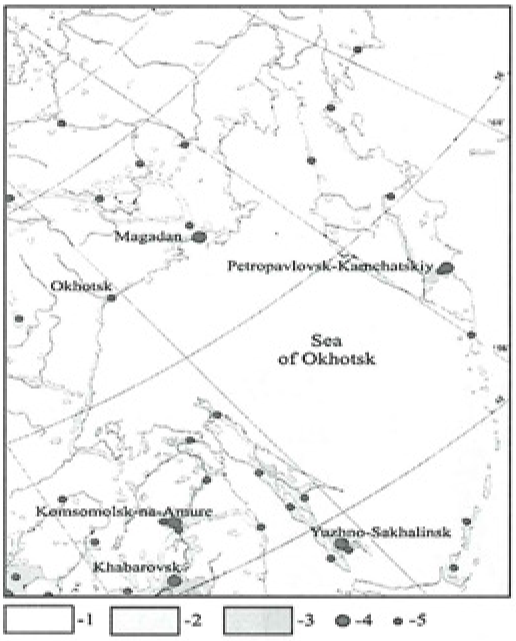


Figure 11. Density of population:
1 - Territories without permanent population;
2 - population density lesser than 5 people/km2;
3 - population density - 5-25 people/km2.
4 - urban population, 100-1000 thousand people;
5 - less than 100 thousand people
(Ecological atlas of Russia, 2002).

The general indicators of economic development in the Sea of Okhotsk region are given in Table 2.

Table 2. Basic Economic Characteristics Of Sectors of the Sea of Okhotsk Basin in 2000 (source - the author's calculations according to The Regions of Russia. Moscow, 2005).

Sectors of the Sea of Okhotsk basin	Population in sector, people	Share of total population of administrative territory, %	Gross regional product, millions of US $	Industrial output, millions of US $	Volume of agricultural production, millions of US $	Cost of basic assets of economics branches, millions of US $
Sakhalin +Kuril	335,000	61,24	722.9	615.8	38.1	2169.4
Magadanskii	125,000	68,41	286.6	244.6	8.5	1110.1
Khabarovskii	407,000	28,4	642.2	557.6	36.4	2931.5
Kamchatkii	24,000	6,3	37.2	32.7	3.5	134.3
Japanese (Hokkaido Island)	310,000	6,1	120025 4 mln. yens.			

Industries are mainly situated in the Sakhalin sector of the Sea of Okhotsk basin and in lower reaches of Amur River, Khabarovskii Krai (Fig. 12). Correspondingly, there are concentrated the major technogenous impacts.

Figure 12 Industrial nodes of the Okhotsk region
(source - the author's calculations according to The Regions of Russia. Moscow, 2002).

In recent years a growth of industrial manufacturing is observed there, but the growth is not steady (Table 3).

Table 3. Growth rates of industrial production (as percentage of preceding year).

	1995	1998	2000	2001	2002
Khabarovskii Krai	81	104	125	112	105
Kamchatkaya Oblast	108	95	107	101	93
Magadanskaya Oblast	86	96	101	108	106
Sakhalinskaya Oblast	109	104	113	110	87

Local agriculture is weakly developed there (Table 3).

Table 4. Production of agriculture by farms of all categories (in actual prices, millions rubles / millions US$)

Region	2000	2001	2002
Khabarovsk Krai	3841 128	5167 172	5930 198
Kamchatka Oblast	1649 55	1724 57	2114 70
Magadan Oblast	374 12	419 14	618 21
Sakhalin Oblast	1865 62	2890 96	2628 88

(source - the author's calculations according to The Regions of Russia. Moscow, 2003).

Small agricultural areas are situated in Sakhalin sector and in Khabarovskii Krai. Focal allocation of agriculture is in Magadanskaya and Kamchatskaya oblasts (Fig. 13).

Figure 13. Agricultural Landscapes Development
1- weak level of development with a share of agricultural lands of 1-5% of total area of a landscape and area of arable lands of less than 1-5 %;
2- weak level of development with a share of agricultural lands of 1-10% of total area of a landscape and area of arable lands of less than 1 %;
3- very weak level of development with a share of agricultural lands of 1 % of total area of a landscape and area of arable lands of less than 0.1 %;
4- landscapes used as hunting and agricultural lands;
5- tundra and tundra-forest landscapes, used partially as the deer pastures;
6- Taiga landscapes.
(Source - Ecological Atlas of Russia, 2002)

The Sea of Okhotsk is an important region for the Russian fishery in the Far East (Table 5).

Table 5. Catches of commercial fishes in different years (thousands tones).

	1992	1994	1996	1998	1999	2000	2001	2002	2003
By Russia's fleet in the Far Eastern basin (according to DalRyba data)	3,159.4	2,317.9	2,982.9	2,959.6	2,642.7	2,284.3	2,145.0	1,751.0	2,005.6
By Russia's fleet in the Sea of Okhotsk (according to DalRyba data)	1,510.8	1,495.9	2,132.6	1,878.4	1,454.1	1,418.5	1,257.8	865.3	1,060.0
By Russia's and foreign fleets in the Sea of Okhotsk (according to Radchenko)	2,353.2	1,775.2	2,417.6	2,030.0	1,584.2	1,509.1	1,308.7	–	

(source - The Sea of Okhotsk Project, GIWA)

The sea transportation and port development have an omportantn economic meaning for this region (Table 6).

Table 6. Consignments by sea transport from commercial ports (millions tones)

Ports of regions	1970	1980	1990	1997
Primorskii Krai	14,7	17,4	27,9	10,0
Khabarovskii Krai	4.3	6.6	7.7	1.9
Kamchatskaya Oblast	1,2	0,9	0,8	0,6
Magadanskaya Oblast	0,7	1,0	1,4	0,5
Sakhalinskaya Oblast	4,0	5,5	5,2	2,7
TOTAL	24,9	31,4	43	15,7

(Source: Transport and Communication of Russia. Moscow, 1997)

Some characteristics showing the environmental state of the Sea of Okhotsk areas, i.e. environmental indicators are given below (Tables 7, 8, 9).

Table 7. Fresh Water Consumption (millions cubic meters)

Region	1991	1995	2000	2001
Khabarovskii Krai	714	558	465	467
Kamchatskaya	309	276	261	252
Magadanskaya	144	137	90	96
Sakhalinskaya	455	376	275	273

(Source - The Russian Regions. Moscow, 2002.)

Table 8. Basic hydrological characteristics of Amur River and river run-off to the Sea of Okhotsk

Characteristics	Value
Water run-off, average, long-term, km^3	**369.1**
Run-off maximum, annual, km^3	**459.2**
Run-off minimum, annual, km^3	**135.0**
Maximum water discharge, m^3/s	**40 000**
Minimum water discharge, m^3/s	**153**
Average annual flow of detritus, millions of tons	**24.0**
Average annual water turbidity, mg/dm^3	**90.0**
Maximum water turbidity, mg/dm^3	**517.0**
Average annual flow of dissolved matter, millions of tons	**20.23**
including Ca^{2+}	**2.34**
Mg^{2+}	**0.74**
$Na^+ + K^+$	**1.60**
HCO_3^-	**10.40**
SO_4^{2-}	**2.10**
$C\ell^-$	**1.10**
Average annual flow of organic matter, millions of tons	**5.3**

According to assessments of Institute of Water and Ecological Problems, FEB RAS (2004)

Table 9. Production of toxic waste of production and consumption (thousands of tons)

Region	2000	2001
Khabarovskii Krai	412	305
Kamchatskaya	145	107
Magadanskaya	857	940
Sakhalinskaya	227	213

(*Source*: Russian Regions. 2002. Moscow, 2002.)

One can come to a general conclusion that by now the aggregated anthropogeneous impacts in the Sea of Okhotsk basin is not large (Fig. 14).

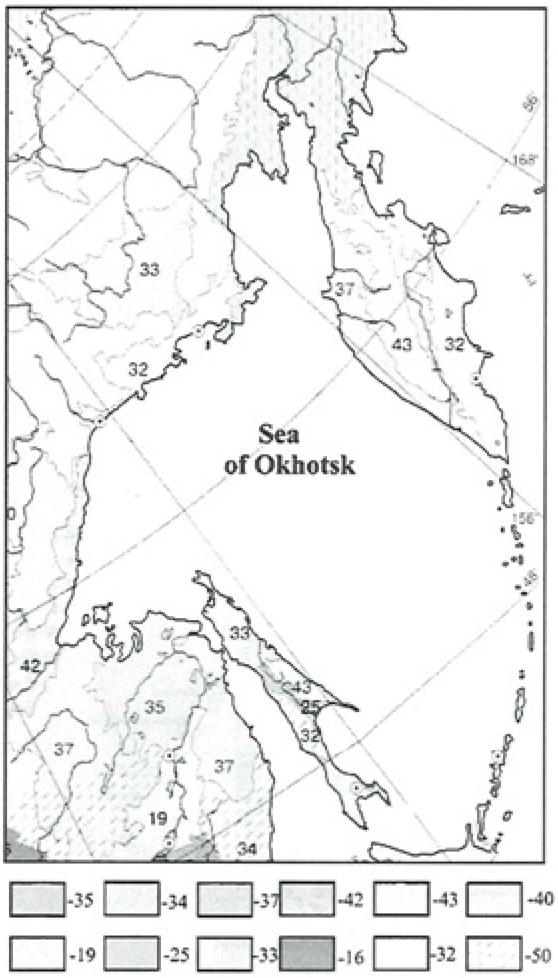


Figure 14. Anthropogenic loads on landscapes:
35- very low urbanization, population density, share of ploughed-up territory, technogenic contaminations;
34- low urbanization, population density, share of ploughed-up territory and practical absence of technogenic contaminations;
37- very low urbanization, population density, share of ploughed-up territory and practical absence of technogenic contaminations;
42- low population density, share of ploughed-up territory and practical absence of technogenic contaminations;
43- insignificant population density and practical absence of ploughed-up territory and technogenic contaminations;
40- insignificant urbanization, population density and practical absence of ploughed-up territory and technogenic contaminations;
19- medium urbanization, population density, low share of ploughed-up territory and sufficient technogenic contamination;
25- not high urbanization, population density, low share of ploughed-up territory and moderate technogenic contamination;
16- medium urbanization, population density, share of ploughed-up and moderate technogenic contamination;
32- low urbanization, population density, share of ploughed-up and moderate technogenic contamination;
50- intense exploitation of forests
(from The Ecological Atlas of Russia, 2002)

The authors (Baklanov, Ganzey, Ermoshin, 2005) assessed an availability and distribution of natural resources in various Russian-Chinese sectors of the Amur River basin (Fig. 15). There is a concentrated natural resources potential, and differentiated structures of nature management are developing

Fig. . The Basin of the Amur River.

Figure 15. Types of natural resources in the basin of Amur River

The Russian part of the Amur River basin is the most developed region of the Far East. The varied industries are located there. One can judge about their structure according to the Tables 10 and 11.

Table 10. Sectoral structure of industrial output in the Russian Far East in 2000, % of regional GDP.

Region	Electric power industry	Fuel industry	Nonferrous metallurgy	Chemical and petro-chemical industry	Mechanical engineering including shipbuilding and ship repair	Wood, woodworking and pulp and paper industry	Food-processing industry including fish complex	Other
Primorsky Krai	16.4	2.1	3.7	1.0	16.3	6.8	46.7	7.0
Khabarovskii Krai	8.5	7.9	8.4	1.6	50.4	8.0	8.5	6.7
Amurskaya Oblast	34.4	4.7	29.6	0.1	6.3	5.7	10.2	9.1
Kamchatskaya Oblast	20.1	0.3	8.3	0.1	4.0	0.6	63.3	3.3
Magadanskaya Oblast	15.3	1.1	66.4	0.0	1.5	0.3	14.0	1.4
Sakhalinskaya Oblast	6.0	60.6	0.2	0.1	1.2	3.2	27.4	1.3
Edreiskaya Autonomous Oblast	13.5	0.2	4.7	0.5	25.4	5.5	13.3	36.9
The Far East as a whole	11.4	13.2	29.8	0.6	16.7	4.1	19.8	4.4

(Source - The Russian Regions. Moscow,2002)

Table 11. Production of the main kinds of an industrial output in the Far East Region of Russia.

A kind of production	1985	1990	1995	1996	1998	2000	2000 to 1990 year
Power generation, million kw-h	38.1	47.5	38.5	37/4	35.0	38.8	0.8
Coal mining, million tons	51.6	49.8	33.8	32.4	27.8	28.3	0.6
Oil production, million tons	2.6	2.0	1.9	1.8	1.9	3.7	1.8
Oil refining, million tons	9.4	9.9	3.5	3.5	3.7	6.3	0.6
Gas production, billion cubic metre	1.8	3.2	3.3	3.4	3.4	3.5	1.1
Timber production, million cubic metre	26.1	23.5	7.4	6.5	4.9	8.4	0.4
Saw-timber production, million cubic metre	6.2	5.4	1.0	0.7	0.5	0.7	0.1
Catch of fish and sea products, million tons	4.2	4.6	2.8	3.0	3.0	2.3	0.5

(Source - Russian Regions. Moscow,2002)

According to Table 11, the main industries in the Amur River region are electric energy production, mining of coal and nonferrous metals, timber production and its partial processing, food industry.

Various kinds of transportation are also developed in the south of the Russian Far East, mainly in the Amur River basin (Table 12). All these kinds of transportation play a great role both in economic and social development of these regions.

Table 12. Transport accessibility of the Far East territory and its serviceability.

Basic indices	Primorsky Krai	Khabarovskii Kraiii	Amurskaya Oblast	Sakhalinskaya Oblast	Kamchatskaya Oblast	Magadanskaya Oblast
Distance from Moscow to the Oblast's centre, km	9302	8533	7985	10417	11 876	10511
Average distance between the urban settlements, km	54	129	95	40	172	146
Extension of navigable river sections, km	222	2999	1963	-	-	990
Number of marine coastal points(do you mean ports?)	34	38	-	74	34	50
Operational length of railways, km (1998) Density of railways per 10 000 km^2	1566 94	2307 29	2982 82	957 110	- -	- -
Length of motor roads (including departmental ones) (1998) (km) Density of motor roads for general use with hard surface, km per 1000 km^2	9647 43	8569 5,7	1156519	2655 21	1520 2,:8	3030 5,8
Provision of population with buses for general use, pieces per 100 000 people, 1999	57	67	54	76	76	103

(Source - Transport and Communication of Russia. 1999. Moscow)

The Amur River basin as a whole is relatively populated, over 85 million people live there, including about 5 million in the Russian part, over 80 million in the Chinese one, and about 50 thousand in the Mongolian part. Large differences in the numbers of population are reflected also in population density. Large contrasts in population density in the Russian and Chinese parts of the Amur River basin can be seen from Figure 16.

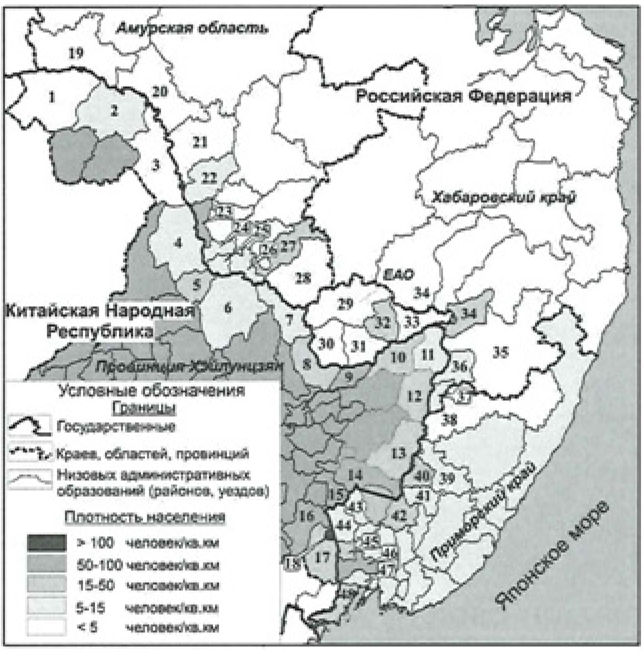


Figure 16. Population density along the Russian-Chinese border.
(from Ganzey, 2005)

Industries in the Chinese part of the Amur River basin are much more developed like extraction and processing of oil, coal mining, production of construction materials, wood processing, food industry and others. They all lead to far above technogeneous contamination of natural systems and river waters (Fig. 17, 18).

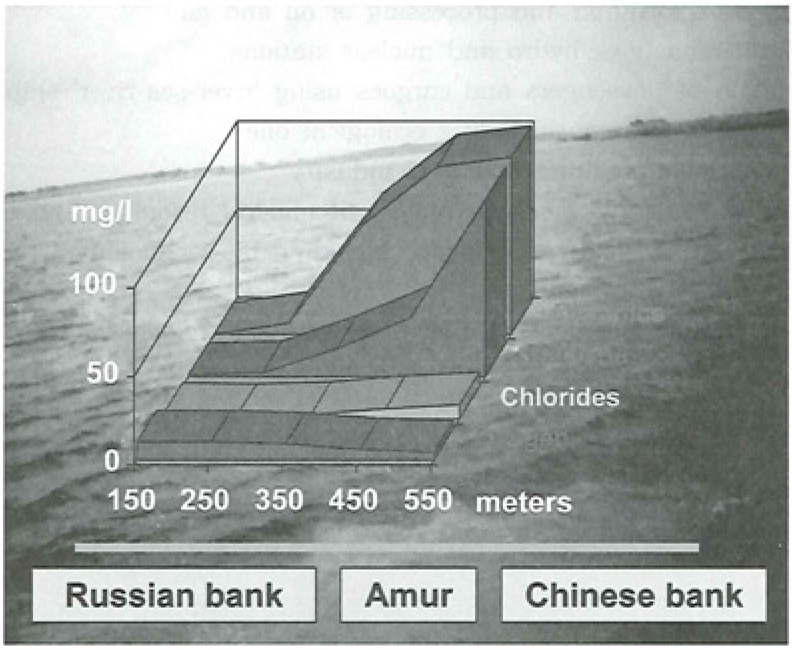


Figure 17. Concentration of pollutants in Amur River waters lower Sungari River mouth.
(source - data of the Institute of water and ecological problems, Far East Branch of the Russian Academy of Sciences)

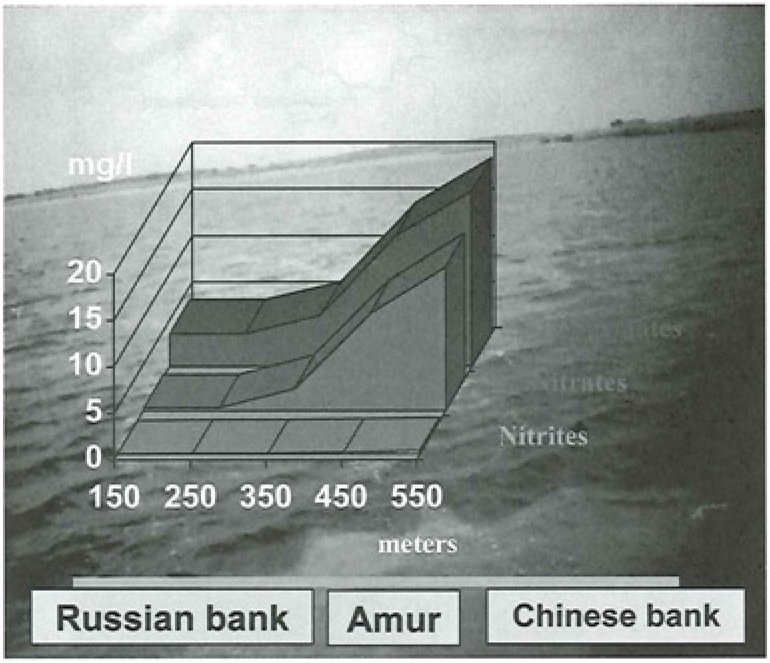


Figure 18. Concentration of pollutants in Amur River waters lower Sungari River mouth (source - data of the Institute of water and ecological problems, Far East Branch of the Russian Academy of Sciences)

On the basis of the analysis of natural and resources factors, and modern social and economic development, we estimate the following perspectives and priorities in the development of the Amur-Okhotsk region namely:

1. Fishery and sea-products processing
2. Extraction, transportation and processing of oil and gas
3. Energy production (gas, hydro and nuclear stations)
4. Transportation of passengers and cargoes using 'river-sea-river' ships
5. Various kinds of tourism, including ecological one
6. Various kinds of agriculture and food industry
7. Harvesting of forest resources, extraction of mineral resources and their processing
8. Development of high-end technologies, including bio-technology

Thus, the sustainable development of the Amur-Okhotsk region in present and in future should be based on rational sustainable nature management.

As a whole, regional nature management is a complicate multi-dimensional process. It can be represented as an interaction of three blocks like population and its activities, combination of natural resources and environment (Fig. 19).

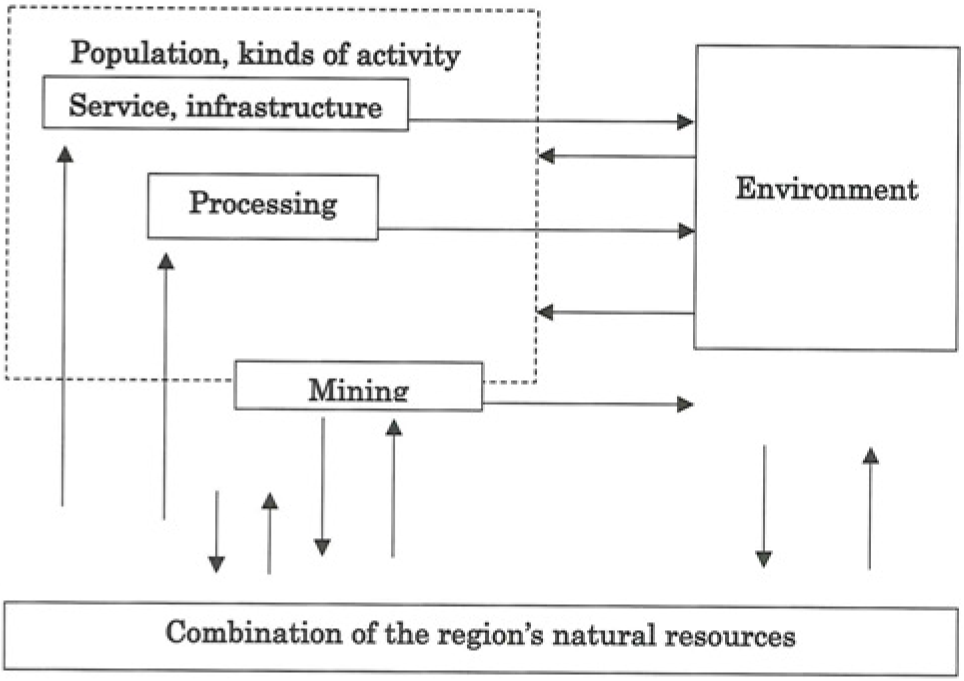


Figure 19. Basic links of the regional nature management

Generalization of the experience of regional nature management and own studies allowed us to formulate the following fundamental thesis as geographical axioms of the regional nature management

- In any kind of the economic activity, a combination of natural resources (land, aquatic, atmospheric etc.) is always used.
- Any kind of the economic activity realizes always a direct and reverse resources consumption. A reverse resources consumption means a reduction of the natural resources potential at the account of technogeneous impacts on natural resources.
- Different links of nature management are members of all components of the regional development.
- The particular links of the regional nature management are always realized and exist in the geographical form, i.e. have a strict territorial expression.
- There are a certain mutual complementarity and spatial-temporal symmetry of social-economic and natural-resource links in the regional development.
- The territorial natural-resource systems are the most complete object of the region's natural-resource potential estimation.

These axioms are important for full coverage and reflection of the regional nature management. The matrix models of nature management in the region have been developed on the basis of these axioms. A scheme of the complete model is shown on Figure 20.

	Activity kinds (enterprises, companies) E_1 E_2 E_3…….$E_к$	**Combinations of natural resources** R_1 R_2 R_3……..R_m	**Environmental components** K_1 K_2 K_3……..K_n	**Total estimations**
Kinds of activity (enterprises, companies)	Economic relations of enterprises, companies	Reverse resources consumption (change in natural resources by the waste of activity kinds)	Technogenic changes of environmental components	
Combinations of natural resources	Direct resources consumption	Inter-resource relations	Effect of extraction of natural resources on the environmental components	
Environmental components	Use of environmental characteristics in the separate kinds of activity	Effect of environmental variations on natural resources	Inter-component relations in the environment	
Total estimations				

Figure 20. The complete matrix model of the regional nature management

To develop the programs of sustainable development of the region, the assessments of dynamics of the regional natural resources potential are very important. For this purpose, the balance model of the regional natural resources potential dynamics has been developed (Baklanov, 2001) (Fig. 21).

Natural resources	R_1	R_2	R_3	R_4	R_5	Stock (estimates) for t_0	Estimates of natural resources dynamics						Stock (estimates) for t_1
							D_1	D_2	D_3	D_4	D_5	$\sum$ (D)	
R_1		K											
R_2			K_2										
R_3				K_3									
R_4					K								
R_5	K_5												
Some generalized (summary) characteristi													

Figure 21. A schematic diagram of the dynamic natural-resources balance of the territorial natural-resources system.

Basic parameters of balance:

R_1, R_2, R_3, R_4, R_5 are individual natural resources of the system, for example, land, water, forest, coal, metallic ores etc.

K_{12}, K_{23}, K_{34}, K_{45}, K_{51} are coefficients of inter-resource connections reflecting a change of the natural resource by unit: R_1, R_2, R_3, R_4, R_5 under change by unit of resources R_2, R_3, R_4, R_5, R_1 respectively. For example, K_{12} = 0,1 - means that under change (decrease) of resource R_2 by 1 (unit) 1 unit of resource R_1 changes by 0,1. I.e. K_{12} reflects an influence of R_2 dynamics on R_1 etc.

D_1, D_2, D_3, D_4, D_5 are individual components of the natural resources dynamics, including D_1 - dynamics due to natural processes, D_2 - due to resources extraction, D_3 - due to reverse resources consumption, D_4 - due to inter-resources links, and D_5 - due to new methods of assessment.

t_0 is some initial time of estimates. t_1 is some future time with estimates of the natural-resources potential dynamics for a period of (t_0 - t_1). Σ are some generalizations or summary characteristics.

Similar models (Fig. 20, 21) can be made using actual data (real-time indicators), and predicted assessments for various variants of the regional development. On the basis of similar models, the indicators, criteria and limitations can be calculated for variants of the regional nature management corresponding to sustainable nature management and development (Table 13).

Table 13. Indicators, criteria and constrains of the sustainable nature management

Types of indices	Indices, estimates
I Indicators of regional nature management	**1.** Reserves, volumes of natural resources; their qualitative and quantitative characteristics **2.** Volumes of extraction and use of separate kinds of natural resources
II Criteria of sustainable nature management	**1.** Indices of changes, dynamics of separate kinds of natural resources **2.** Balance calculations and estimates **3.** $\Sigma - \Delta$ NRP $\rightarrow$ min (minimization of the natural-resource potential reduction)
III Constrains of sustainable nature management	**1.** ΣR_{dir} (direct resources consumption) $\geq \Sigma R_{rev}$ (reverse resources consumption) **2.** $\Sigma - \Delta$ NRP $\leq \Sigma + \Delta$ NRP **3.** Environmental characteristics $\geq$established standards

According to the matrix models and calculations of indicators, criteria and limitations for sustainable nature management the following scheme for monitoring of regional nature management can be created (Fig. 22).

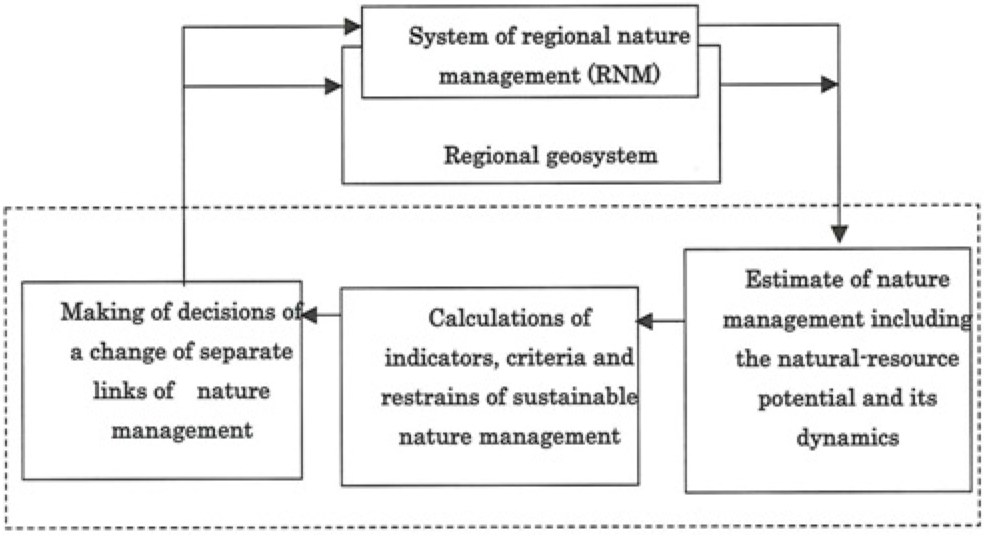


Figure 22. A scheme for monitoring of regional nature management.

Conclusions

1. Amur-Okhotsk region is a large two-tier transboundary geosystem
2. Sustainable development of the Okhotsk region is impossible without the balanced development of the Amur region
3. To ensure the sustainable development of the Amur-Okhotsk region, it is necessary to elaborate a complex international program and to organize an international monitoring

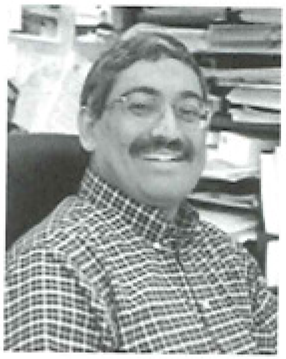
References

1. Baklanov P.Ya. The Far Eastern region of Russia. Problems and preconditions for sustainable development. DalNauka, Vladivostok, 2001. 144 p.
2. Baklanov P.Ya., Ganzey S.S. Frontier and transboundary territories as object of geographical researches // Proceedings of the Russian Academy of Science. Geographical Series. 2004. No. 4, p. 27-34.
3. Baklanov P.Ya., Ganzey S.S., Ermoshin V.V. Natural and economic zoning of transboundary territories // Geography and natural resources Journal. 2005, No. 4. p. 107-114.
4. Baklanov P.Ya., Ganzey S.S., Kachur A.N. Sustainable development of the basin geosystems under conditions of transboundary phenomena // Natural and resources, ecological and social and economic problems of environment in large river basins. Nauka, Media Press, Moscow, 2003. 368 p.
5. Ganzey S.S. Transboundary geo-systems in the south of the Russian Far East and in Northeast China. DalNauka, Vladivostok, 2005. 235 p.
6. Baklanov P.Ya., Arzamastsev I.S., Kachur A.N. et al. Nature management in the coastal zone. DalNauka, Vladivostok, 2003. 251 p.

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3: Wednesday August 9, 2006 / 1:45pm-2:05pm
Speaker

Sustainable Food Production: Integration of Food, Health and Environmental Challenges

Kalidas Shetty



Professor
Department of Food Science,
University of Massachusetts,
Amherst, U.S.A.
E-mail: kalidas@foodsci.umass.edu

Sustainable development requires us as a global community to capture the opportunities in Life Sciences to solve global problems. To achieve this the world needs a look at Biology as an integrated ecosystem. Therefore, Eco-Evolutionary pressures that drive Biological and Biochemical diversity (as genomes are plastic and adapt) are key to understanding individual Biological systems at the Cellular, Molecular and Biochemical levels. From this basic premise the challenges facing this world must be seen within the global human population trends that is projected to grow from the current 6 billion to 9 billion by 2050 with more people living longer. Another significant challenge that has emerged of late are the Food, Health and Wellness issues with more people excessively (excess calories) nourished than mal (under)-nourished. This has resulted in enhanced disease challenges from chronic obesity-linked diseases at a time many parts of the world are still facing the challenges of infectious diseases from mal-nutrition. Therefore, to understand and solve the sustainable development challenges facing humanity (and in particular food production and quality issues), we need to explore the opportunities and impact of Life Sciences. These opportunities have to be integrated with other technological changes emerging such as in the area of information technology and telecommunications in order enhance quality of life for all people within a sustainable ecosystem. These developments will have to be clearly linked to Environmental consequences of the above challenges and sustainability, with primary challenges coming for energy and water management. For all the above challenges we need an integrated approach (Systems Biology) for problem solving and especially in complex Biological Systems that are oxygen dependent (Redox Biology). These challenges and opportunities have to be seen within the perspective of a global economy and sustainable economic diversification that is bringing in new high growth countries such as India, China and Brazil.

Sustainable Food Production: Integration of Food, Health, Environmental Challenges

Dr. Kalidas Shetty

Professor of Food Biotechnology
Department of Food Science
University of Massachusetts
Amherst, Massachusetts, USA

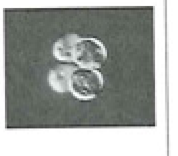
Integration of Redox (Oxygen) Biology as dominant biological systems are driven by oxygen-based energy metabolism

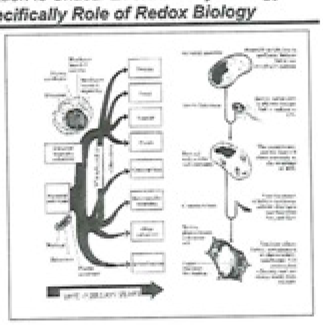
- Nature of Biological Systems and therefore Life Sciences is Complex from 3 Billion Years of Known Evolution. Harnessing this Knowledge for Technological advances (in Life Sciences) will require better understanding of "Critical Control Points" of Biological Systems for developing "Design" principles for Products, which means better understanding and Integration of Molecular and Metabolic Biology at Systems level ("Systems Biology") and in particular role of Redox (Oxygen) Biology

Where are the Challenges and Opportunities Based on Global Issues

- **Eco-Evolutionary Pressures** that drive Biological and Biochemical diversity (**genomes are plastic and adapt**) are key to understanding individual Biological systems at the Cellular, Molecular and Biochemical levels.
- This core investigative direction has to take into account
- Current human population trends (8-9 billion by 2050) and **more living longer.**
- **Food, Health and Wellness issues** with more people excessively (excess calories) nourished than mal(under)-nourished .
- Technological and economic evolution, especially impact of **Life Sciences** and **Information Technology** on Quality of Life.
- **Environmental consequences** of the above issues and **sustainability. Energy** sources/de-centralization
- and **Fresh Water** conservation/pollution
- **We need an integrated approach (Systems Biology) to problem solving and especially in complex Biological Systems.**

Better Understanding of Cellular Evolution and Organization is Critical-Evolutionary Biology &Specifically Role of Redox Biology





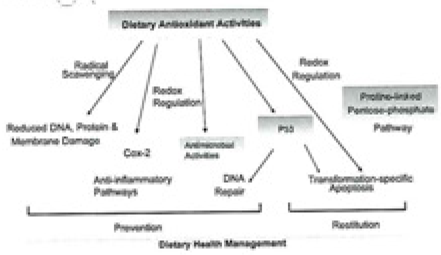
Systems Biology Concept by Kitano

- Kitano, H., 2002-Systems Biology. Science: 295: 1662-1664
- "To understand biology at the systems level we must examine the structure and dynamics of cellular and organismal function, rather than the characteristics of isolated parts of cell or organism"
- " A system level understanding of a biological system can be derived from insights into 4 key properties:

1) Systems Structures: Network of gene interactions and biochemical pathways; mechanisms by which these interactions modulate the physical properties of intracellular and multicellular structures.
2) System Dynamics: System understanding over time through metabolic analysis, biochemical factor responses and sensitivity analysis.
3) Control: Mechanisms that control the state of cell, tissue or organism and prevent malfunction and identify targets of interventions.
4) Design: Construction of biological systems with desired properties dependent less of trial and error and more based on biochemical principles. Stronger concept-linked as well as hypothesis-driven research is key to better design. "

REDOX BIOLOGY IS IMPORTANT TO SUSTAINABILITY OF BIOLOGICAL SYSTEMS & BASIS FOR CRITICAL CONTROL POINT

(Adapted from Brash and Havre, PNAS 2002: 99,13969)



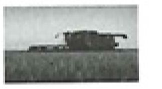
Sustainable Development Targets

- Agriculture and Food
- Health
- Industrial
- Environmental
- Energy
- Water

Agriculture and Food

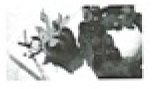
Low in put Agriculture

- Improvement of Yields—Photosynthesis/Respiration
- Pest and Pathogen Tolerance/Low Chemicals
- Stress Tolerance/Abiotic
- Nutrient Improvement
- Weed Management



Healthy Food

- Functional Foods
- Food Preservation
- Post-harvest Management
- Waste Remediation
- Novel Ingredients
- Dairy
- Alcoholic Beverages



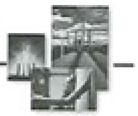
Health

- Protein Therapies
- RNA interference
- Vaccines
- Small Molecules
- Complex Carbohydrates
- Complex Lipids
- Nutritional Therapies
- ALL targeted for specific diseases

Industrial

- Solvents
- Detergent Proteins
- Enzymes for various applications
- Intermediates for complex synthesis
- Amino acids
- Nucleic acids

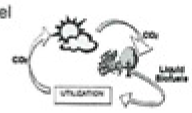
Environmental



- Detoxification
- Waste Remediation
- Indoor Pollution Control
- Sanitation
- Water Purification systems

Energy

- Biofuels—Bio-Ethanol
- Biomass-Plant systems
- BioMethane
  BioDiesel



Technologies and Approaches for SUSTAINABLE Product Development

–Concept-driven technology approach

- Science/Concept-driven technology approach
- Need Original Thinking and Creativity
- Need to Think Outside the Box and Outside Normal Approaches
- Biological Complexity requires a "Systems Approach" and this is more complex than Software Development for "Systems Integration" in machinery and many, many times more complex than hardware manufacturing
- Need to consider Evolutionary concepts and Traditional Knowledge to enhance quality of science concepts
- Better integration of Natural and Social sciences to have maximum effect

Complex Biology Technology Platforms

based on Critical Control Points -- CCP

Development of Technology Platforms

Resource Development and Management

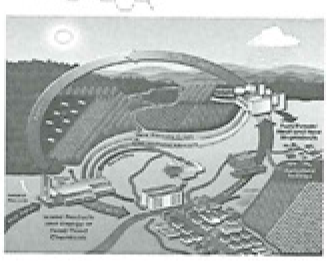
Development and Integration of Value Chain-Complex Integration

Technology Partnerships-National and International

Other Critical Needs

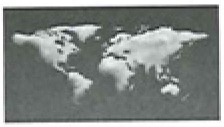
- Techniques and Instrumentation to address concepts and develop technologies—Tools to understand at Molecular level to Eco-Systems level and now Nano level
- Integration of Concepts and Technologies
- Interdisciplinary approaches
- Integration of Systems and Molecular Approaches

Focus on Major Global Challenges



- Food, Health and Environmental Challenges
- Water and Energy Challenges
- Downstream and Value-added technologies focused on quality of life and sustainability

Overall Understanding of the World Around Us and World Experiences



Turning
Global dreams
into reality

- Global Technology Assessment and Progress
- Resource and Commercial Geography
- Global Economic Development
- Global Political, Philosophical & Social History
- Challenges Posed by China Brazil, New Russia and India—Rapid Changes and New Models calls for Effective Partnerships (by 2025 55-60% of global GDP would move to Asia)
- Sustainability challenges posed by above

THANK YOU FOR YOUR KIND ATTENTION and HOSPITALITY

"Sathwath Sanjayathe Jnanam"

"True knowledge comes from understanding the essence of existence"

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3: Wednesday August 9, 2006 / 2:05pm-2:25pm
Speaker

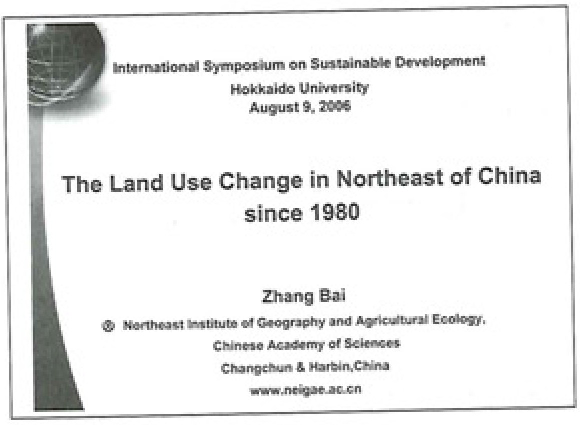
The Land Use Change in Northeast of China since 1980

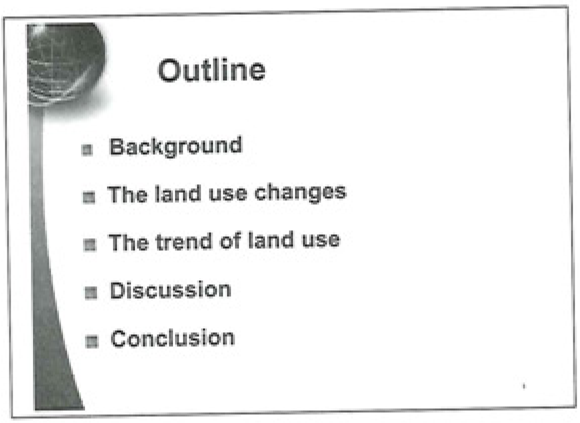
Bai Zhang

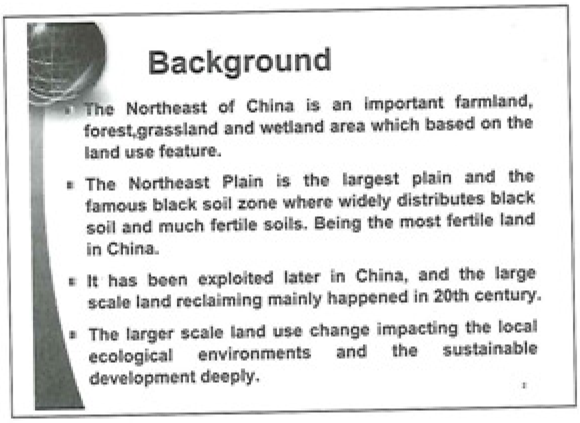
Director
Northeast Institute of Geography and Agricultural Ecology,
Chinese Academy of Sciences, China
E-mail: zhangbai@neigae.ac.cn

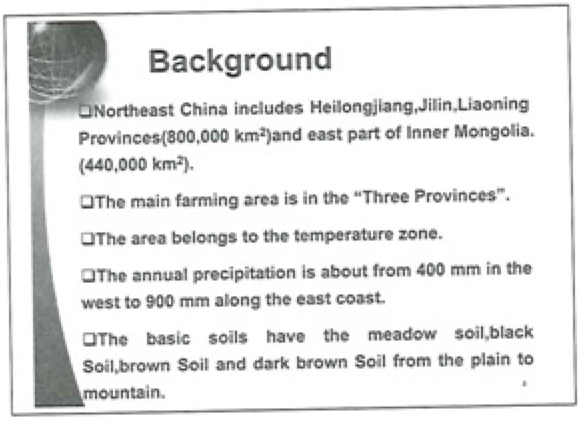
Human-induced changes in land use/cover form an important component of sustainable development research. Therefore, it is important to study land use/cover and its change. Northeast China is one of the main agricultural regions in China, its yield of corn and soybean now accounting for more than 30% and 40% of the nation's total. In the past two decades, Northeast China has suffered dramatic land use change as a result of activities of human beings. These changes led to aggravating loss of water and soil, decrease in soil fertility in the black soil zone of the central part, wetland loss in Sanjiang Plain, desertification and grassland degradation in western part. There were many efforts to analyze climate change, landscape change, and effects of agricultural activities on local environment in Northeast China. Yet quantitative knowledge on changes in land use and in ecosystem services at regional level for the whole area is few. For this reason, three datasets of land use/-cover produced from 1980 and 2000 Landsat satellite images were overlaid in ArcInfo to reveal changes in land use/cover. In addition, this study aims to elucidate the interactive nature between changes in land use/cover caused by human activities and the environment (e.g., climate) in Northeast China in the past two decades.

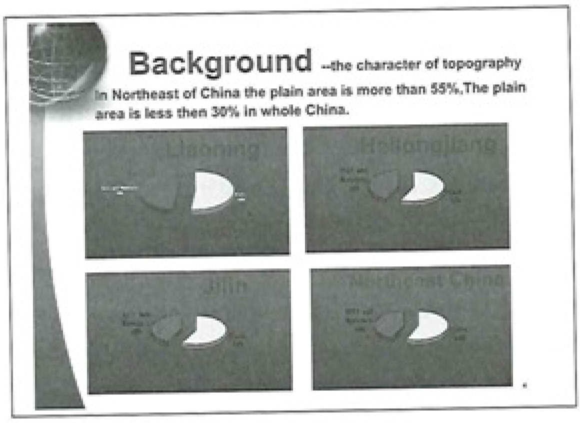
From 1980 to 2000, according to study results obtained from Landsat images, widespread changes in land use/cover took place in Northeast China. Grassland, marsh, water body and woodland decreased by 9864, 3973, 1367 and 10052 km^2, respectively. By comparison, paddy field, dry famland, and built-up land expanded by 7339, 17193 and 700 km^2, respectively. These changes bore an interactive relationship with the environment, especially climate change. On the one hand, climate warming created a potential environment for grassland and marsh to be changed to farmland as more crops could thrive in the warmer climate, and for dry farmland to paddy field. On the other hand, the changed surface cover modified the local climate. These changes, in turn, have adversely influenced the local environment by accelerating land degradation in the agro-pastoral belt of western part of Songnen Plain, and exacerbating flooding in the drainage areas of the Songhua River and the Nenjiang River.

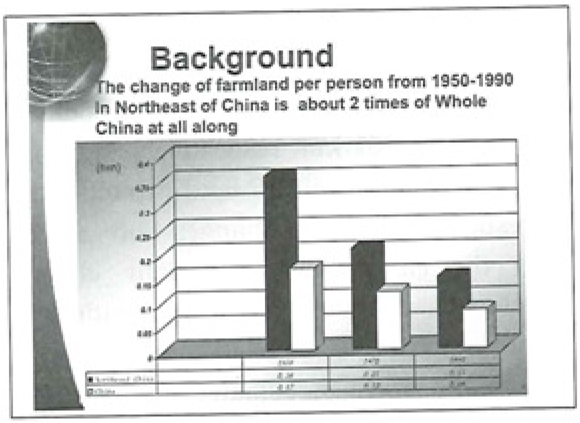


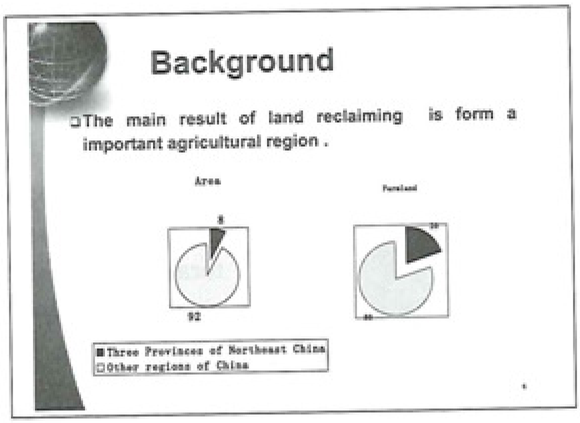






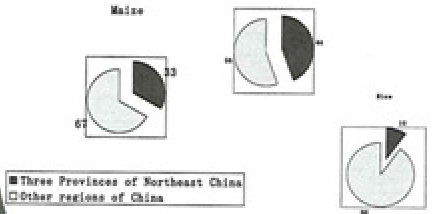






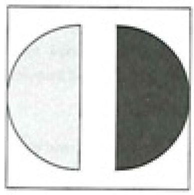
Background

- The main result of land reclaiming is to produce a great many grains .



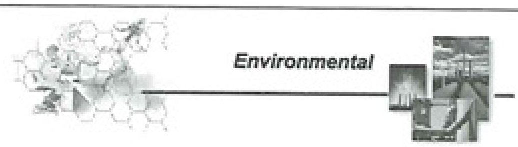
Background

- The NE-China provided about 50% of total commercial grain in China every year since 1980.



The land use changes

- The land use information is figured from Landsat satellite images in 1980 and 2000 which is overlaid in GIS to show the changes.
- Meanwhile, the spatial features of regional land use change can be modeled.
- The study aims to analyze the land use changes which caused by human activities and natural waves.It can provide some information for the sustainable development research in the area.



Environmental

- Detoxification
- Waste Remediation
- Indoor Pollution Control
- Sanitation
- Water Purification systems

The land use changes

Land use change of each category from 1980 to 2000

Land use type	1980	2000	Change		
	(km^2)	(km^2)	km^2	%	%per year
Paddy field	36631	43970	7339	20.04	1.67
Dry land	239335	256527	17193	7.18	0.63
Forest	359349	349297	-10052	-2.80	-0.26
Grassland	59018	49154	-9864	-16.71	-1.65
River & lake	25959	24592	-1367	-5.27	-0.49
residential area	23666	24367	700	2.96	0.27
Wetland	33553	29581	-3973	-11.84	-1.14
Unused land	12406	12466	60	0.48	0.04

The land use changes

- From 1980 to 2000, the paddy field increased fast. The area of paddy field increased by 7,339km^2 (20.4%).
- The dry land increased by 17,193 km^2 (7.2%).
- The grassland decreased from 59,018 km^2 to 49,154 km^2(16.7%).
- Area of wetland, river & lake and forest decreased by 11.8%, 5.3%, and 2.8%.

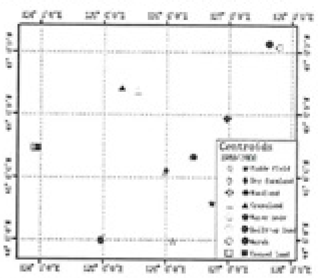
The land use changes

- Through calculated the area-weighted centroids to show the land use temporal changes.
- The movement of spatial distribution was defined as the difference between centroids of each land use type in different periods.

$$X_t = \sum_{i=1}^{N}(C_{ti} \times X_i) / \sum_{i=1}^{N} C_{ti} \qquad Y_t = \sum_{i=1}^{N}(C_{ti} \times Y_i) / \sum_{i=1}^{N} C_{ti}$$

Where X and Y are abscissa and ordinate of all the patches of land use type in different periods, respectively. Ai is the area for patch 'i'. Xi and Yi represent the abscissa and ordinate of the patch 'i'.

The land use changes



Movement of centroids of each land use type in Northeast China from 1980 to 2000

The land use changes

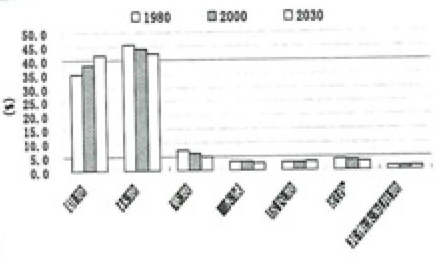
- From 1980 to 2000, the centroid of paddy field move to north-eastward with a distance of 84 km. This was related to the climatic warming trend and the technique development of rice planting in colder northern region.
- The centroid of grassland move to north-westward with a distance of 20 km, which resulted from reclamation of grassland, mainly in Songnen Plain.
- Due to change into farmlands, the centroid of wetland shifted to south-eastward with a distance of 14 km.
- The centroid of dry farmland, residential area, unused land and river & lakes moved about 6 km,5 km, 4 km and 3km.

The trend of land use

The land use trend is predicted which based on the MORKOV model

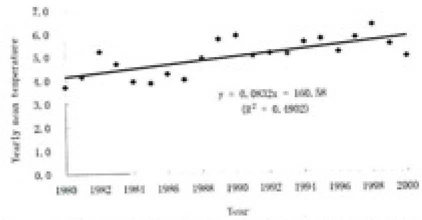
Land use type	Area in 2030 (km^2)	%
Paddy field	50713.07	6.42
Dry land	277816.00	35.17
Forest	334137.50	42.30
Grassland	39970.12	5.06
River & lakes	22196.84	2.81
Residential area	25119.50	3.18
Wetland	25435.53	3.22
Unused land	12006.83	1.52

The trend of land use



Discussion

Natural changes-Climate ......



According to the 49 stations data in NE-China during 1980–2000, the yearly mean temperature showed the rising trend

Discussion

Natural changes-Climate ......

- Associated with this warming trend ,the growing season was prolonged.it enables cultivation of rice in more northern areas than before
- So that a lot of wetland and dry land changed into paddy field in Heilongjiang and Jilin provinces.
- As a result, the wetland and grassland dramatic decreasing in these provinces.

Discussion

Human action-Policy , technology &market...

- Because of the magnitude population in China, the government have to pay the strict attention to the huge food requirement with eco-environmental protection. Under this situation, farmland was increased through reclamation of grassland and wetland year by year.
- After 1980, the maize and soybean were not so profitable as rice in the market.Meanwhile,followed the development of rice planting technology in colder area the paddy field was extended sharply.

Conclusion

- By analyzing the land use change in Northeast of China since 1980, the transitions from grassland into dry land ,dry land and wetland into paddy field are the dominative points.
- Modeling the land use trend in the future, the farmland and residential area are going to increase continuously and the proportion of farmland will reach to 40 % of Northeast China.
- Keeping the adaptive and stable land use is important for sustainable development.

Thanks!

zhangbai@neigae.ac.cn

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3: Wednesday August 9, 2006 / 2:40pm-3:00pm
Speaker

An Evaluation of Water Allocation Mechanisms: A Korean Case

Dong-Geun Han

Professor
School of Economics and Finance
Yeungnam University, Korea
E-mail: dghan@ynu.ac.kr

According to a report by UN, Korea is classified as a water-shortage country. Annual total amount of rainfall in Korea may not seem insufficient, but the rainfall concentrates mostly in the monsoon season, and there are considerable deviations among different regions.

There is a big debate under way about how to deal with the problem. Some people assert that we need to build more dams to store up the rainwater. Others argue that water management needs to be more efficient and that dam construction is not a sustainable approach, only to destruct environment.

Supporting the demand management approach, my paper is about how to improve the efficiency in allocating scarce water among regions. The study offers two methods of water allocation between upstream and downstream regions; a proportional allocation method and a fixed-amount allocation method. The former method assigns each region with a proportion of the total water available in a river. The latter method allocates a fixed-amount of water to the downstream region, with the leftover being assigned to the upstream region. We apply those methods to Hwang River in Korea and evaluate the performances of each allocation method. This case study shows that, in general, the proportional allocation method is superior from an efficiency point of view, while the fixed-amount method dominates from a risk-equity point of view.

An Evaluation of Water Allocation Mechanisms: A Korean Case

Dong-Geun Han

Yeungnam University

---

1. Introduction

Background

- Shortage of 1.8 billion tons of water in Korea by 2011
- Environmental concerns prevent building new dams
- Regional disputes over water resources
- Need to improve efficiency in water allocation

Objective

- Improve water allocation method from efficiency and equity point of view
- Evaluate water allocation methods

Introduction

Methodology

- Offer three water allocation mechanisms by which water is allocated between upstream and down stream regions
- The first mechanism is an optimal allocation, a solution to the social-utility-maximizing problem with no constraints imposed
- The second mechanism is a proportional allocation: pre-determined proportion of water is allocated to each region
- The third mechanism is fixed allocation: a fixed amount of water is given to downstream region, with the leftover being assigned to the upstream region
- Risk analysis with variation coefficients

Model

Basically we extend Bennet et al. (2000)'s model, and add risk analysis using variation coefficient.

Social Utility

$$\max_{C_L} \; E\{ B_U(W - C_L(W)) + \lambda B_L(C_L(W)) \}$$
$$\text{s.t. } 0 \le C_L \le W$$

W = amount of water available in a river ($\sim N(E(W), \sigma^2)$)

C_i = water allocated to i region (i = U, L, U:upstream / L:downstream)

$B(C_i)$ = utility function of region ($B'>0$, $B''<0$)

Benefit Function

$$B_i(C_i) = a_i C_i^2 + b_i C_i + c_i \quad (i=U, L,\; a_i<0,\; b_i>0,\; c_i>0)$$

---

2. Model

Optimal allocation

If $E[W] < \frac{b_U - \lambda b_L}{2\lambda a_L}$, then $C_L^* = W$

If $E[W] \ge \frac{b_U - \lambda b_L}{2\lambda a_L}$, then $C_L^* = \frac{2a_U E[W] - \lambda b_L + b_U}{2(\lambda a_L + a_U)} = \frac{a_U E[W]}{(\lambda a_L + a_U)} + \frac{b_U - \lambda b_L}{2(\lambda a_L + a_U)}$

Proportional allocation

$$\beta^* = \frac{2a_U E[W^2] + (b_U - \lambda b_L)E[W]}{2(a_U + \lambda a_L)E[W^2]}$$

β: proportion of water assigned to the downstream region ($0<\beta<1$)

Model

Fixed amount allocation

$$\overline{W}^* = \frac{2a_U E(W \mid W > \overline{W}^*) + b_U - \lambda b_L}{2(a_U + \lambda a_L)}$$

Risk measurement

Regardless of allocation method, each region is exposed to risks

: depending on the rainfall, the amount of water given to them varies

⇒Use variation coefficient(CV) to assess the risk imposed on each region

CV = (Variance of volume of water allocated)
/ (Expected volume of water under an allocation method)

Model

Variances of the fixed allocation

$$Var(C_L) = \int (W - m_L)^2 f(W)dW + \int (\overline{W} - m_L)^2 f(W)dW$$
$$= \int (W - m_L)^2 f(W)dW + (\overline{W} - m_L)^2 \int f(W)dW$$
$$Var(C_U) = \int (0 - \mu_U)^2 f(W)dW + \int (W - \overline{W} - \mu_U)^2 f(W)dW$$
$$= \mu_U^2 \int f(W)dW + \int (W - \overline{W} - \mu_U)^2 f(W)dW$$

Variances of the proportional allocation

$$Var(C_L) = Var(\beta W) = \beta^2 Var(W)$$
$$Var(C_U) = Var((1-\beta)W) = (1-\beta)^2 Var(W)$$

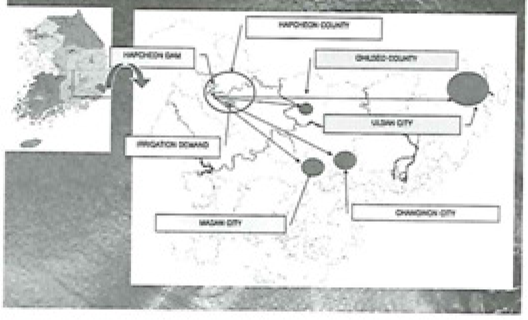
Case study

Case Study area and data source

- Hwang-River area (Hapchon multi-purpose dam)
- Water flow data : monthly data during the years of 1989~2001
  - This study focuses on the second quarter's(April, May, and June) because this season is usually drought season and dispute occurs
  - In Korea, about 2/3 of all precipitation is concentrated on the third quarter (summer season)
  - Average amount of flowing water in the 2nd quarter in the Hwang river : 130 million tons with standard deviation being 73.3

Case study

Hwang River Basin



Case study

Estimation of benefit Function

- The parameters of benefit function are obtained by the following three terms.

(1) $B_i(0) = 0$; No consumption means zero benefit.
(2) $B'(C_i) = 0$; First order condition for benefit maximization.
(3) $B_i(C_i) = B_i$; C_i, B_i means optimal water consumption and benefit respectively.

- Also we assume that weight(λ) is equal 1, which put same weight for both regions.
- We use Input-Output Table for the estimation of benefit per unit input of water.
- Unit: million won, million tons

Region	Benefit Function
Upstream Region (Irrigation, Chilseo, Hapcheon)	$B_i = -0.13X_i^2 + 2.69X_i$
Downstream Region (Masan-Changwon, Ulsan)	$B_i = -0.12X_i^2 + 28.32X_i$

The result of analysis

Water allocation results by allocation methods

- Water allocation results by each method
(mean amount of flowing water is 130 mil. tons and standard deviation is 73.3)

Water allocation results and expected benefits

Proportional method				Fixed-amount method				Optimal method		
β^* (%)	Amount of Allocation (Million m³)		Expected benefit (million won)	W^*	Amount of Allocation (Million m³)		Expected benefit (million won)	Amount of Allocation (Million m³)		Expected benefit (million won)
	Down	Up			Down	Up		Down	Up	
81.9	106.6	23.6	1,670	108	108	22.2	1,673	119	11.2	1,685

The result of analysis

Simulation

- Data of the second quarter shows severe fluctuation:
only 26million tons in 1994, one fifth of annual mean volume of flowing water.
- It is difficult to allocate water when available water is short of demand.
⇒ make reasonable scenarios based on actual data
⇒ find which allocation method is more efficient with respect to expected benefit under various situations.

Hypothetical cases: assumption of mean and standard deviation

Mean volume of flowing water (million tons)	Standard Deviation		
Case 1 : 100	100	75	50
Case 2 : 80	100	75	50
Case 3 : 50	100	75	50

The result of analysis

Allocation results by scenarios

CASE	σ	Proportional method				Fixed amount method				Optimal method		
		(%)	Amount (million m³)		Expected benefit (million won)		Amount (million m³)		Expected benefit (million won)	Amount (million m³)		Expected benefit (million won)
			Down	Up			Down	Up		Down	Up	
1	100	77.6	78	22	1,493	98	98	2	1,626	100	0	1,632
	75	84.8	85	15	1,554	94	94	6	1,613	100	0	1,632
	50	93.0	93	7	1,608	91	91	9	1,597	100	0	1,632
2	100	77.0	62	18	1,308	91	80	0	1,498	80	0	1,498
	75	86.1	69	11	1,397	86	80	0	1,498	80	0	1,498
	50	98.5	78	2	1,484	82	80	0	1,498	80	0	1,498
3	100	72.5	36	14	992	81	50	0	1,116	50	0	1,116
	75	83.5	42	8	991	75	50	0	1,116	50	0	1,116
	50	100	50	0	1,116	70	50	0	1,116	50	0	1,116

Risk analysis

Variance

CASE	Variance	Allocation type	Value of Variance		
			$\sigma = 100$	$\sigma = 75$	$\sigma = 50$
Mean Streamflow : 100 million m³	Var(C_d)	Proportional	529	144	12
		Fixed	3,223	2,001	1,024
	Var(C_u)	Proportional	5,929	3,969	2,162
		Fixed	809	663	471
Mean Streamflow : 80 million m³	Var(C_d)	Proportional	529	110	1
		Fixed	3,070	1,789	830
	Var(C_u)	Proportional	5,909	4,160	2,401
		Fixed	507	523	463
Mean Streamflow : 50 million m³	Var(C_d)	Proportional	784	162	-
		Fixed	2,915	1,690	489
	Var(C_u)	Proportional	5,256	3,921	2,500
		Fixed	243	238	212

Risk analysis

Coefficient of variation

CASE	Allocation type	Region	Variation(Var)		
			$\sigma = 100$	$\sigma = 75$	$\sigma = 50$
Mean Streamflow : 100 million m³	Proportional	Upstream (A)	76	47	23
		Downstream(B)	24	10	2
	Fixed	Upstream (C)	8	7	5
		Downstream(D)	1,612	334	114
Mean Streamflow : 0.8 million m³	Proportional	Upstream (A)	96	60	31
		Downstream(B)	28	10	1
	Fixed	Upstream (C)	7	7	6
		Downstream(D)	-	-	-
Mean Streamflow : 0.5 million m³	Proportional	Upstream (A)	146	93	50
		Downstream(B)	56	20	-
	Fixed	Upstream (C)	5	5	4
		Downstream(D)	-	-	-

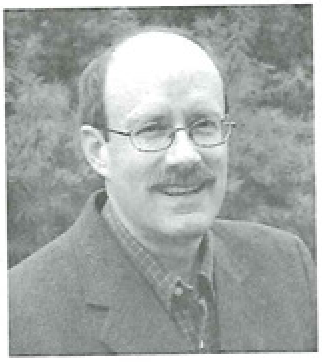
Conclusions

Results

- In many cases, the fixed allocation method is superior to the proportional allocation method in efficiency aspect.
- It is intuitively plausible result because the fixed amount allocation method ensures the down stream region, having higher productivity, to have a stable supply of water.
- The proportional allocation, in general, is more equitable than the fixed allocation method
- Tradeoff between efficiency and risk equity

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3: Wednesday August 9, 2006 / 3:00pm-3:20pm
Speaker

Challenges and Strategies for the Planning and Design of Sustainable Landscapes



Jack Ahern

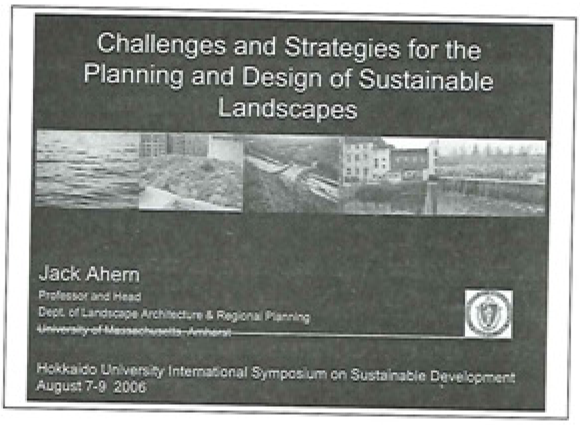
Professor and Head
Department of Landscape Architecture and Regional Planning,
University of Massachusetts, Amherst, U.S.A.
E-mail: jfa@larp.umass.edu

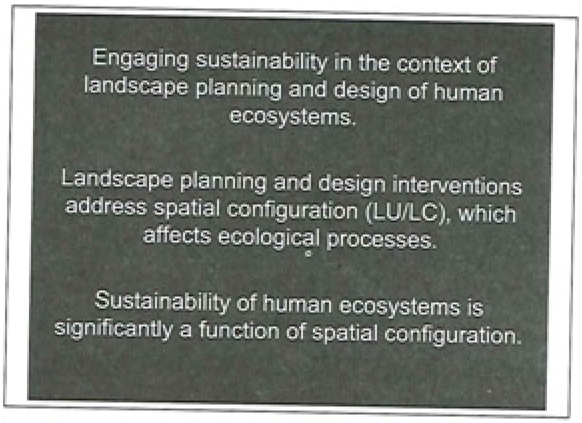
Planning of sustainable environments is a complex process addressing the fundamental triad of economic, environmental and socially-equitable sustainability. This paper discusses challenges and strategies related to the environmental area of the sustainability triad, specifically for determining spatial configurations of landscapes that support physical, biological and cultural processes.

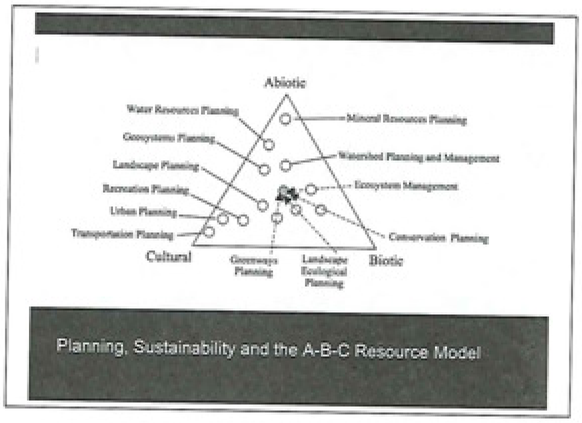
Because sustainable landscape planning addresses a great complexity of natural and cultural resources, a collaborative and interdisciplinary approach is needed. To meet this challenge, a transdisciplinary model of collaboration has been developed in which stakeholders are involved in the planning process with multiple scientific disciplines and professionals. A transdisciplinary approach emphasizes the connection between academic researchers and user groups/stakeholders - with all participants contributing tacit and explicit knowledge, sharing information, and jointly deciding policies and actions. Although this transdisciplinary approach appears obvious and logical, it has yet to be widely practiced in landscape planning.

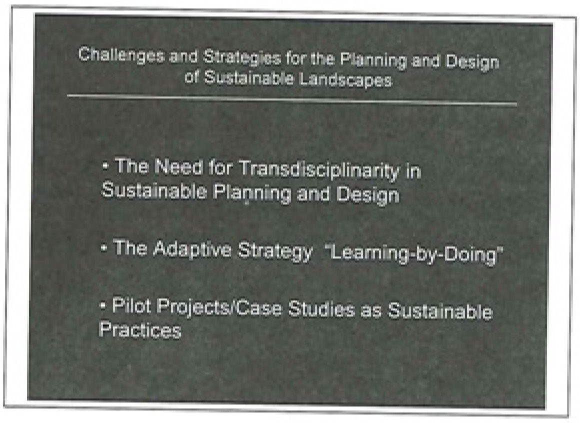
Uncertainty is another major challenge to the understanding of complex landscapes and the testing of innovative policies and recommendations to address sustainability. An adaptive approach to planning defines uncertainty explicitly, minimizes risks, and then proposes actions to "learn by doing" through monitoring, analysis, and revision of plans. While the adaptive approach has been widely used in natural resource management in the USA, it remains a novel, but promising strategy for sustainable planning.

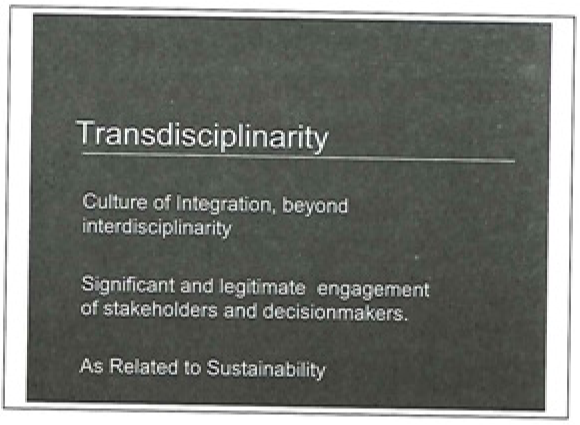
A major challenge to planning sustainable environments is the need to demonstrate through pilot projects what sustainability looks like, how it functions, what it costs, and how people respond to it. If sustainability remains only a subject of academic discourse, or abstract governmental policy, it will not change the course of human existence as boldly intended. Pilot projects, from regional plans, to neighborhood districts to individual buildings are all needed to make sustainability a real and tangible model that can be replicated and adapted widely.

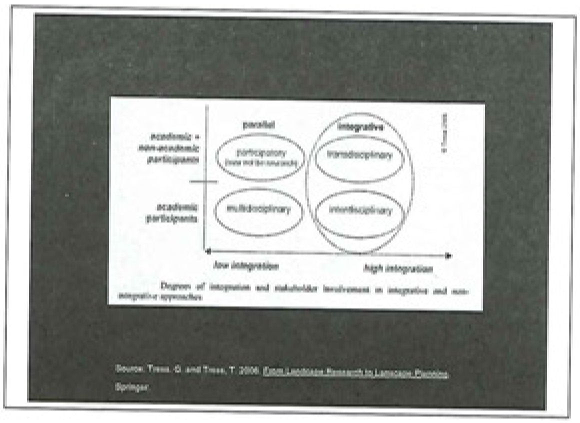


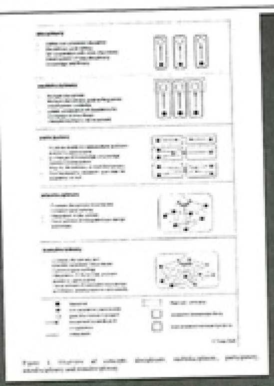








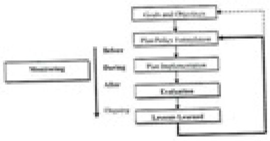




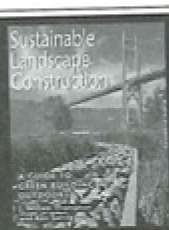
Source: Tress, G. and Tress, T. 2006. From Landscape Research to Landscape Planning. Springer.

Adaptive Planning: *Learning-by-Doing*

- Inherent uncertainty in landscape planning and design
- Imperative to act
- Decisions as experimental probes based on available knowledge
- Monitoring and evaluation is essential
- Managing risks
- Goal: Generation of new knowledge (learning-by-doing)



Schematic steps for an adaptive planning method



10 Principles for Sustainable Landscape Design and Construction

1. Keep healthy sites healthy
2. Heal injured sites
3. Favor living flexible materials
4. Respect the waters of Life
5. Pave less
6. Consider the origin and fate of materials
7. Know the costs of energy over time
8. Celebrate light, respect darkness
9. Quietly defend silence
10. Maintain to sustain

(Thompson and Sorvig, 2000)

Pilot Projects: Manifesting Sustainable Practices in Architecture and Landscape

- Put a "face" on sustainability
- Test new or experimental ideas
- Involve public and experts (transdisciplinary)
- Gain knowledge through monitoring and adaptation
- Projects illustrate application of sustainability principles internationally, at multiple scales and across a range of landscape/urban contexts.

Pilot Projects/Case Studies

- US Green Building Council, LEED Program
- Green Roofs
- Sustainable Urban Communities
- Transportation infrastructure: Ecoduct
- Sustainable Streets
- Florida Greenways Plan

US Green Building Council Leadership in Energy and Environmental Design (LEED)

Goals:

- Define green buildings
- Promote sustainable whole-building practices
- Recognize environmental leadership (rating system)
- Stimulate green competition
- Transform the building market
- Over 1000 LEED-recognized projects (2002)
- Voluntary Program
- Public, Corporate and Private Buildings Eligible

www.usgbc.org

Environmental Impact of Buildings*

65.2% of total U.S. electricity consumption

> 36% of total U.S. primary energy use

30% of total U.S. greenhouse gas emissions

136 million tons of construction and demolition waste in the U.S. (approx. 2.8 lbs/person/day)

12% of potable water in the U.S.

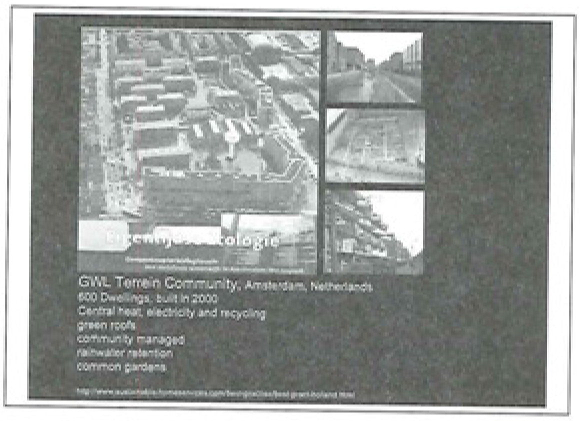
40% (3 billion tons annually) of raw materials use globally

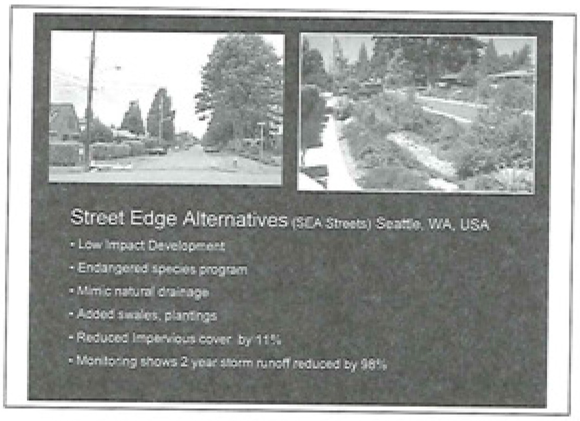
* Commercial and residential Source: US Green Building Council

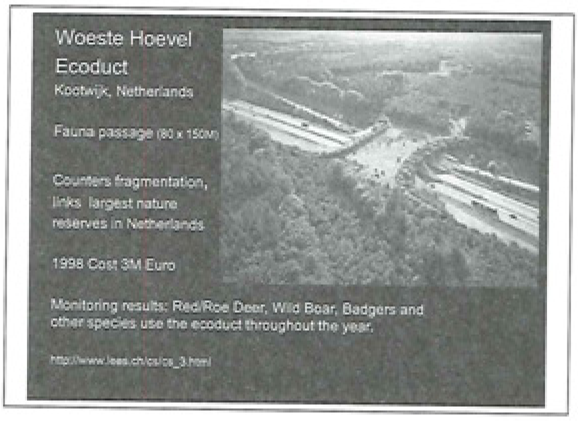

Genzyme Center, Cambridge, MA USA
LEED Platinum Green Building
Bioclimatic design
Innovative structural design (less steel and concrete)
Energy co-generation
Solar Photovoltaic
Green Roof
23% recycled building materials
93% construction waste recycled
Flexible floor plans
Occupant recycling programs
http://leedcasestudies.usgbc.org/images.cfm?ProjectID=274

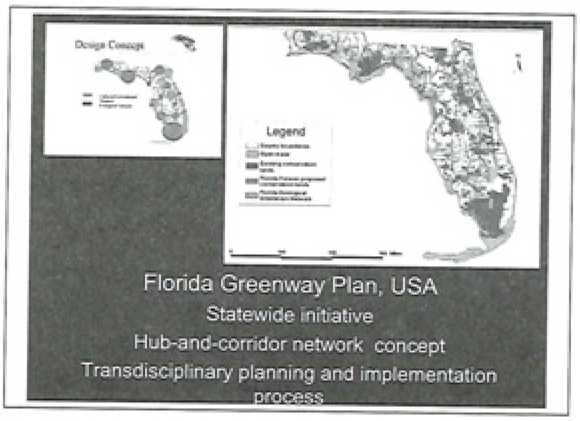

Green Roof: Chicago City Hall, USA
Mayor Richard M. Daley (2001)
Emulates natural processes
Absorbs most rainfall
Reverses urban heat island effect
Provides wildlife habitat
Insulates building
Improves urban aesthetics
Demonstration for research and educational outreach
38 C reduction surface temp
8 C reduction air temperature

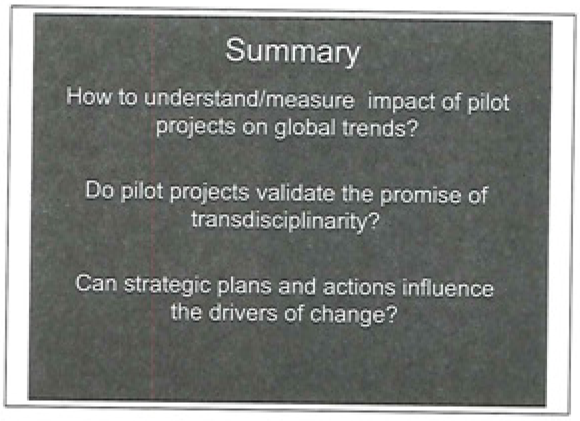

Duisberg Inner Harbour, Germany
Urban infill housing, Mixed income
Culture:Life:Work
Regional brownfield strategy (Emscher)
Mixed-income housing
Accessible to downtown
Green Architecture
Biofiltration of stormwater


GWL Terrein Community, Amsterdam, Netherlands
600 Dwellings, built in 2000
Central heat, electricity and recycling
green roofs
community managed
rainwater retention
common gardens


Street Edge Alternatives (SEA Streets) Seattle, WA, USA
• Low Impact Development
• Endangered species program
• Mimic natural drainage
• Added swales, plantings
• Reduced impervious cover by 11%
• Monitoring shows 2 year storm runoff reduced by 98%


Woeste Hoevel
Ecoduct
Kootwijk, Netherlands
Fauna passage (80 x 150M)
Counters fragmentation, links largest nature reserves in Netherlands
1998 Cost 3M Euro
Monitoring results: Red/Roe Deer, Wild Boar, Badgers and other species use the ecoduct throughout the year.
http://www.lees.ch/cs/cs_3.html


Design Concept
Legend
Florida Greenway Plan, USA
Statewide initiative
Hub-and-corridor network concept
Transdisciplinary planning and implementation process


Summary
How to understand/measure impact of pilot projects on global trends?
Do pilot projects validate the promise of transdisciplinarity?
Can strategic plans and actions influence the drivers of change?

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3: Wednesday August 9, 2006 / 3:20pm-3:40pm
Speaker

Creating Effective International Regimes: New Approach of Political Science

Toru Miyamoto

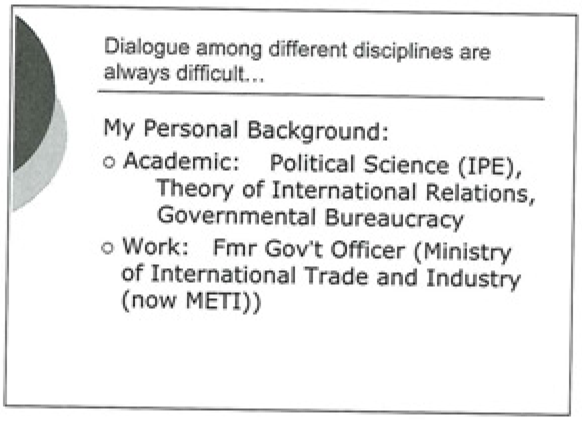
Associate Professor
Graduate School of Public Policy
Hokkaido University
E-mail: toru@juris.hokudai.ac.jp

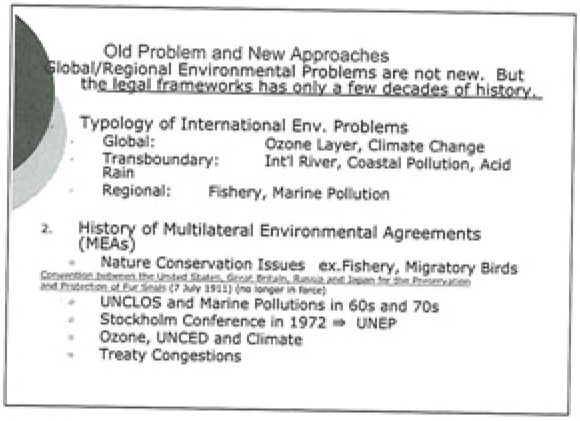
Although the international environmental problems are not new, the creation of regimes for them is relatively new phenomena. This is because we need new science to understand the problem enough to write prescriptions. Therefore scientists play vital roles. But the regime formation is one thing but its implementation is another. Even scientists convince diplomats to agree on multilateral environmental agreements (MEAs), economic activities within borders are difficult to control. Some MEAs are effective in solving the problems, but others are not. We need new approach to design the effective ones.

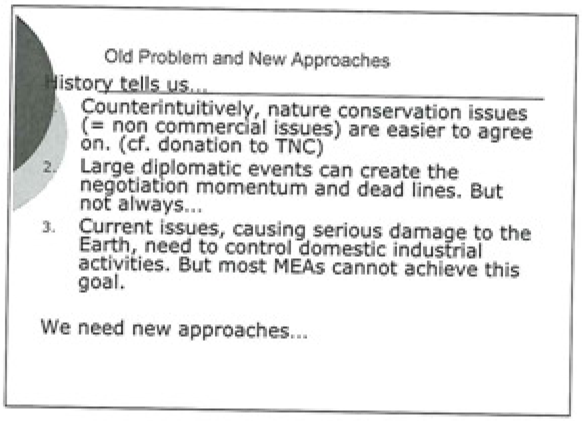
Political scientists have long defined the fundamental character of international relations as chaos. However, researches on the cases found the reality had been much less pessimistic. Scientists share many things such as respect in knowledge, political positions (i.e. in terms of research funding, or free from responsibility to their interest of domestic industries), despite the difference in nationalities. Therefore, networking among them is possible, which often extended to citizen's groups, environmental activists. This network of "enlightened people," often called the "epistemic community" contributes significantly in global/regional regime formation through framing the national interests in new ways.

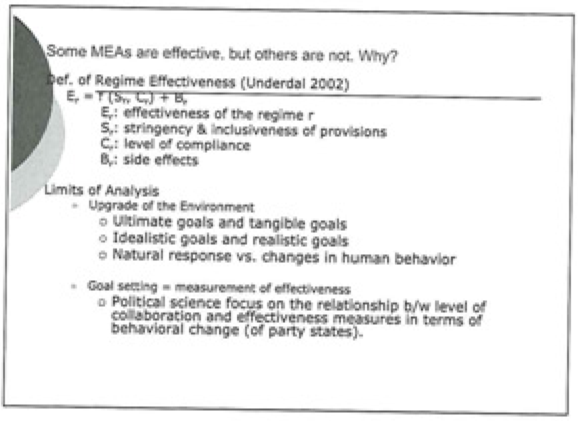
However, now we have "congestion" of MEAs. Only some are effective. Activists advocate they should have "teeth" to harness economic activities within state borders. But this is not easy. Looking precisely at effective MEAs, most of them are originally designed, or later amended to be "self-implementable." Confrontational dialog between activists and practitioners rarely bear fruits. We need three new approaches to inquire the new diplomacy. First is the politics of ideas. National interests are not defined only by material interests. Bearing legitimacy is important resource for a country to be influential. The second is that we need to consider the domestic decision making process on foreign policy. The third is the politics of regulation. Regulations create costs as well as benefits. Their pay-off structure shapes the politics on their implementation.

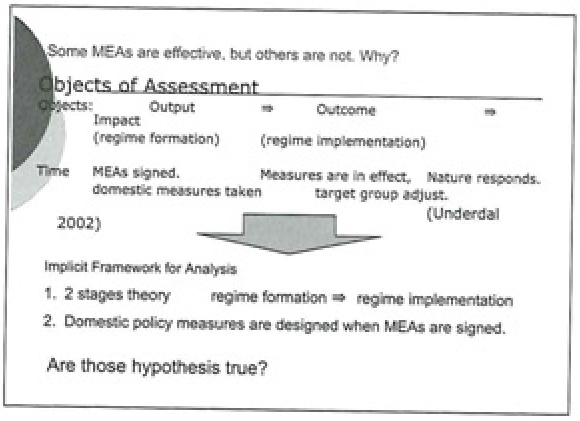
The recognition for the conundrums in the (especially North) East Asia is quite new. But the cold latitudes are fragile. With learning experience, we need action now. Scientists should take the lead.











Rosy Description of Ozone Success

Montreal Protocol

- Scientists (Rowland & Molina) discovered the problem.
  - There was great debate on it among scientific community at first.
  - State level regulation on spray cans started before scientists agreed on R&M hypo.
- Scientists and environmental activists formed the "epistemic community" beyond national borders and lead the negotiation.
  - States are only actors in UN system. Scientists' representation are not justified.
  - Industry, government and press played large parts.
- Certain states lead the ideal way.
  - Even US State Dept. was pushed to negotiate.
  - Many diplomats are too busy to learn details of the issues.
- UNEP play the role of catalyst.
  - UNEP has to defend its raison d'etre.
  - UNECD also play a role.
- Industry actors change their behavior swiftly, once they are convinced.
  - Game theory Olson vs. Stigler
  - Regulations that create benefits to be shared by the regulated are self-implementable.
  - Corporate managers got together after the MP was signed and found the implementation solution. (Canan and Reichman 2002)

Regime Formation and Regime Implementation

- Researches on MEAs are mainly interested in regime formation, because regimes formation were the political objective.
- Most of MEAs are still at the early stage of implementation. The recent study on the TEAP shows details of implementation were to be designed on the process of implementation.
- If we take this into our consideration, we should perceive that the regimes are not fully formed when diplomats agree on it. We should understand regimes are supplementary formed on the process of implementation.
- This explanation describes the Kyoto Protocol discussion after 1997 as well as fits properly with the "New Sovereignty" arguments (Chayes & Chayes 1998).
- *Forget 2 steps theory and watch the fact!*

International Relations in the Post-Modern World

- As states have regular diplomatic relations, negotiators are less likely to deceive others (The more the meetings are regularly held, the more players choose corporative equilibrium.)
- National interests are not the aggregation of material resources. They are largely influenced by the ideas, such as human rights and environment conservation.
- *Idea matters!*

Things be taken Into consideration...

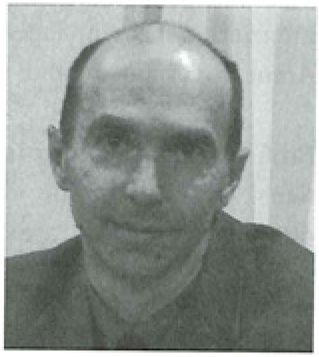
- States are not unitary actors. Look at the decision making process on foreign policy.
- Design regulations to be implemented smoothly. Pay off structure of key players are the key.
- Idea matters.

Lessons for the Future

- Scientists play important roles especially at the *early* stage, when awareness raising is the core mission. This may be true in the Northeast Asian region.
- However, designing "self-implementable" regulation is not easy. You need to specify the harmful activity and design the regulation economically viable. Only technologically capable, commercially viable and politically justifiable regulation will be implemented in the world especially without the single sovereignty. Economists as well as corporate actors should be involved in the regulation design process.
- *Don't forget inviting political scientists for your next conferences!*

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3: Wednesday August 9, 2006 / 1:15pm-3:45pm

Summary of Plenary Session 3: Countermeasures for Sustainable Development



Chaired by **Oleg Shcheka**

Department of International Programs and Projects,
Far Eastern Branch of the Russian Academy of Sciences, Russia
E-mail: shcheka@hq.febras.ru

Co-Chaired by **Takayuki Shiraiwa**

Research Institute for Humanity and Nature, Japan
E-mail: shiraiwa@chikyu.ac.jp

Keynote Speaker:
Petr Y. Baklanov, Director, Pacific Institute of Geography, Far Eastern Branch of the Russian Academy of Sciences, Russia
Speakers:
Kalidas Shetty, Professor, Department of Food Science, University of Massachusetts, Amherst, U.S.A.
Bai Zhang, Director, Northeast Institute of Geography and Agricultural Ecology, Chinese Academy of Sciences, China
Dong-Geun Han, Professor, School of Economics and Finance, Yeungnam University, Korea
Jack Ahern, Professor, Department. of Landscape Architecture and Regional Planning, University of Massachusetts, Amherst, U.S.A.
Toru Miyamoto, Associate Professor, Graduate School of Public Policy, Hokkaido University

Prof. P.A. Baklanov defined "a sustainable development of the region" as its stable development during a long period of time (tens of years) in the economic, social and ecological spheres. He discussed "Amur River basin-the Sea of Okhotsk system" and showed various components which we should take into account for the sustainable development of the region. Prof. Zhang Bai presented us recent land-use changes in the Northeast China. Significant land-uses changes are occurring in this region following Chinese policy in the last 20 years. It seems that Russia and China has been developing their own policies but we believe that international involvement is necessary in treating with transboundary ecosystem such as Amur River basin and the Sea of Okhotsk system.

Prof. Kalidas Shetty proposed "System Biology" to solve problems in complex Biological systems. By keeping the idea in mind, Prof. Shetty claimed that evolutionary concepts and traditional knowledge are necessary to enhance quality of science concept.

Prof. Dong-Geun Han reported three different methods in allocating water to Hwang-River area. He concluded that fixed allocation method is superior to the proportional allocation method in efficiency aspect. The proportional allocation method is, however, more equitable than the fixed method.

Prof. Jack Ahern reported strategies for the planning of sustainable landscape. He proposed three steps 1) necessity of transdisciplinarity in planning and design; 2) "Learning-by-Doing" adaptive strategy and 3) pilot project/case studies as sustainable practices.

Finally, Prof. Toru Miyamoto discussed a new political science approach how to create effective international regimes. He claimed that only technologically capable, commercially viable and politically justifiable regulation would be implemented.

Summary of Parallel Session 1: How to Sustain Agrosphere, Biosphere and Geosphere

Mitsuru Osaki

Director
Sustainability Governance Project (SGP), Hokkaido University
E-mail: mosaki@chem.agr.hokudai.ac.jp

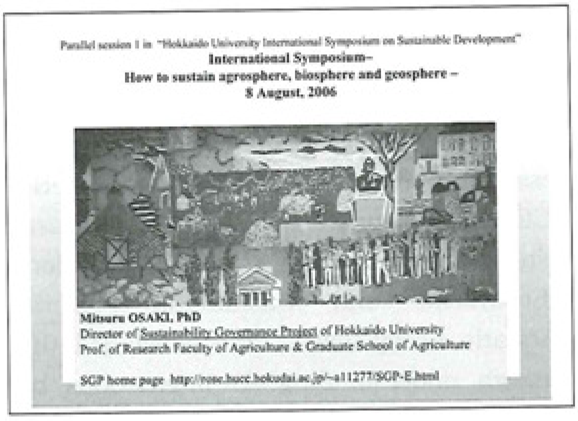
The aim of this symposium was to discuss and find ways to sustain the global environment and ecosystem by addressing worldwide governance issues. The symposium was organized and sponsored by the Sustainability Governance Project (SGP), Hokkaido University, and co-sponsored by 1) 21st Century COE Program "Marine Bio-Manipulation Frontier for Food Production - Toward Advanced and Safe Use of Aquatic Organisms" (Graduate School of Fisheries Science, Hokkaido University), 2) 21st Century COE Program "Prediction and avoidance of an abrupt change in the biogeosphere system" (Graduate School of Environmental Science and Institute of Low temperature Science, Hokkaido University), and 3) Strategic Priority Project "Sustainable and Safe Food Production" (Creative Research Initiative "Sousei"). A total of 15 oral presentations and 82 posters were presented during the symposium.

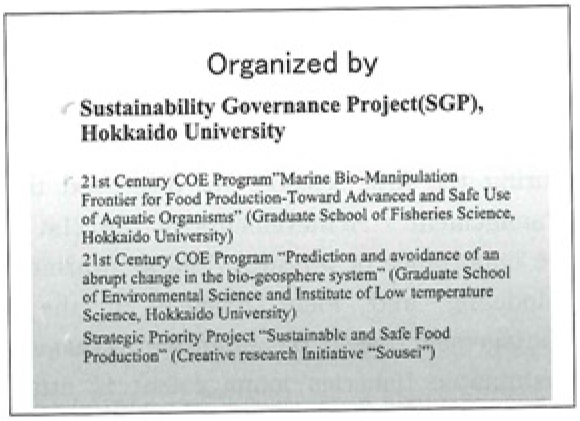
During the first session, we discussed the "Progressive Approach on Sustainable Fisheries Management - Achievements of the 21st Century COE and Future Issues -". We discussed the importance of 3 issues, "Stable Marine-food Products with Increasing Human Population", "Modeling and Field Science in the Ocean Ecosystem" and "Sustainable Fisheries Management based on Adaptive Management in Aquatic Ecosystems". We concluded that sustainable fisheries management is attainable through understanding: 1) interactions between the abiotic environment and organisms, and 2) biodiversity, which is influenced by natural factors and human impacts.

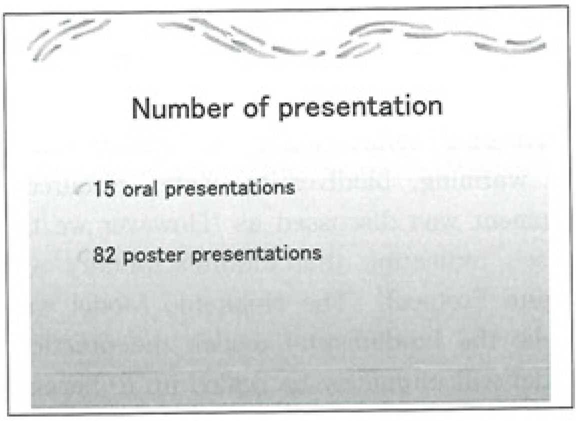
In the second session, the "Roles of the coupled system of biosphere and geosphere" were argued. The need for structures through inter-departmental collaboration was clearly introduced. Feedback with problems such as global warming, biodiversity, water resources, energy, food, health, and population growth development was discussed as "However we try to solve one problem, we often make others worse", indicating that multidisciplinary approaches are required for targeting beyond the Kyoto Protocol. The Hokkaido Model was then shown to the audience. Composed of 3 levels: the fundamental model, the practical model and the governance model, the Hokkaido Model will ultimately be scaled up to become a global model.

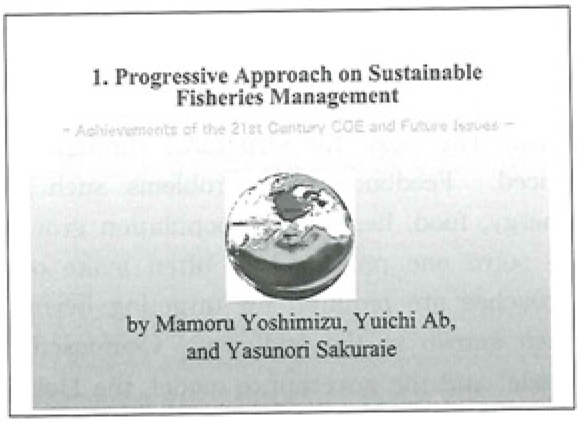
During the third session, the "Sustainability and Security of Food Production" was discussed, focusing on the problems of present agricultural systems. As fossil fuel is currently the engine of modern agriculture, it must eventually switch to bio-products derived from natural ecosystems.

At the fourth session, "Integrative Perspective on the Sustainable Earth" was discussed by sharing information about the Sapporo Nodal Office of Global Land Project, presently being managed by the SGP. The Global Land Project (GLP), the IGBP/IHDP joint-core project succeeding the GCTE and LUCC, was launched this year and is focused on coupled social/natural systems. The thematic foci of the Sapporo Nodal Office include vulnerability, resilience and sustainability targeting on "Northern systems affected by global warming", "Freshwater linkages, Watershed processes", "Modeling ecological-human processes at regional scales", "Southeast Asian restoration and sustainable management", and "Training, education and capacity building in Southeast Asia".



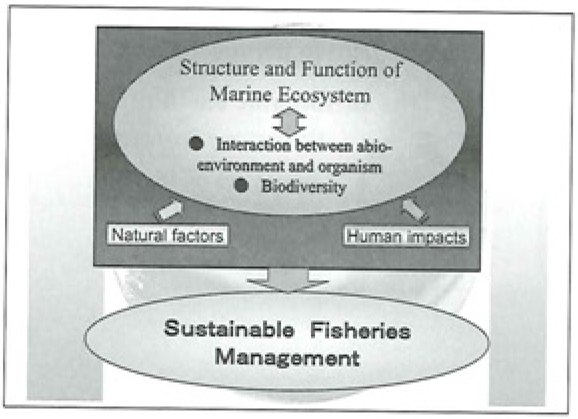


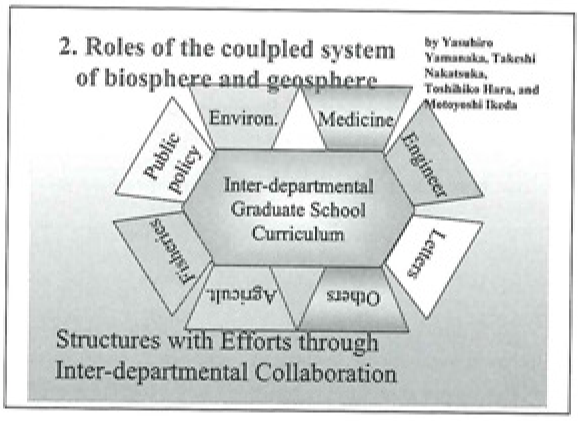


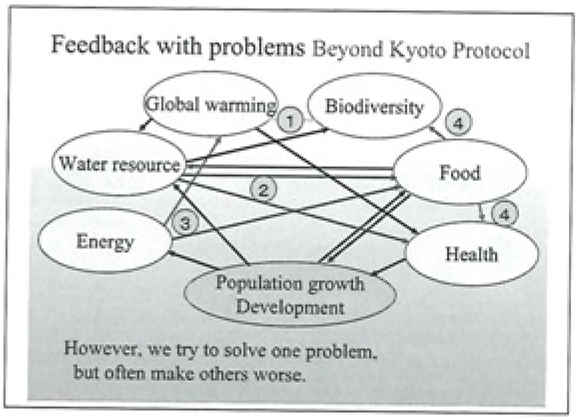


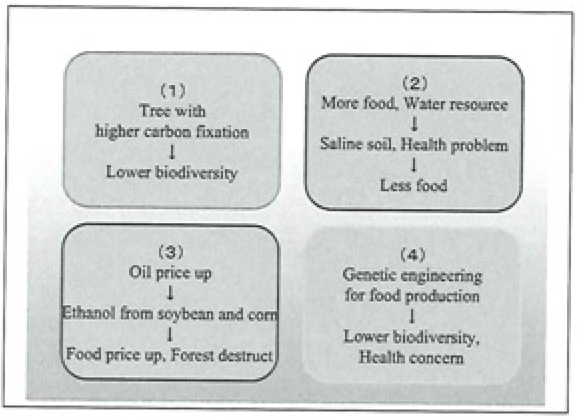
Sustainable Fisheries Management as Fisheries & Ocean Sustainability Science

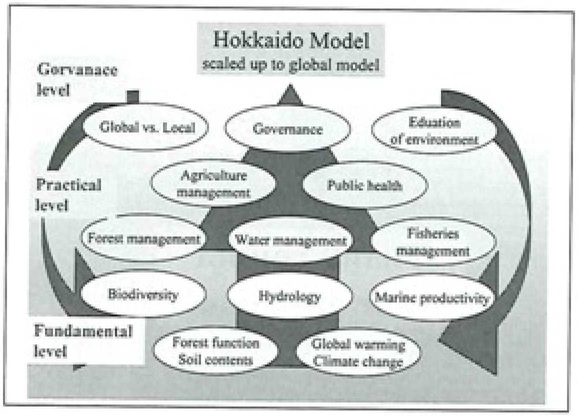
1. Stable Marine-food Product with Increase in Human Population
   - Creating "Safe and Worry-Free" salmon products using a HACCP system from fishing through processing to distribution (H. Kasai & M. Yoshimizu)
2. Modeling and Field Science in the Ocean Ecosystem
   - Development of an integrated ocean model for understanding changes in ecosystem in the western North Pacific associated with global warming (Y. Yamanaka)
3. Sustainable Fisheries Management based on Adaptive Management in Aquatic Ecosystem
   - Genetic approach to management and sustainable use of marine bio-resources (S. Abe, M. Yoon & N. Azuma)
   - The Shiretoko World Natural Heritage including marine and land ecosystems: towards coexistence with marine diverse and fisheries (Y. Sakurai & M. Kaeriyama)











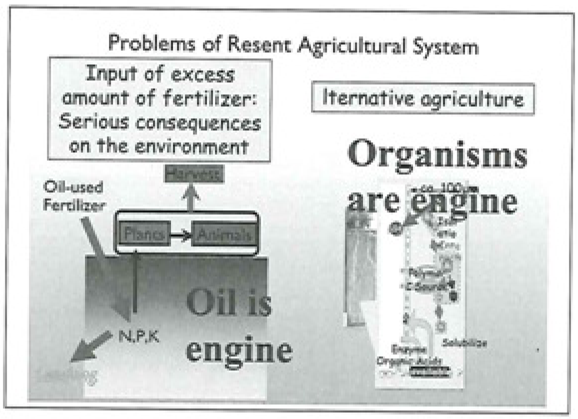
3. Sustainability and Security of Food Production

Dr. Zhang (China): Soil quality evaluation and sustainable agriculture development in the region of southwest part of China-Yunnan Province

Dr. Rashid (Bangladesh): Arsenic Contamination of Groundwater: Food Safety and Human Health Hazard in Bangladesh

Dr. Koyama (Japan): Improvement of P uptake from acid soil by transgenic plants with modified citrate metabolism

Dr. Tawaraya (Japan): Mycorrhizal fungi in the tropical rain forest of Indonesia and its utilization for reforestation



4. Integrative perspective on the sustainable earth

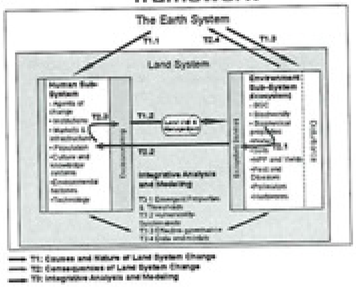
Global Land Project (GLP)

joint IGBP/IHDP core project succeeding GCTE and LUCC launched in this year

focusing on coupled social/natural systems

By He-Qing Huang and Billie Turner
+Kensuke Fukushi

Global Land Project conceptual framework



Sapporo office structure

Integrated Research System for Sustainability Science(IR3S)

NC-GLP

Hokkaido University

Sustainability Governance Project (SGP)

Sapporo Nodal Office
Global Land Project

Initiative for Sustainable Development (HUISD)

SSC/IPO GLP

JAXA
monitoring

JICA
capacity building

Thematic foci of Sapporo Office

Vulnerability, resilience and sustainability

- Northern systems affected by global warming
- Freshwater linkage, watershed processes
- Modeling ecological-human processes at regional scales
- Southeast Asia restoration and sustainable management
- Training, education and capacity building in Southeast Asia

SGP Office as campus-scale platform, coexisting with GLP Nodal Office as an international platform

Thank you for your attention!

Summary of Parallel Session 2: Protection of Society from Infectious Threat

Hiroshi Kida

Director
Research Center for Zoonosis Control, Hokkaido University
E-mail: kida@vetmed.hokudai.ac.jp

The aim of the symposium is to discuss and to find the way how to control emerging zoonoses such as Influenza, SARS, Ebola virus infection, Flavivirus infection, Tuberculosis, Trypanosomiases, Echinococcosis, and Prion diseases.

Excellent presentations on the ecology, natural history, and prediction of antigenic variation, prevention and control of emerging zoonoses were given by Drs. R.G. Webster (St. Jude Children's Research Hospital, USA), K. Ito (Hokkaido University), G.C. Telling (University of Kentucky, USA), Y. Suzuki (Hokkaido University), L.-F. Wang (CSIRO Animal Heath Laboratories, Australia), K. Morita (Nagasaki University), A. Takada (Hokkaido University), T. Romig (University of Hohenheim, Germany), and C. Sugimoto (Hokkaido University).

The conclusion of the symposium is that in order to protect society from infectious diseases and to achieve sustainable society, intensive research and education on the following points are essential;

1. To clarify the ecology of infectious agents in nature
2. Prediction of and preparedness for emerging zoonoses
3. Development of novel methods of early and rapid diagnosis of zoonoses
4. Global surveillance of zoonoses under the international collaboration

Parallel session 2

The 10th International Symposium for Zoonosis Control -Protection of Society from Infectious Threat-

Organized by
21st Century COE Program "Program of Excellence for Zoonosis Control"
Hokkaido University Research Center for Zoonosis Control

Date: August 8, 2006 9:30 -17:35
Venue: Conference Hall, Hokkaido University

Aim of the symposium: *How to control emerging zoonoses*

such as *Influenza, SARS, Ebola virus infection, Flavivirus infection, Tuberculosis, Trypanosomiases, Echinococcosis, and Prion diseases.*

Excellent presentations on the ecology of pathogen, prediction of antigenic variation of human influenza viruses, prevention and control of emerging zoonoses were given by

- ***Dr. R.G. Webster*** *(St. Jude Children's Research Hospital, USA)*
- ***Dr. K. Ito*** *(Hokkaido University)*
- ***Dr. G.C. Telling*** *(University of Kentucky, USA)*
- ***Dr. Y. Suzuki*** *(Hokkaido University)*
- ***Dr. L.-F. Wang*** *(CSIRO Animal Heath Laboratories, Australia)*
- ***Dr. K. Morita*** *(Nagasaki University)*
- ***Dr. A. Takada*** *(Hokkaido University)*
- ***Dr. T. Romig*** *(University of Hohenheim, Germany)*
- ***Dr. C. Sugimoto*** *(Hokkaido University)*

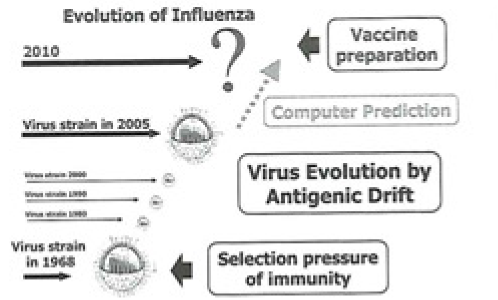
by Dr. R.G. Webster

H5N1: Pandemic Outlook

- It is extremely difficult for humans to be infected
- People cannot contact H5N1 from cooked poultry
- The healthcare industry would be running beyond surge capacity
- If there is a cytokine storm pregnant women and 15-40 year olds would be hardest hit
- Urgent need to increase influenza vaccine manufacturing capacity

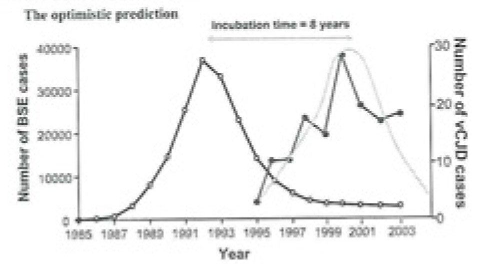
by Dr. K. Ito

A Proactive Control Strategy for Influenza



by Dr. G.C. Telling

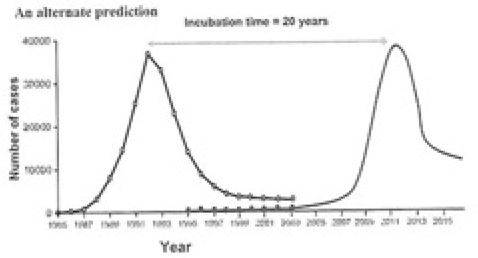
BSE and vCJD: What will happen?



Around 200 cases in total and disease will virtually disappear by year 2010

by Dr. G.C. Telling

BSE and vCJD: What will happen?



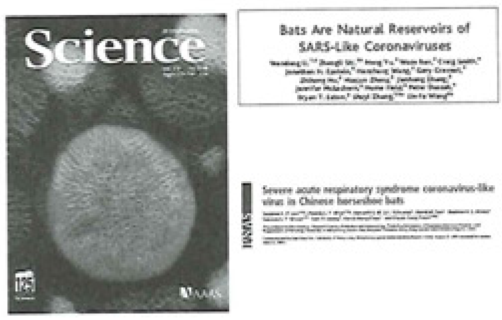
Disease has not begun yet.
The few cases so far are just part of the noise of people infected before the BSE epidemic

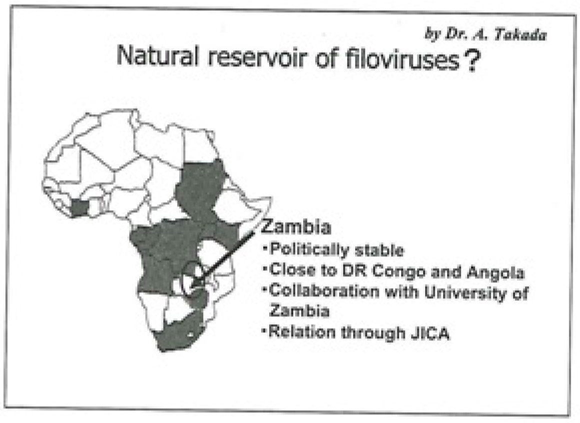
by Dr. Y. Suzuki

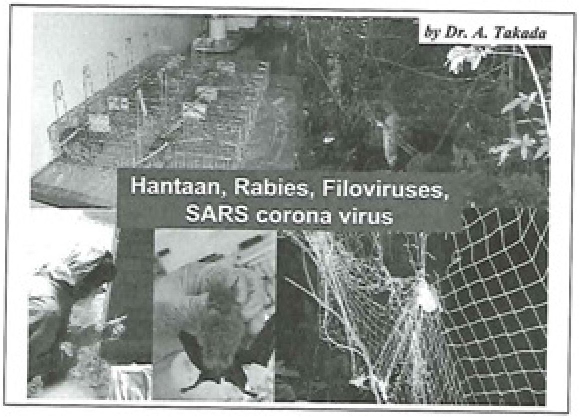
Conclusions

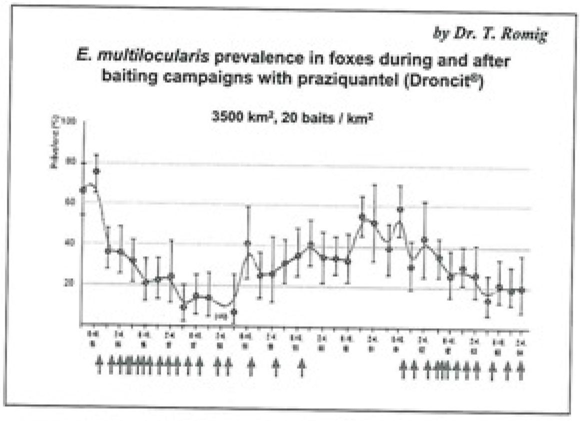
1. Early diagnosis, Early treatment
   > Rapid diagnostic test for TB
   >> LAMP method can contribute to rapid detection of tubercle bacilli
2. Prevention of spread of drug resistant TB
   > Rapid detection test for drug resistance
   >> Gene diagnosis may be the best choice
3. Clarification of spread route
   > Molecular typing of tubercle bacilli
   >> Digitalized methods can provide globally compatible data

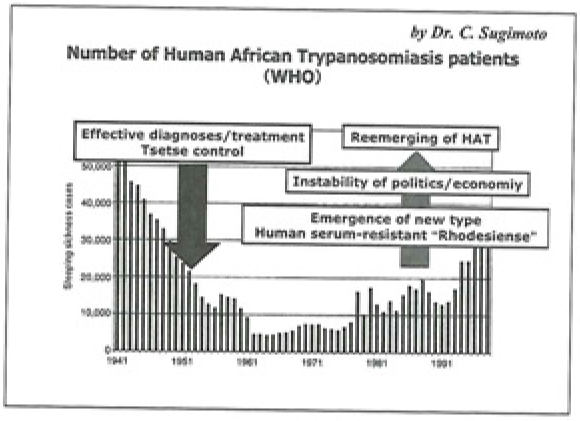
by Dr. L.-F. Wang











To protect society from infectious diseases and to achieve sustainable society, research and education on the following points are highly important:

- *Prediction of the emergence of infections*
- *Clarify the ecology of infectious agents in nature*
- *Preparedness for emerging zoonoses*
- *Development of novel methods of early and rapid diagnosis*
- *Global surveillance of zoonoses under the International Colaboration*

— Protection of Society from Infectious Threat —

Hokkaido University International Symposium on Sustainable Development
Parallel Session 3: Tuesday August 8, 2006

Summary of Parallel Session 3: Sustainable Metabolic System of Water and Waste for Area-Based Society

Yoshimasa Watanabe

Professor
Graduate School of Engineering, Hokkaido University
E-mail: yoshiw@eng.hokudai.ac.jp

The parallel session 3-1 "Innovation of Membrane Technology for Water and Wastewater Treatment (IMTEC)" and 3-2 "Strategy for Sustainable Solid Waste Management (SSSWM)" are organized by the 21st Century COE Program "Sustainable Metabolic System of Water and Waste for Area-based Society".

Group 1. Innovation of Membrane Technology for Water and Wastewater Treatment -IMTEC Sapporo-

IMTEC invited 7 speakers as well as 7 nominated discussers from 9 countries including Japan to be carried out in a Speaker-versus-Discusser Format. Those speakers and discussers developed lively discussions on the recent advances in innovation and integration of membrane filtration and the state of the art and future developments of membrane technology applying to water and wastewater treatment. The new format was well received and the IMTEC achieved a successful outcome.

Group 2. Strategy for Sustainable Solid Waste Management

SSSWM had 3 invited speakers from Austria, USA and Korea. They talked for 1 hour each about the sustainable management of waste and resource. The final phase of SSSWM was a panel discussion with those 3 guests and all participants engaged in a heated debate. IMTEC and SSSW gained 295 participants in total.

Report from Parallel Session 3:

Innovation of Membrane Technology for Water and Wastewater Treatment

Yoshimasa Watanabe
Graduate School of Engineering

Innovation of Membrane Technology for Water and Wastewater Treatment

—IMTEC Sapporo— Place: Hotel Royton Sapporo, Japan http://www.daiwaresort.co.jp/english/29_royto.html
Date: August 8 Tuesday 2006

FREE

Yoshimasa Watanabe
Hokkaido University

Keynote address
RECENT ADVANCES IN INNOVATION OF MEMBRANE AND INTEGRATION OF MEMBRANE FILTRATION SYSTEM

PATICIPANTS

WATER	:196
WASTE	: 99
TOTAL	:295

AIM OF THE WORKSHOP

The Sustainable Water Metabolic Systems Group has achieved considerable results under the 21st Century COE Program "Sustainable Metabolic System of Water and Waste for Area-based Society". The major aims of this workshop are to publicize our accomplishments, and at the same time, to bring together a number of selected experts on membrane technology from around the world to share information and knowledge about problems, current status and a future trend of membrane technology through a thorough discussion.

SIGNIFICANCE OF "MEMBRANE"

The Japanese 3rd Science and Technology Basic Plan that has started in April 2006, advocates that we should "achieve a healthy water metabolism and sustainable use of water" in its policy. In the policy, "membrane technology" is recognized as one of the most important leading-edge technologies for water treatment that can be widely used throughout the world.

WORKSHOP STYLE

The program of the workshop consists of counterargument, one-on-one debate and all-hand discussion. A Speaker will give a presentation for 25 minutes first. After each presentation, his/her nominated discusser will give the 10 minutes of counterargument. In the following 10 minutes, the speaker and Discusser will develop the one-on-one discussion. Finally other participants will join the discussion in the last 5 minutes. Your active participation to the discussion will be encouraged.

Track for Wastewater

SESSION MODERATORS

Kazuo Yamamoto
The University of Tokyo
Japan

SPEAKERS

Say Leong Ong
National University of Singapore
Singapore

"Performance of Pre-denitrification Submerged Membrane Bioreactor (MBR) under various Solid Retention Times"

Roger Ben Aim
INSA Toulouse
France

"An Approach towards a Better Understanding of Fouling Phenomena in MBR"

Satoshi Okabe
Hokkaido University
Japan

"Membrane Biofouling in the MBR Treating Domestic Wastewater: Identification of Key Players in Membrane Biofouling"

DISCUSSERS

Hang-Sik Shin
KAIST
Korea

"Effect of SRT on Membrane Fouling and Performance"

Duu-Jong Lee
National Taiwan University
Taiwan

"An Alternative Approach towards a Better understanding of Fouling Phenomena in MBR"

Guang-Hao Chen
Hong Kong University of Science & Technology
Hong Kong

"Is Biofilm Formation The Key Player in MBR Biofouling?"

Track for Drinking Water I

SESSION MODERATORS

Shin-ichi Nakao
The University of Tokyo
Japan

SPEAKERS

Mark R. Wiesner
Duke University
USA

"Nanomaterials and Membranes for Water and Wastewater Treatment"

Katsuki Kimura
Hokkaido University
Japan

"Mechanism involved in the Evolution of Irreversible Fouling in Microfiltration (MF) and Ultrafiltration (UF) Membranes used for Water Treatment"

DISCUSSERS

Yoshihiko Matsui
Hokkaido University
Japan

"Nanosized Materials in Membrane Applications"

Gary Amy
UNESCO-IHE
The Netherlands

Discussion of "Mechanism involved in the Evolution of Irreversible Fouling in Microfiltration (MF) and Ultrafiltration (UF) Membrane used For Water Treatment"

Track for Drinking Water II

SESSION MODERATORS

Yoshimasa Watanabe
Hokkaido University
Japan

SPEAKERS

Chihpin Huang
National Chiao Tung University
Taiwan

"Recovery of Spent Filter Backwash Water Using Coagulation Assisted Membrane Filtration"

Stefan Panglisch
IWW Water Center
Germany

"Low Pressure Membrane Filtration for Drinking Water Production in Germany : State of the Art and Future Development"

DISCUSSERS

So-Ryong Chae
Hokkaido University
Japan

Discussion for "Recovery of Spent Backwash Water Using Coagulation-Assisted Membrane filtration"

Chung Hak Lee
Seoul National University
Korea

Comment on "Low Pressure Membrane Filtration for Drinking Water Production in Germany : State of the Art and Future Development"

Developments/Findings Reported

- Recent Advances in Innovation and Integration
  - Hybrid Coagulation-Microfiltration System
  - (Monolith) Ceramic Membrane Filtration with Pre-Coagulation
  - Flocculation within Membrane Channels
  - Other Hybrids: Powdered Activated Carbon; Biological Oxidation
- Membrane Bioreactors (MBRs)
  - Role of Biofilm vs Feedwater Components in MBR Fouling
  - Effects of Operational Conditions on Performance and Fouling
  - Different Microbiological Communities Responsible for Biofilm Formation versus Foulant "Scavenging"
  - Differentiation of Fiber versus Bundle Fouling
  - Need for Common Terminology and Methods to Assess MBR Performance and Fouling
- Membrane Fouling in Cleaning
  - Chemical Identity of Foulant(s) Revealed
  - New Fouling Mechanism(s) Hypothesized
  - Synergy of Hydraulic (Backwashing) and Chemical Cleaning

Developments/Findings Reported – cont.

- Nanomaterials and Membranes
  - Ceramic Membranes
  - Particle Templating
  - Reactive Membranes (e.g., Oxidation)
  - Nanoparticle Adsorbents (e.g., Microground Powdered Act. Carbon)
- Sidestream (e.g., Filter Backwash Water) Treatment
  - Novel Coagulation-Microfiltration Approach
  - Removal of Supra- and Sub-Micron Particles
  - Solid Phase (Sludge) as Final Membrane Residual
- State of the Art and Future Developments
  - Rapid Growth of Membrane Technology in Germany
  - Emphasis on Low Pressure (Polymeric) Membranes
  - Emerging Interest in Ceramic Membranes
  - Unit Costs Decreasing (e.g., €0.10/m³) Approaching Conv. Treatment
  - New Interest in High Pressure Membranes for Xenobiotics
  - Issue: Pretreatment

Strategy for Sustainable Solid Waste Management

Date: 13:30-17:30, August 8, 2006
Place: Hotel Royton Sapporo

Program

13:30-Opening  Professor Toshihiko Matsuto
Graduate School of Engineering, Hokkaido University

13:40-14:40
Waste management, an integrated part of sustainable resource management
Professor Paul H. Brunner
Institute for Water Quality, Resource and Waste Management
Vienna University of Technology

14:40-15:40
Sustainable Land Disposal: Definitions and Possible Approaches
Dr. Luis F. Diaz
President, CalRecovery, Inc.
Editor in Chief, Waste Management

16:00-17:00
Integrated Strategy of Recycling in Korea
Professor Dong-Hoon Lee
Department of Environmental Engineering, College of Urban Science
Director of Center for Biowaste Recycling Research
Director of Industry-Academy Cooperation Foundation, The University of Seoul

17:30- Panel Discussion

Summary of Plenary Session 4: "Summary of the Symposium"

Takeo Hondoh

Global Manager
Hokkaido University Initiative for Sustainable Development (HUISD)
E-mail: hnd@lowtem.hokudai.ac.jp

Report from Parallel Session 1.
---Mitsuru Osaki, Sustainability Governance Project (SGP), Hokkaido University
Report from Parallel Session 2.
---Hiroshi Kida, Research Center for Zoonosis Control, Hokkaido University
Report from Parallel Session 3.
---Yoshimasa Watanabe, Graduate School of Engineering, Hokkaido University
Closing Remarks: *For Our Future Direction*
---Takeo Hondoh, Hokkaido University Initiative for Sustainable Development (HUISD)

Throughout this symposium, we aimed to stimulate and to deepen discussions among researchers of various fields relating to sustainable development in order to enhance understanding our challenges from various viewpoints on sustainability and to surmount potential barriers between different disciplines, different nations and different regions.

We thank that more than 900 participants in total including 80 overseas participants from 19 different countries joined the symposium. Also we had a number of researchers from various disciplines such as eco-system, governance, recycle economy, water management, etc. These were the reasons why the discussion became active and thoughtful.

This symposium featured the three-day program to address and to integrate the sustainable development issue both the inter-disciplines and specific fields; Day-1 "Four plenary sessions on comprehensive view of sustainable development", Day-2 "Three parallel sessions on different disciplines", and Day-3 "Plenary sessions on roles of higher education and countermeasures for sustainable development" including poster presentations. Comprehensive summaries provided by the chairpersons of these sessions are included in this volume.

With a integrated discussion, the symposium reached the conclusion for the realization of need of solid network/collaboration, which is highly needed, among universities, institutions and individual researchers, in which the organizer of the symposium declared that Hokkaido University is willing to provide a comprehensive network for information-exchange on sustainable development and to organize next symposium in Sapporo in 2009 to continue and develop the discussion raised by this symposium. Coming Hokkaido University's activities on sustainable development will be informed to all participants immediately after the concrete plan is confirmed.

Thank you again to all your sincere supports to the symposium.
Hope to see you again at Sapporo on summer 2009!

Poster Abstracts

P-1

Research Activities on Environmental Studies in the Pan-Okhotsk Research Center

Naoto Ebuchi, Yasushi Fujiyoshi, Toshihiko Hara, Sumito Matoba, Humio Mitsudera, Tomohiro Nakamura, Takeshi Nakatsuka, Kay I. Ohshima, Takayuki Shiraiwa, Kunio Shirasawa

Pan-Okhotsk Research Center, Institute of Low of Temperature Science, Hokkaido University,

This poster introduces research activities concerning environmental studies in the Pan-Okhotsk Research Center, Institute of Low Temperature Science, Hokkaido University.

The Sea of Okhotsk is one of the southernmost seasonal sea ice zone in the Northern Hemisphere.

Thus, it is expected that the generation of sea ice in the Sea of Okhotsk is very sensitive to the global environmental changes, such as global warming. Aiming to properly evaluate role of the Sea of Okhotsk in the global environment, the Pan-Okhotsk Research Center (PORC) was inaugurated in the Institute of Low Temperature Science, Hokkaido University in April 2004.

The Center covers physical, chemical and biological aspects of the environment in the Sea of Okhotsk and its surrounding areas. Field observations and monitoring have been conducted using various instruments, such as the dynamic monitoring system for sea ice areas, which enables simultaneous observations of the oceanic currents, sea ice drift and atmospheric circulation above the ice-covered sea, unmanned meteorological monitoring towers, and research vessels.

Moreover, researchers at the center have been developing numerical models of the Atmosphere- Ocean-Land-Biosphere-Cryosphere system to clarify physical, chemical, and biological mechanisms of the environmental variations in the Pan-Okhotsk area and to predict them.

Properly evaluating the impact of and predicting the future of climate change require conducting intensive observations and developing predictive models based on the collected data. Moreover, the establishment of observation and research networks is also indispensable for continuing long-term, extensive observations.

This Center has been proceeding with comprehensive monitoring and modeling efforts for the Pan-Okhotsk region in collaboration with universities and research institutions not only in Japan, but also in Russia, Canada, the U.S., China, Korea, and numerous other nations.

P-2, 3

International Antarctic Institute project in Hokkaido University

Takeo Hondoh [1], Shin Sugiyama [1], Shigeru Aoki [1], Masanobu Yamamoto [2], Testuo Sueyoshi [1], Sohey Nihashi [1], Hiromi Kimura [1],

1/Institute of Low of Temperature Science, Hokkaido University,

2/Faculty of Environmental Earth and Science, Hokkaido University

The international Antarctic Institute (IAI) is an international, multi-campus program of education in cryosphere science. The institute was firstly proposed by the University of Tasmania and now 16 universities and institutions from 11 countries are involved as international partners. IAI aims to offer international standard education programs at undergraduate and graduate level with a special emphasis on Antarctic and cryosphere sciences. The universities and institutions share their curriculums within the framework of IAI partnership so that the students are able to take lectures and courses internationally. For those students who completed an agreed portion of the curriculum, bachelor and master degrees will be offered by IAI in addition to the degrees given by their home institutions.

Hokkaido University is enrolled in the IAI program as one of the leading universities in the field of cryosphere science. Institute of Low Temperature Science and Faculty of Environmental Earth Science have initiated a project to tailor and newly establish lectures and field courses for the purpose of IAI program. To offer a curriculum with an international standard, we collaborate internationally with Swiss Federal Institute of Technology (ETH) and University of Tasmania, and domestically with National Institute of Polar Research and Tokyo University of Marine Science. In May 2006, a glacier field course in Switzerland has been conducted for the first time with 15 students from Graduate School of Environmental Science. Another field course studying sea ice is planed in February 2007 at lake Saroma, East Hokkaido. Two lectures are commonly offered in Hokkaido University and in ETH by using a text book jointly published by professors in the universities, and also by e-learning systems. The curriculum is specially prepared with an English environment to accept students from all over the world.

P-4

Environmental role of methane Hydrate formation near sea bottom offshore Sakhalin, Okhotsk Sea

Hitoshi Shoji, Nobuo Takahashi, Hirotsugu Minami, Akihiro Hachikubo, Hirotoshi Sakagami,
Alexey Krylov, Masato Kida
Kitami Institute of Technology

Fluid venting from depths of sea sediment will transport a significant amount of methane gas into sea water, and eventually to the atmosphere, contributing to enhance greenhouse gas activity for global warming. Gas hydrate formation near sea bottom may act as negative factor for the global warming by fixing methane gas in a solid crystalline form as gas hydrates. However, the details of this gas seep and fixation processes near the bottom are not understood quite well at present.

Side-scan-sonar survey with high-resolution seismo-acoustic profiling was performed offshore Sakhalin, Okhotsk Sea by the members of CHAOS (hydro-Carbon Hydrate Accumulations in the Sea of Okhotsk) project by Japanese, Russian, German, Belgium and Korean scientists in 2003. The survey results revealed characteristic distributions of gas hydrate accumulations with unique images of gas seepage structures and vertical fluid channel at/near sea bottom. More than 40 seepage structures were found within a 10 x 20 km survey area. The maximum size of seepage structure observed is about 600 m in diameter. Methane gas released from the seepage structures into the above water was detected as flare images by hydro-acoustic profiling. Investigations for an understanding of methane hydrate formation mechanisms and monitoring of hydrate formation activities are required to understand the role of near-bottom hydrate formation for methane gas budget in the atmosphere and to discuss about future actions against long-term trend of increasing greenhouse gas contents.

P-5

Sustainable Farming System and Natural Resource Utilization:
Evidence from the Rice-prawn Gher Fariming System of Bangladesh

Basanta Kumar Barmon, Takumi Kondo, Fumio Osanami
Laboratory of Development Economics Department of Agricultural Economics, Graduate School of Agriculture, Hokkaido University

This present study attempts to examine the economic evaluation and sustainability of rice-prawn gher farming system using indigenous natural resource use in Bangladesh. Experimental data and field survey data were used in the present study. Soils were collected after prawn production (before paddy production) and after paddy production (before prawn production) and tested in the Soil Resource Development Institute (SRDI) laboratory in Khulna, Bangladesh. The findings of the study indicated that the farmers used less chemical fertilizers in MV paddy production under the rice-prawn gher farming system compared to MV paddy production in Bangladesh and were statistically significant between the two agricultural systems. The main reason is that farmers apply various combinations of feed to gher plots during the prawn production and the leftover feeds make the land fertile for MV paddy production. Moreover, various types of algae and weeds grow on the bottom of the canal as well as the mid field of the gher farm, helping to make the land fertile for MV paddy production after prawn production. The cost of chemical fertilizers for MV paddy farming was about six times higher than MV paddy production under the rice-prawn gher farming system. However, per acre MV paddy production of MV paddy farming was almost same to MV paddy production under the rice-prawn gher farming system. The rice-prawn gher farming is a cost-saving technology for MV paddy production.

P-6

Problems in controlling invasive alien raccoons in Hokkaido, Japan

Tohru Ikeda, Go Abe, Yuji Masuyama, Shiro Tatsuzawa
Research Group of Regional Science, Division of Human Sciences, Graduate School of Letters, Hokkaido University

Irresponsible release and escape of pet raccoons (Procyon lotor) has caused their naturalization in Hokkaido, Japan. Raccoons had naturalized in cattle breeding area at first, where they could find food easily, then spread throughout Hokkaido.

Raccoons have opportunistic and omnivorous feeding habits, taking crops and fruit in agricultural areas and predating indigenous species such as the Japanese crayfish (Cambaroides japonicus) and the Ezo salamander (Hynobius retardatus) in forests.

Nuisance control harvests of invasive alien raccoons were conducted in some areas in Hokkaido, but raccoons show high reproductive power and potentially rapid rate of population growth, thus it will be impossible to control invasive raccoons only by nuisance control harvesting. Intensive extermination under scientific control programs on the basis of adaptive management is indispensable to controlling invasive alien raccoons. As public awareness of invasive alien raccoon issues is low, except in some areas where agricultural damage is serious, educational efforts will be needed regarding invasive alien raccoon issues, especially irreversible impacts on native ecosystems.

P-7

Toward Sustainble Managemant in Japanese National Parks: Recreational impacts on natural resources and visitor experiences

Tetsuya Aikoh [1], Yasushi Shoji [1], Kazushige Yamaki [2], Kazuo Yamaguchi [3], Akihiro Kobayashi [4]

1/Hokkaido University, 2/Tohoku Research Center, Foresty and Forest Products Research Institute, 3/Consultant for Natural Resources Developments Inc., 4/Senshu University, Hokkaido College

Increasing number of visitors on outdoor recreational areas are threatening inherent conditions of such areas like national parks, national forest and world heritage registered sites in Japan. Soils are eroded, and alpine flowers are trampled by hikers on trails. Human waste and papers are found around shelters and campgrounds. Water contamination and disturbance of wildlife habitats are concerned. Also, quality of visitor experience are degraded. There are some conflicts among different type of visitors, such as hikers and bikers, kayakers and anglers, etc. Expected quiet atmosphere are loosing, because visitors are gathered at some summits, trailheads and accommodations, especially in some famous park like Mt. Fuji or Shiretoko.

To achieve sustainable management in natural recreational areas, some planning and management frameworks has been developing in North America, Recreational Opportunity Spectrum, Carrying Capacity, Limit of Acceptable Change, Visitor Experience and Resource Protection, etc. Those frameworks need to establish the management objectives which show the purposes and visions of such area, and the evaluation and monitoring of natural resource conditions and visitor experiences. On the other hand, Japanese National Park system seems to lack such type of planning and management framework. Lacks of reasonable planning and management framework is one of causes that park management are not effective. This series of posters describe the necessary of planning framework, the method to get exact recreational use statistics, and the importance of information about visitor choice behavior, toward sustainable management in Japanese National Parks.

P-8

Understanding Visitor Flows in Daisetsuzan National Park: Toward Sustainbale Management in Japanese Nationial Parks

Yasushi Shoji [1], Kazuo Yamaguchi [2], Kazushige Yamaki [3], Tetsuya Aikoh [1]

1/Hokkaido University, 2/Consultant for Natural Resources Developments Inc., 3/Tohoku Research Center, Foresty and Forest Products Research Institute

Visitor monitoring is fundamental to the sustainable management of recreation areas. Without this information, landowners or recreation managers cannot develop appropriate action plans to maintain natural resources and to manage quality of visitor experiences. In North American and European countries many studies have been conducted and a great deal of knowledge and techniques has been accumulated. In contrast to these countries, little attention has been given to the understanding of visitor monitoring in Japan.

Simple aggregation of self-registration books has been the main source of visitor counting in Japan. Most of mountain recreation areas, landowners or recreation managers request trekkers to write their information on self-registration books at trailheads, and it is said that not a few trekkers are willing to cooperate with it. Therefore, the official number of trekkers, which is reported by the Ministry of Environment, has also largely depended on simple aggregation of these self-registration data.

However, the number is fundamentally underestimation since there always exists some uncooperative trekkers, in addition a trend toward reluctance to cooperate with it against leaking of personal information has affected the registration rates. Thus, these ungraspable trekkers have evolved into an uncertainty on management of mountain recreation areas in Japan. Toward sustainable management, this paper examines closer annual visitor flows in the Omote-Daisetsu area, Daisetsuzan National Park, Japan, combining data from self-registration books and infrared trail traffic counters.

P-9

Understanding Hiker's choice behavior in Daisetsuzan National Park: Toward Sustainble Managemant in Japanese National Parks

Tetsuya Aikoh [1], Akihiro Kobayashi [2], Yasushi Shoji [1]
1/Hokkaido University, 2/Senshu University, Hokkaido College

The information about visitors' choice of the sites for hiking is useful to manage trails in recreational areas.
Based on such information, managers will be able to take effective management actions to achieve the sustainability of the park. Visitors' choice behavior are known as the composition of several attributes such as personal factors, information sources and site attributes, etc. Increasing number of visitors and the change of access has caused the concentration of visitors on some popular routes, therefore natural resource impacts and the change of wilderness experience has been reported in Daisetsuzan National Park. Managers and stakeholders are seeking some management strategy to modify such situation.
Hikers were asked to rate the importance of 21 attributes about the routes, the trailheads and the camp sites. We also asked the information sources, the motivation, their experience and their willingness to next visit. The result of factor analysis showed that visitors considered the convenience of camp site, the walkability of route, the convenience of trailhead, the condition of natural resource and the less visitors. Those factors had relationships with their motivation, information sources and their experience of hiking and Daisetsuzan National Park. We found the significant relationships among visitors' personalities and site attributes which they had considered. Those information will be helpful for managers to control visitor flows and to choose the information they offer.

P-10

The industrialization of agricultural villages and the employment structure in the Sunan area of China - A follow-up research of Kaixiangong village -

Hong Park
Graduate School of Agriculture, Hokkaido University

In China, reform of the ownership system of enterprises was promoted on a large scale in the late 1990's. Due to the increase of private enterprises, "Sunan model", which was owned by the town and village enterprises, has become a "Wenzhou model". This paper clarifies the real state and characteristics of farming village industrialization, centering on one of the villages in the Sunan area. In addition, by making clear the present status of progress of home-based industry, this presentation ascertains the change in the agricultural work structure in the economic development area, based on the existing study materials and actual condition survey.

P-11

Analysis of Indemnity for Community related to the World Natural Heritage Site — on Fisheries Management in Shiretoko —

Yayoi Hisasue
Graduate School of Law, Hokkaido University

On July 14, 2005, Shiretoko was finally registered as the World Natural Heritage Site.
Now, dynamic ecosystem of Shiretoko which contains both the land and sea become well known to the world.
On the other hand, Shiretoko shows through Japanese fisheries management that it is a difficult and delicate problem to balance up interests of communities in the Site.
This research tries to find the best way to indemnify for communities which suffer losses from ecosystem conservation policies which implemented in the World Natural Heritage Site.
The history of Japanese fishing rights began with the Fisheries Law of 1902(Meiji era) which licensed fishing rights for the first time. Since postwar amendment of 1949(Showa era) adopted a concept of "adjustments for fishing", Japanese fishing

rights have had natures both property right as legal and environmental right as essential. Shiretoko fisheries management raises the question of where shall we find the common ground when the nature of environmental right restricts the exercise of fishing rights.

In the context of a new conflict between fishing rights and environmental right, change in the substance of "environmental right" might exist which is influenced by the stream of International Environmental Law that regards ecosystem conservation as most important.

It is necessary to establish strict fishery resources management system developed from old concept of adjustment for fishing to reach both goals of "marine ecosystem conservation" and "sustainable development in the sea" that is to say on one hand to meet the IUCN(International Union for Conservation of Nature and Natural Resources) demand to regard ecosystem conservation as most important among diverse values which the World Heritage Convention(1972) brings and on the other to continue Shiretoko fishing based on fishing rights. Thereby it is appropriates to outline the way to indemnify for communities in Shiretoko World Natural Heritage Site in three phases as follows:

Ⅰ establish strict fishery resources management system,

Ⅱ adopt administrative fisheries controls as a part of above system,

Ⅲ and allow those whose fisheries rights are injured bringing actions(administrative/ civil) for their damages.

Actually, Shiretoko fisheries management raises our environmental awareness which shift from the amenity improvement stage to the Global Environment Facility stage.

P-12

Why could be small villages inside of dolines in China sustained for centuries?

Tadao Ando [1], Eriko Okada [1], Katsuhiko Demura [2], Toshiaki Tadano [3]
1/Hiroshima University, 2/Hokkaido University,
3/Tokyo University of Agriculture

Among the thousands dolines distributed in the limestone area in Western China, around one thousand of dolines have been inhabited for the past several hundreds years. The very steep limestone walls surrounding the village limited the villagers' activities to exchange materials with the outside of the dolines. There is no river above ground in the villages. Therefore, the villagers have been mostly dependent on the products inside of the dolines including basic life-supporting materials like water and foodstuff.

In order to elucidate the reasons why these life-supporting systems were sustainable for several centuries, we tried to analyze the material-cycling systems in the village in collaboration with the local scientists in China. The followings are the main findings obtained;

1) The solar energy was almost sole source of the energy to support the villagers' lives and activities. They obtained the essential energy from the food (mainly corn, beans and vegetables with occasional intake of meat) and the wood (for fuel and timbering) produced inside of the dolines.

2) Two types of mineral nutrient cycling routes were recognized in the system; the closed cycling route passing mainly fields and rather open cycling route passing through forest. The both route joined in the human life and the nutrients were incorporated in the fields as ash minerals.

3) Since almost all the materials including human bodies were incorporated in the recycling systems, there were not found any waste materials.

4) The people were very diligent and healthy, and passing constant daily life.

Though the way of living is not applicable to the industrialized countries, the fundamentals underlying those findings may be helpful for us to develop a sustainable society.

P-13

Wildflowers in Hokkaido as a natural resources - their conservation, creation, sustainable management, and use-

Tetsuya Kondo, Hajime Matsushima
Research Faculty of Agriculture, Division of Bioresources and Product Science

Although most parts of the mainland Japan have been developed, some areas in Hokkaido with several natural resources still remain. In particular, habitats of wildflower species with beautiful flowers are characteristic and important natural

features in Hokkaido. Some of these habitats have been conserved, and are used as sightseeing destinations or for recreation purposes, already.
In this study, personal interview surveys and field investigations were conducted at nine sites at which are wildflower habitats to determine the site characteristics, vegetation type, maintenance methods used, and utilization patterns.
Five sites were public domain land, two sites were on company-owned land, one site was in the precincts of a Shinto shrine, and one site was on the campus of a university. Most of the plant species that were conserved were spring ephemerals that are peculiar to the Northern region in Japan. Eight sites were managing pre-existing habitats, and one site was managing a habitat created by transplantation of individuals. All the sites were managed by mowing understory once or twice a year during summer or autumn. The duration of mowing ranged from 5-45 years. The site of each habitat of wildflower was used as a sightseeing location, for a stroll, or for nature observations.
We assume that, in Hokkaido, there are many promising wildflower habitats that are being suppressed by competitive species such as Sasa senanensis. We will be able to establish aesthetic wildflower habitats by suitable management of them, and also create new aesthetic wildflower habitats by transplantation of wildflower individuals. Aesthetic wildflower habitats that are maintained sustainably by appropriate maintenance strategies will be useful for a sightseeing location, for a stroll, or for nature observations.
The evaluation of such wildflower communities will be also necessary in the future.

P-14

Sustainable coastal management for recreational use and natural resource conservation: The case of Ishikari Coast, Hokkaido

Hajime Matsushima, Tetsuya Kondo
Graduate School of Agriculture, Hokkaido University

The purpose of this study is to consider and propose sustainable coastal area management method for their recreational use and natural resource conservation. Ishikari coast, 10km long at middle part of Hokkaido, was used by a lot of people for recreational use (e.g. swimming, barbeque, fishing, ATV, PWC) in summertime. Such a concentration of recreational use caused the impact of natural resources and the conflict between recreational users, especially motorized vehicle users and others. This poster resulted in the necessity of future vision and environmental education for sustainable coastal management, which Ishikari coast does not have established yet. Future vision means a framework of decision making for management planning. To establish the vision, application of natural park system were proposed.
Environmental education has great potential to enhance knowledge in the short run and to prompt attitude change in the long run. This research showed that the visitor landscape preferences were different according to their purpose. Such a "gap" may cause the conflict between visitors who have different purpose. This result showed that the effort to fill in the gap, called environmental education (share of the information, sign board, guides, etc.) is important. This poster was concluded that the application of natural park system is suitable to this area for the sustainable coastal management.

P-15

Design Viewed from the Perspective of Sustainalbe Development

Mirei Hagiwara, Nozomi Hokari, Kazuyuki Seino, Shun Niizuma, Masuyo Tokita
Hokkaido Universityy

Design is indispensable to achieve a society that promotes sustainable development. Products surrounding us affect our daily life physically, mentally, aesthetically, economically, and environmentally.
The way we design products reflects our approach to society. In other words, our daily actions and judgments in making and selecting products reflect our society's sense of values.
Therefore, we propose, as an extension of our freshman semiar course entitled "Power of Design", to reevaluate materials indigenous to Japan and re-examine traditional designs and techniques associated with these materials.
Among the various natural materials that will help us return to a "cradle to cradle" society, we will focus on bamboo and diatomaceous earth. We will first analyze their properties and current uses, and then present functional and beautiful designs suitable for these materials. Through the use of daily products made of such natural materials, we will learn to appreciate the beauty that nature bestows on us.

Such happy experiences will raise individual awareness of ecology and encourage responsible social behavior that does not overload our environment.

P-16

Effect and effectiveness of vaccination: pertussis in NZ as the case of sudy

Andrei Korobeinikov
RIES, Hokkaido University

In some cases vaccination is unreliable. For example vaccination against pertussis has comparatively high level of primary and secondary failures.
To evaluate efficiency of vaccination we introduce the idea of effective vaccination rate and suggest an approach to estimate it. We consider pertussis in New Zealand as a case study. The results indicate that the level of immunity failure for pertussis is considerably higher than was anticipated.

P-17

Research and Development of ubiquitous information services for sustainable fisheries operation and management in the offshore around Japan

Sei-ichi Saitoh [1,2], Fumihiro Takahashi [2], Daichi Tachikawa [2,3], Motoki Hiraki [2,4], Masami Yoshida [2,5], Teruaki Hiura [2,5], Hidetada Kiyofuji [6]
1/Laboratory of Marine Bioresource and Environment Sensing, Graduate School of Fisheries Sciences, Hokkaido University, 2/SpaceFish LLP, 3/Fujitsu Hokkaido Systems Limited, 4/GIS Hokkaido Limited, 5/Fujitsu Limited, 6/Joint Institute of Marine and Atmospheric Research University of Hawaii

This paper presents an overview of a newly developed ubiquitous fisheries information system using satellite remote sensing and geographical information system (RS/GIS). The system was developed to aim for providing high value-added fisheries oceanographic information in anytime and at anywhere. We also make this system to come into wide use for especially fishermen and managers in fisheries cooperation or fisheries experimental stations. All users can operate all products dynamically such as overlaying, measuring distance from nearest port or fishing grounds on the GIS. This system can help to support effective fishing activities such as economy with time for fishing ground destination or nearest landing port. This ubiquitous information services promise to promote sustainable fisheries operation and management in the offshore around Japan.

P-18

Organochlorine Pesticide Residues in the Pasture Environment, Meat and Milk of Philippine Buffaloes (Bubalus bubalis) from Angat, Bulacan

Elenanor S. Austria [1], Dr. Evangeline C. Santiago [2]
1/Faculty, Natural Science Department, Adamson University, Manila, Philippines
2/Head, Research and Anayltical Services Laboratory, Natural Science Research Institute, University of the Philipines, Diliman

The levels of OCP residues in environmental samples (soil, sediments, water and forage) as well as in meat and milk of Philippine Buffaloes from Angat and CLSU were determined. From Angat, Barangays Laog and Banaban were chosen because of its history of pesticide use and a preliminary study revealed the presence of several OCP residues. CLSU-PCC was chosen as the pseudocontrol area because although pesticide use was stopped more than a decade ago, contamination of the area cannot be ruled out.
Samples were collected from August 2002 to October 2003 and were taken to the Research and Analytical Services Laboratory of the Natural Science Research Institute (RASL-NSRI), University of the Philippines, for analysis. In the laboratory, soil, sediments and meat samples were extracted with DCM and hexane by Soxhlet apparatus for 8-16 hours. The extract was cleaned up using column packed with fully activated silica. Forage samples (grasses, legumes and feed concentrate) were extracted with acetone by sonication and cleaned up with silica and alumina. Milk samples were extracted with hexane and ethyl alcohol by sonication with reflux. Each sample was spiked with a surrogate standard (teterachloro-m-

xylene), OCP mix and internal standard mix (pyrene-d-10, phenanthrene-d-10) to assess performance of the method. A recovery of 60- 120% was considered acceptable. Method Detection Limits (MDL) was also determined for each compound and was computed based on US EPA method. Levels below MDL were reported as <MDL.
Analysis of water samples revealed residue levels below MDL indicating low levels of contamination. However almost all of the studied OCPs were detected in soil samples from Banaban and Laog with Banaban having the highest amount of contamination, 39.89 μg/kg. It is followed by Laog (37.97 μg/kg) and CLSU (6.48 μg/kg). It is possible that the longer use of OCP in Laog and Banaban than in CLSU resulted to higher level of contamination in soil from these areas.
The contaminants detected in soil samples were also the same contaminants detected in sediment samples. Laog contains the highest amount of contamination (104.20 μg/kg) followed by Banaban and CLSU (51.54 μg/kg and 1.72 μ g/kg, respectively). The higher amount of contamination in Laog sediments may be due to the more intensive use of irrigation in Laog than in Banaban and CLSU.
Analysis of OCP residues in forage samples revealed that endrin ketone was the predominant contaminant being present in all forage samples in high amounts. CLSU feed concentrate was also found to contain higher residue levels than grasses and legumes taken from the three areas. In meat, almost all of the studied OCP were present with the cyclodienes, heptachlor, dieldrin and endrin aldehyde as the predominant contaminants. But although many residues are found in the environment and meat of carabaos, only a few residues were present in milk samples. This may be because body burdens were not high enough to be incorporated in the milk. Comparison with the Codex EMRLs for meat and milk revealed that all of the detected residues were below their respective EMRLs suggesting that it is relatively safe to consume these animal products.

P-19

Determination of the presence of Organochlorine Pesticide Residues in the Einvironment of IPO Dam

Elenanor S. Austria
Faculty, Natural Science Department, Adamson University, Manila

The levels of OCP residues in environmental samples (soil, sediments, water) from Ipo Dam were determined. Samples were collected in September, 2005 and taken to the Research and Analytical Services Laboratory of the University of the Philippines, Diliman. Analysis of the water samples revealed that the levels of all of the studied OCP residues were below the Method Detection Limits (MDL), suggesting very low levels of contamination. In sediments, only residues of endrin aldehyde and endosulfan 2 were detected in Ipo Dam and comparison with the data from Laog , an agricultural community revealed Ipo Dam contained less OCP residues. This study also found out that the levels of OCP residues in sediments were higher in Laog, than in Ipo Dam (total OCP mean concentration: 6.0 ug/kg in Ipo Dam and 67.71 ug/kg in Laog). This may be due to the more intensive use of chemicals and irrigation in Laog. The analyzed soil samples revealed that only residues of endosulfan sulfate was present in soil samples from Ipo Dam. Comparison of the total OCP mean concentration in soil revealed that Laog has a higher amount of contamination than Ipo Dam (16.15 ug/kg in Ipo Dam and 4.24 ug/kg in Laog). Since pesticide use was not allowed in the watershed area, the presence of endosulfan sulfate residues may mean that Ipo Dam has received inputs of the persistent OCP residues from the surrounding agricultural areas.

P-20

21st Century Center of Excellence Program 'Prediction and avoidance of an abrupt change in bio-geoshpere system'

Motoyoshi Ikeda
Faculty of Environmental Earth Science, Hokkaido University

"Global warming by CO2", "ozone depletion", "forest destruction by exploitation" and "pollutants" are not influencing the environment independently. A possible feedback loop is that "Low absorption of CO2 caused by forest destruction" promotes "global warming", and then, "global warming" in turn enhances "forest destruction". They interact each other. Therefore, we need to understand these phenomena as a coupled system and to predict a future change. We are trying to understand and predict the phenomena by clarifying on the basis of bio-geoscience and intercomparison between the high latitude region and the low-to-mid latitude region. Our final objective is to avoid the abrupt change by not controlling nature but helping it from the cycle between natural ecosystem and material circulation.

P-21

The Land Use Changes and Modern Landscape Structure of the Russian-Chinese Transboundary Geosystem

Natalia Mishina
Research Institute of Humanity and Nature (RIHN)

Anthropogenic impacts on the adjacent territories of North-eastern China and the Russian Far East are considerably different. But a number of such territories have similar natural conditions and are the parts of integrated formations - transboundary natural geosystems. Both ecological and economical conditions of every transboundary territories depend on one another. Therefore transboundary territory's researches have large theoretical and practical value for the planning their sustainable development.

The territory of our research is the transboundary low mountain region with common geologic and geomorphologic structure, similar soils, vegetation and climate. The Ussuri River, on which the state boundary of Russia and China passes, divides this territory into two almost equal parts. The Chinese part of the transboundary geosystem is situated in Heilongjiang province, the Russian one is in Primorskii and Khabarovskii krais.

To conduct the ecologic-geographical analysis of the transboundary geosystem, the map of its modern landscapes was compiled, the main features of landscape structure were determined. Statistical economic data and tendencies of resource's use were also analyzed. It allowed us to define the main stages of economic and land use development of Russian and Chinese part of geosystem. Studying of land use changes from 1990 to 2000 showed the major trends of modern landscape transformation and the basic ecological problems in the different parts of the transboundary geosystem. Some measures on improvement of their ecological situation were offered. The obtained data were mapped.

In conditions of deficiency of the unified information about the Russian-Chinese geosystems, the received information is the important basis for further planning of the sustainable territorial development of the near-boundary administrative formations of both countries.

P-22

Germination and growth responses of some key plant species from Horqin sandy land of China to the simulated desertificated conditions

Lijun Chen
Institute of Applied Ecology, Chinese Academy of Sciences

There is little knowledge on the germination and growth response of key plant species in Horqin sandy land, to environmental stress conditions. This study aim to investigate the effects of different temperatures and light intensities on the germination of 7 key plant species, and the influence of interaction of varied nitrogen/phosphorus regimes simulated different degrees of degraded soil on the growth of 4 key plant species grown in desertificated area in Horqin sandy land.

P-23

Decentralized Cooperation for Sustainable Development: Toward Paradigm Shift for International Cooperation Framework

Kuniko Seki
Graduate School of International Media and Communication, Hokkaio University

For many years, nation states have made significant efforts to resolve diversified and complicated global issues in cooperation with international organizations, NGOs and private companies. Despite these experiences, accumulated under existing international cooperation framework, global issues remain unsettled.

Then, what is an effective international cooperation framework to cope with global issues? One alternative framework, decentralized cooperation (cooperation decentralisee), sets out to give us an answer to this question.

Decentralized cooperation is a form of grass-roots international cooperation, institutionalized by French government in 1992, between French municipalities and their counterparts in developing countries. Under this framework, French municipalities offer techniques, knowledge and know-how to their partner cities in almost every field concerning public administration (environment, education, public health, urban and rural development, etc.).

Why have existing international cooperation frameworks failed? One of the main reasons has been insufficient effort aimed at strengthening the basis of democratic public administration systems in developing countries. In other words, without

reinforcing self-resolving capacity against local problems, sustainable development of recipient communities can not be assured. In this meaning, decentralized cooperation seems useful for recipient communities, assuring transfer of public administration experience from French municipalities to their external counterparts.
Furthermore, we can remark other advantages of decentralized cooperation, compared with classical international cooperation frameworks: First of all, we can observe a less hierarchical relationship between supplier and recipient of decentralized cooperation. Because, in general, decentralized cooperation is concerned with the benefits of the vast existing sister city network established between French and foreign municipalities, respecting the reciprocal and equal partnership. Secondly, sister city relationships assure also long-term cooperation, one important element for sustainable development. Thirdly, long-term and equal partnership enables French municipalities to reply precisely to local needs, which is often needed by recipient municipalities.
Therefore, decentralized cooperation should be considered as a new paradigm for the international cooperation framework.

P-24

Life Cycle Assessment of Fishery Products - Case studies of Squid and Scallop production -

Kazuhito Watanabe [1], Teisuke Miura [2]

1/Miyagi Prefectual Government, 2/Graduate school of fisheries science, Hokkaido university

It is indispensable to incorporate environmental measures into fishery production process in addition to a resource and economic viewpoint to achieve sustainable fishery. Life Cycle Assessment (LCA) is an important and useful tool to evaluate the environmental effects and potential impacts associated with a product and a service throughout its life span. Up to date, however, few data have been reported concerning the environmental burden of fisheries. In this research, we quantitatively calculated the environmental burden of the entire squid and scallop fishing systems in Hokkaido and assessed the environmental impacts using LCA. Squid and scallop were chosen for this case study because they are important fishery products for the Japanese food supply. Moreover, we suggested the evaluation procedure, while applying LCA to the fishery. As to squid related fishery, squid jigging fishery exhibited the largest environmentally burden, followed by off-shore trawl fishery, and large scale set-net fishery. The results suggested the largest value of the squid jigging fishery was mainly due to the use of fuel oil by fish gathering lamps. As to the scallop cultivation industry, on the other hand, the value indicated the ground sowing method was superior to the hanging method. We demonstrated that LCA was applicable to fishery, and this new methodology was to be useful toward the improvement of the environmental aspects of fishery.

P-25

Rabies in Sri Lanka: Knowledge, attitudes, practices and beliefs among community-dwellers

Matibag GC [1], Kamigaki T [1], Kumarasiri PVR [2], Wijewardana TG [3], Kalupahana AW [3], Dissanayake DRA [3], De Silva DDN [3], Gunawardena GSP DeS [3], Obayashi Y [1], Taniguchi T [4], Sawa H [5], Umemura T [6], Tamashiro H [1]

1/Department of Global health and Epidemiology Division of Preventive Medicine, Graduate School of Medicine, Japan,
2/Faculty of Medicine, University of Peradeniya, Sri Lanka,
3/Faculty of Veterinary Medicine and Animal Science University of Peradeniya, Sri Lanka,
4/Ministry of Healthcare, Nutrition and Welfare, Sri Lanka Japan International Cooperation Agency,
5/Department of Molecular Pathobiology and 21st Century COE Program for Zoonosis Control Hokkaido University Research Center for Zoonosis Control, Sapporo, Japan
6/Department of Vetarinary Clinical Sciences, Graduate School of Veterinary Medicine, Hokkaido University, Japan

[Background]
Although Sri Lanka had adopted its national program for the elimination of rabies during the mid-1970s, this fatal disease still remains endemic in all provinces.
Objective
To assess the knowledge, attitudes, practices and beliefs of the study population about rabies.
[Materials and Methods]
This cross-sectional study, performed on 8-25 May 2006, utilized in-person interviews using structured and pre-tested questionnaires in the urban, rural and estate sectors of Kandy District, Central Province. After randomized selection, the sample

consisted of 6,925 persons from 1,570 households of the 26 survey areas, which represented 0.5% of the population of Kandy District.

[Findings]

Most respondents knew that dogs are the most common reservoirs in Sri Lanka (90%) and that rabies is a fatal disease (79%). Eighty-eight percent knew that rabies could be prevented by regular animal vaccination while nearly half knew the universal pet registration law (55%). Majority preferred to seek treatment from physicians if bitten (95%) while the most common reason for not consulting was the distant location of health practitioners (49%). Although most pet dogs were vaccinated (76%), only 44% of immunization cards were shown during the interview. Ninety-three percent would send their pets for free immunization, however, 46% would send them immediately and 40% would send upon respondents' time availability. Although only 43% were aware that the head of the suspected animal should be sent to diagnostic laboratories for confirmation, 58% were willing to send the specimen. While 85% favored animal population control, common reasons against it were personal beliefs (44%) and religion (38%). Most pet dogs were fed more than 3 times per day (85%) and were free-roaming (33%).

[Discussion and Conclusion]

Public health education, awareness and advocacy are vital for disease eradication. Intensified animal welfare programs and responsible pet ownership, especially in inaccessible areas, would be most valuable to increase community participation.

P-26

Rabies in Sri Lanka: Assessing health-seeking behavior following animal bite injuries

Matibag GC [1], Kamigaki T [1], Kumarasiri PVR [2], Wijewardana TG [3], Kalupahana AW [3], Dissanayake DRA [3], De Silva DDN [3], Gunawardena GSP DeS [3], Obayashi Y [1], Taniguchi T [4], Sawa H [5], Umemura T [6], Tamashiro H [1]

1/Department of Global health and Epidemiology Division of Preventive Medicine, Graduate School of Medicine, Japan,
2/Faculty of Medicine, University of Peradeniya, Sri Lanka,
3/Faculty of Veterinary Medicine and Animal Science University of Peradeniya, Sri Lanka,
4/Ministry of Healthcare, Nutrition and Welfare, Sri Lanka Japan International Cooperation Agency,
5/Department of Molecular Pathobiology and 21st Century COE Program for Zoonosis Control Hokkaido University Research Center for Zoonosis Control, Sapporo, Japan
6/Department of Vetarinary Clinical Sciences, Graduate School of Veterinary Medicine, Hokkaido University, Japan

[Background]

Although Sri Lanka had adopted its national program for the elimination of rabies during the mid-1970s, this fatal disease still remains endemic in all provinces with an annual dog bite incidence of 2,000/100,000 and human deaths at 4/100,000. Data on health-seeking behavior after animal bites have not been properly studied at the community level.

Objective

To establish the benchmark data on medical care-seeking behavior and treatment compliance among animal bite victims in selected localities of the Central Province, Sri Lanka.

[Materials and Methods]

This cross-sectional study, performed on 8-25 May 2006, utilized in-person interviews using structured and pre-tested questionnaires in the urban, rural and estate sectors of Kandy District, Central Province. After randomized selection, the sample consisted of 6,925 persons from 1,570 households of the 26 survey areas, which represented 0.5% of the population of Kandy District.

[Findings]

A total of 357 animal bite cases (5,155/100,000) and 2 cases of rabies deaths (29/100,000) have been encountered 12 months prior to the survey. One was a documented case while the other died at home. Eighty-eight percent of injuries fell within 6 to 64 years of age (mean: 33.84 years; 95% CI: 31.73-35.95). Bites in males (54%) were more than in females (46%). Bites on the legs and feet were the most common (60%). Dogs were the most frequently attacking animals (93%) and were mostly pets (75%) that were previously vaccinated (53%). Half the cases occurred at home. Most patients have consulted physicians for treatment (96%). Most patients (86%) received post-exposure vaccine less than five times upon physicians' advice (50%) and upon observation that the animal remained healthy and with prior immunization history (9%).

[Discussion and Conclusion]

Our results showed that the incidence of annual animal bites and human rabies are well above the reported national average. It is of paramount importance to carefully examine the existing surveillance and reporting systems. We highlight the importance of universal registration and immunization coverage especially for owned pets to prevent potential rabies transmission.

P-27

Environmental Impact on Wildlife

Mayumi Ishizuka, Kentaro Sakamoto, Shoichi Fujita
Graduate School of Veterinary Medicine, Hokkaido University

Chlorinated / brominated persistent toxic substances (PTS), such as polychlorinated, -dibenzo-p-dioxins, -dibenzofurans, -biphenyls, -organochlorine pesticides, hexachlorobenzene, 2,2-bis(p-chlorophenyl)-1,1,1-trichloroethane (DDTs), hexachlorocyclohexane and -brominated diphenyl ethers, are ubiquitous contaminants in the environment. Due to the high lipophilicity / resistance to biological degradation, wildlife animals and humans accumulate notable levels of them through food chain. Our research subject is to elucidate the biological effects of these environmental pollutants on wildlife, such as crabs, fishes, birds and mammalians.
Especially, we detected the high level of PTS accumulation in top predators, e.g., seals, Steller's Sea Eagle and White-tailed Sea Eagle. The residues of PTS caused the suppression of thyroid hormone and induced xenobiotic metabolizing enzyme, which was biomarker enzyme for the contamination of planar compounds.
In the meantime, until to day, there is few document reported contamination of PTS in terricolous wild animals. Norway or Brown rats (Rattus norvegicus) inhabit over world especially close to human population. The Brown rats are useful indicator for the effects of environmental contamination on land-wildlife due to their position in food-chain. In recent study, we found the high concentration of PTS in liver of wild Brown rats, and the contaminants affected the gene expression profiles in testis and liver.
We concluded that our environment is polluted enough to find animals with altered hormone levels.

P-28

Sustainability cannot be realized without the Environmental Governance and the Participation of Indigenous Peoples

Yugo Ono
Graduate School of Environmental Science, Hokkaido University

Sustainability is a concept which postulates the environmental safety over the generations. If the environment is destroyed for the convenience of the present life, it is not sustainable. This corresponds to the idea of the Native American's saying that the Earth is not the heritage from the Ancestor, but we rent it from the future generation. Although the sustainability is a global concept, we have to act locally to realize it. Here I will take two cases in which we are acting in Hokkaido as environmental scientists to realize the sustainability of our planet.
1: Conservation of natural river ecosystem
The natural river is rare even in Hokkaido where the dam construction and all kinds of concrete works have destroyed the natural river ecosystem especially the migration of salmonids through the 20th century. Hokkaido Development Agency has planned the construction of a big dam (46m high, 300m wide) in the Sanru, a tributary of the Teshio, the second longest river in Hokkaido. The dam not only cuts the migration but breaks the spawning habitat of cherry salmon which is important fishing resources. Major purposes of dam construction are flood control, power generation and water supply. But they are satisfied by alternative ways which do not destroy the environments. Free and open discussion is needed to evaluate the alternatives, but it is not realized by the policy of Hokkaido Development Agency. Change of the decision making system is necessary for such environmental issues. Environmental governance is urgently introduced.
2: Participation of Indigenous Peoples
Sustainability cannot be realized in a society where the equality is not certified. The Ainu, the indigenous people in Japan, is still in the position not equal to the other Japanese people. They lost the rights of caching salmon, shooting brown bears and deer, and land rights. Public education of their language has never been done for a long time. Their land names of the Ainu language have been changed to the Japanese. Recovery of the Ainu's rights and culture should not be neglected when we talk of sustainability.

P-29

Amur-Okhotsk Project 2005-2009

Takayuki Shiraiwa
Research Institute for Humanity and Nature

Recent studies in the northern North Pacific have revealed that biological productivity was limited by iron availability there. Because iron can be hardly dissolved in water, phytoplankton largely relies on the iron supply from land via the atmosphere and/or rivers. In contrast to the central region of the northern North Pacific, the phytoplankton productivity is very high in the Sea of Okhotsk, probably due to the sufficient supply of iron from the Amur River. Riverine iron cannot keep dissolved in the seawater without being a complex with humic substances created in forest and wetland. Therefore, changes in land uses on the Amur basin such as deforestation, forest fire, cultivation, urbanization and/or reduction of wetland may reduce the biological productivity in the Sea of Okhotsk and the northwestern area of North Pacific Ocean.

In this project, we try to answer the following questions; 1) how large is the discharged flux of materials such as iron from the Amur River, how far the iron is transported offshore and to what extent the iron is contributing to the biological productivity in the Sea of Okhotsk; 2) what are the factors controlling the release of materials such as iron from the land to the Amur River in the natural and/or artificially altered land surface conditions in the Amur basin; 3) to what extent the economic and political systems around Northeast China and Far East Russia change the land uses in the Amur basin in the past, present and future; 4) how variable are the water and material cycles around the Amur basin and the Sea of Okhotsk in the natural conditions.

P-30

A Lower Trophic Ecosystem Model Including Iron Effect in the Okhotsk Sea

Takeshi Okunishi
Graduate School of Engineering, Hokkaido University

The Okhotsk Sea is one of the most biologically productive regions in the world, and it supports high fisheries production. The micronutrient iron plays a key role in limiting phytoplankton growth rates and structuring plankton communities over much of the world ocean. Recent studies have shown that iron is an important factor controlling phytoplankton in the western subarctic Pacific Nitrate is depleted after the spring phytoplankton bloom in the Okhotsk Sea. This fact suggests that iron supply is higher in the Okhotsk Sea than in the western subarctic Pacific and, that phytoplankton growth is not limited by iron availability in the Okhotsk Sea. However, it is not well known whether iron limits phytoplankton growth or not, or what is the main source of iron in the Okhotsk Sea. We applied a three dimensional ecosystem - physical coupled model including iron effect to the Okhotsk Sea. In order to clarify the sources of iron, four iron compartments were added to Kawamiya et al. (1995)'s model (KKYS) to create our ecosystem model (KKYS-Fe). We hypothesized that four processes supply iron to sea water: atmospheric loadings from Northeastern Asia, input from the Amur River, dissolution from sediments and regeneration by zooplankton and bacteria. We simulated 1year, from 1 January, 2001 to 31 December, 2001, using both KKYS-Fe and KKYS. KKYS could not reproduce the surface nitrate distribution after the spring bloom, whereas KKYS-Fe agreed well with observations in the western subarctic Pacific because it includes iron limitation of phytoplankton growth During spring bloom, the main source of iron at the sea surface is from the atmosphere. The contribution of riverine iron to total iron utilized for primary production is small in the Okhotsk Sea. Atmospheric deposition, iron flux from sediment and regeneration of iron in water column play an important role in maintenance of high primary production in the Okhotsk Sea.

Keywords: ecosystem model, Okhotsk Sea, phytoplankton, iron, primary production

P-31

Evaluation of the impact of water dilution within the eutrophic Lake Barato, Japan

Ryuichiro Shinohara
Graduate School of Engineering, Hokkaido University

Lake Barato is a eutrophic and subarctic 4.37 km2 lake in Hokkaido, Japan. This lake is an oxbow lake that was isolated from the Ishikari River following the development of flood-protection measures on the river. Although environmental criteria for water quality in Japan are defined as total nitrogen (TN) less than 71 ?mol L-1 and total phosphate (TP) less than 3.2 ?mol L-1, levels in Lake Barato exceed these standards by a factor of three (TN: 229 ?mol L-1; TP: 6.3 ?mol L-1). To dilute eutrophic water in Lake Barato, an Inlet Project was carried out during the summer of 2005 via a 1 m3 s-1 inlet from the Ishikari River. In this study, field data and three-dimensional numerical simulations are used to evaluate the impact of water dilution on eutrophication. River water was discharged from the margin of the upper section of the lake to dilute the water. We undertook a numerical simulation of total nitrogen (TN) and total phosphate (TP) distribution and its impact on the emergence of cyanobacteria considering five inlet cases. Model results suggest that the most effective and feasible way to achieve dilution is via a 5 m3 s-1 inlet and open the Shinko Gate, which connects the lake and Ishikari Bay through the channel. Following this scheme, TN and TP concentrations were reduced by 28% following 30 days of discharge according to the simulation results.

Keywords: Lake Barato, dilution of a eutrophic lake, numerical model

P-32

COMPARISION OF PERFORMANCE AND MEMBRANE FOULING CHARACTERISTICS BETWEEN PRESSURIZED AND SUBMERGED PVDF MICROFILTRATION MEMBRANES

So-Ryong Chae
Graduate School of Engineering, Hokkaido University

As a means of complying with current and anticipated regulations, membrane technologies have been widely adopted in the world. Especially, the low-pressure driven membrane techniques such as microfiltration (MF) and ultrafiltration (UF) have attracted a considerable amount of attention in drinking water treatment to remove particulate by size exclusion and usually produce a filtrate free of turbidity and bacteria from river, lake, and underground waters.

There are two different configurations (i.e. pressurized and submerged modules) of membrane filtration technology. Submerged module has become a major feature in wastewater application of membrane technology. Many researchers reported that this module remarkably reduced the power consumption of recirculation pumps used in a membrane bioreactor. However, there were no available reports comparing the pressurized and submerged membrane modules in water treatment. The goal of this study was to compare process performance and fouling characteristics between pressurized and submerged PVDF (polyvinylidene fluoride) hollow fiber membranes having 0.1? nominal pore size (MicrozaR, Asahikasei Chemical co., Japan) treating Chitose River water having relatively high turbidity and humic substances under the same operating conditions (permeate flux of 0.65 m/d, recovery rate of 92%, and physical cleaning using permeate and the compressed air for 90 s).

As a result, turbidity (100%), Al (> 84%), and Fe (> 95%) were removed very well by both membrane modules. However, humic substances and Mn were not effectively removed by the membranes. On the other hand, different fouling characteristics of the two membranes were observed during the experimental period.

In case of the submerged membrane, fouling could be effectively mitigated by backwashing and air scrubbing. In contrast, fouling of the pressurized membrane could not be easily recovered once it increased rapidly. Focused on this point, characteristics of foulants in both membranes were studied. As a result, it was found that relatively large amounts of organic matter (especially carbohydrates and humic substances) and Fe were extracted from the cake layer of the pressurized membrane than that of the submerged membrane.

In addition, from the surface analysis, it was observed that the cake layer formed on the pressurized membrane surface was intensely smoother and thicker than that formed on the submerged membrane surface. Finally, it was recognized that interaction between organic matters and Fe in the pressurized membrane improved significantly the cake compressibility and stability deteriorating membrane fouling.

Keywords: drinking water treatment, pressurized and submerged modules, PVDF, membrane fouling, surface analysis

P-33

Development of a super high-rate ANAMMOX reactor and in situ analysis of biofilm structure and function

Ikuo Tsushima
Graduate School of Engineering, Hokkaido University

The anaerobic ammonium oxidation (ANAMMOX) process is a new efficient and cost effective method of ammonium removal from wastewater. Under completely anoxic conditions ammonium is oxidized with nitrite as electron acceptor to dinitrogen gas and small amounts of nitrate. This process has many advantages as it demands no oxygen and no organic carbon source and produces small amount of sludge and could make the reactor footprint smaller than that of conventional systems. However, it is difficult to cultivate the ANAMMOX bacteria due to their low growth rate (the dabbling time is approximately 11 days). This indicates that rapid and certain start-up of ANAMMOX process is apparently the key to practical application. However, there is still little information on the efficient screening method of appropriate seeding sludges for ANAMMOX process. Therefore, in order to screen a good seeding sludge for the ANAMMOX process, we developed the real-time quantitative polymerase chain reaction (RTQ-PCR) assay with newly designed primers for the quantification of the ANAMMOX bacteria in the sludge. Thereafter, we successfully obtained a seeding sludge with high abundance of ANAMMOX bacteria and inoculated this sludge into an upflow anaerobic biofilter (UAB). The UAB was operated for more than one year, and the performance of ANAMMOX process was monitored. As a result, we successfully achieved the highest nitrogen removal rate of 26.0 kg-N/m3/day, which has never been reported. In addition, the ecophysiology of ANAMMOX bacteria (spatial distribution and in situ activity) in biofilms was analyzed by combined use of a full-cycle 16S rRNA approach and microelectrodes to be improved and stabilize the performance. As a result, the microelectrode measurement clearly revealed that a successive vertical zonation of the partial nitrification (NH4+ to NO2-), ANAMMOX reaction, and denitrification was developed in the biofilm in the UAB. This result agreed with the spatial distribution of corresponding bacterial populations in the biofilm. The coexistence of ammonium oxidation bacteria (AOB), ANAMMOX bacteria, and denitrifiers gives mutual advantages, such as that AOB and Eubacteria give the ANAMMOX bacteria an advantage by consuming dissolved oxygen and organic matter derived from ANAMMOX reaction. We will link micro-scale information (i.e., single cell and/or biofilm levels) with meso-scale information (i.e., the reactor level) to understand the details of ANAMMOX reaction occurring in this UAB.

Keywords: ANAMMOX, RTQ-PCR assay, a full-cycle 16S rRNA approach, microelectrodes.

P-34

SUBCRITICAL CRACK GROWTH IN ROCK

Yoshitaka Nara
Graduate School of Engineering, Hokkaido University

Knowledge of the time-dependent properties of deformation and fracture behaviors in rocks is essential to ensure the long-term stability of structures in rock mass, such as underground power plants or sites for radioactive waste disposal. Subcritical crack growth is one of the main causes of the time-dependent behaviors in rocks. Under low homologous temperatures and atmospheric pressure, stress corrosion is the main mechanism of subcritical crack growth in rocks. In silicate rocks, stress corrosion is a weakening process due to a chemical reaction between the siloxane bond structure near the crack tip and water. The author has studied subcritical crack growth in rock and investigated the effects of surrounding environment and rock fabrics on subcritical crack growth.

The relation between the crack velocity and the stress intensity factor was determined by using a fracture mechanics testing method called "Double Torsion (DT) method" and effective agents on subcritical crack growth in rock were investigated. It was shown that subcritical crack growth in granite was anisotropic and affected by the preferred orientation of pre-existing micro-cracks. When the crack growth occurred in the direction parallel to the plane in which the density of pre-existing micro-cracks was the highest, the crack velocity at the same stress intensity factor was the highest in the same environmental condition. Dependence of the crack growth on the water vapor pressure was clarified in air. The crack velocity at the same stress intensity factor increased with increasing the water vapor pressure. It was also clarified that the

crack velocity at the same stress intensity factor and temperature was higher in water than in air.
Preparing thin sections from the rock specimens used for DT test and observing the crack paths, the relation between the geometry of the crack path and the crack growth behavior was investigated by the fractal analysis. It was clarified that the density of pre-existing micro-cracks affected strongly the geometry of the crack path.
Subcritical crack growth was also observed for micro-cracks by raising the temperature and relative humidity of surrounding environment. By the measurement of P-wave velocity in granite with the change of temperature and humidity, the decrease of P-wave velocity was observed when the relative humidity increased under high temperatures. This result is due to the stress corrosion crack growth for micro-cracks.
From this study, the effects of environment and rock fabrics on subcritical crack growth have been clarified quantitatively.

Keywords: subcritical crack growth, stress corrosion, Double Torsion method, preferred orientation of micro-cracks, water vapor pressure, crack path.

P-35

MICROBIAL COMMUNITY ANALYSIS IN PILOT-SCALE MEMBRANE BIOREACTORS TREATING DOMESTIC WASTEWATER

Yuki Miura
Graduate School of Engineering, Hokkaido University

Membrane separation technology is increasingly becoming an important innovation in biological wastewater treatment. Membrane fouling particularly biofouling, is a major factor affecting the efficient and economic operation of membrane bioreactors (MBRs) and properties of biomass (sludge) in the MBR. We therefore, analyzed the microbial community structure of pilot-scale submerged membrane bioreactors treating municipal wastewater by applying a full cycle of 16S rRNA approach including clone library analysis and fluorescence in situ hybridization (FISH) and related to membrane fouling. FISH analysis revealed that the population Chloroflexi, belonging to subdivision 1 and 3, accounted for ca. 24% of total bacteria present in the mixed liquor, and they seem to be a key player in formation of microbial flocs and in degradation of soluble microbial products derived from biomass decay in the MBR. When the population of Chloroflexi decreased, soluble polysaccharide concentrations increased and trance membrane pressure (TMP) also accordingly increased. We further conducted the identification and characterization of this group of bacteria by using microautoradiography combined FISH (MAR-FISH) analysis. It was found that Chloroflexi was able to uptake N-acetyl-[1-14C] D-Glucose (NAG) as a major constituent of bacteria cell wall peptidoglycan and lipopolysaccharide. This implied that they were terminal organic degraders (scavengers) of dead biomass.
In addition, we observed the biofilm attachment and growth on the hollow fiber membrane surface by the SEM, Live/Dead staining and FISH anlysis. The number of active bacteria attached on the membrane surface increased with time, resulting in an increase in TMP. FISH analysis revealed that this biofilm was composed of mainly Betaproteobacteria, accounting for ca. 70% of total bacteria in the biofilm. Furthermore, we analyzed the microbial community structure in this biofilm by 16S rRNA gene clone libraly analysis followed by FISH. In the clone library, most of the clones belonged to only two bacterial lineages: Betaproteobacteria (detection rate; 32/47) and Gammaproteobacteria (detection rate; 8/47), which agreed with the result of FISH analysis. This biofilm microbial community structure was complete4ly different from that in the suspended mixed liquor sample. This indicate that bacteria belonging to the Betaproteobacteria have a special ability to attach to the membrane surface and form mature biofilms.

Keywords: Membrane Bioreactor (MBR) ; membrane fouling ; biofouling ; microbial community ; Chloroflexi ; Proteobacteria ; Fluorescence in situ hybridization (FISH).

P-36

Development of mathematical model for a landfill cell

Sang Yul Kim
Graduate School of Engineering, Hokkaido University

Many studies have been done in laboratory scale or even field scale experiments to obtain detailed information on the fate and transport of pollutants from municipal solid waste (MSW) landfills. However, such studies can only get a result for a specific set of parameters. In this regard, a numerical model can be a powerful tool to understand the behavior of pollutants according to various conditions: time scales, the type of waste, the dimensions of landfill, landfill structure as well as climatological conditions.

In past years, most landfill models were to simulate organic-rich landfills, so these models have addressed the fate of carbon compounds such as acetate, CO_2, CH_4. And solid calcium carbonate ($CaCO_3(S)$) has been generally used as main buffer mineral in landfill. However, Japan has promoted the incineration of MSW over 30 years. Consequently, the quality of landfilled wastes has been changed from organic waste to inorganic wastes such as incineration residues.

Therefore, we developed a mathematical model of the fate and transport of pollutants from inorganic-rich MSW landfills as well as organic-rich MSW landfills. For this, we considers the precipitates of $CaCO_3(S)$, $Ca(OH)_2$, and $CaSO_4(S)$ as main buffer mineral in landfills.

Our model is based on compartment model (or a box model), in which one compartment represents a unit cell of the landfill. This allows simulation of a landfill of various cells by using different parameters values in different landfill cells. In addition, the model is able to switch anaerobic conditions into aerobic conditions and vice versa, depending on the local oxygen concentration. Furthermore, the influence of environmental factors, such as moisture content, pH, and temperature on reaction rates has been also incorporated.

Although the validation of model parameters is needed by applying to various field data, simulation results show a typical pattern of biogas and leachate composition as observed in actual landfill sites. In the near future, the model is scheduled to be improved by validating model parameters with field data, by including chemicals such as heavy metals and dioxins, and by expanding the one cell model to a multi-cell model to simulate actual landfilling operations and different structural designs.

Keywords: mathematical model, landfill, pollutant, simulation, municipal solid waste (MSW).

P-37

HUMAN DNA MICROARRAY ANALYSES FOR THE EVALUATION AND DIFFERENTIATION OF HEAVY METAL TOXICITY

Koji Kawata
Graduate School of Engineering, Hokkaido University

Current approaches to risk assessment of toxic chemicals focus on a single end point and are inadequate for the evaluation of environmental water including a large number of unspecified substances. DNA microarray technology, which makes it possible to analyse chemically induced alteration of gene expression, has become an important technique in toxicology and may provide new multiple bioassay method for detection of environmental chemicals. In this study, we evaluated and differentiated the toxicity of seven heavy metals on the basis of tentative elemental toxicity: oxidative stress, protein denaturation, and carcinogenesis through a comparison of the gene expression profiles in human hepatoma cell line, HpG2. Using 8795 gene array, gene expression changes following high-dose exposures (60-80% cell viability after 6 hr treatment) of arsenic, cadmium, mercury, chromium, nickel, antimony or manganese were examined along with those of model chemicals: hydrogen peroxide (oxidative stressor), phenol (protein denaturing agent), 12-O-tetradecanoylphorbol-13-acetate (TPA, tumor promoter), dimethylnitrosamine (DMN) or mitomycin C (MMC, tumor initiator). As the result of t-test with $p<0,05$, a total of 1230 genes with treatment : control ratios ? 2.0 or ?2.0 were identified. The hierarchical clustering analysis showed that gene expression profiles after exposure of five heavy metals (As, Cd, Hg, Cr, Mn) were closely related to that of H_2O_2, while the expression patterns induced by Ni and phenol were grouped together. These results suggested that high-dose exposure of five heavy metals and Ni induce oxidative stress and protein denaturation respectively. We further examined the dose-dependent toxicity of arsenic. The gene expression pattern induced by low-dose (78% cell viability after 48 hr exposure) arsenic was significantly different from high-dose exposure and closely related to three carcinogens (TPA, DMN, MMC). Thus, comparison of gene expression profiles, using DNA microarray allowed us to evaluate and differentiate heavy metal toxicity. This method has potential for predicting the major toxicities caused by chemicals in water environment and will provide information about toxic risks in humans.

Keywords: DNA microarray, heavy metal, oxidative stress, protein denaturation, carcinogenesis.

P-38

Recovery of nitrogen from source separated feces and urine in onsite wastewater differentiable treatment system

Shinya Hotta
Graduate School of Engineeing, Hokkaido University

Source separation of feces from urine has been studied to improve the present issues in Bio-toilet system that is the key technology in Onsite Wastewater Differentiable Treatment system (OWDTS). We need to apply urine diverting composting toilet system (UDCTS) to treat human waste in OWDTS. Source separated feces is treated in the sawdust matrix as conventional. Source separated urine is stored in urine storage and treatment unit (USTU). It is still not studied well in literatures how we recover the nitrogen from feces and urine in UDCTS. The aim of this study is to provide basic knowledge and to contribute the discussion for the nitrogen recovery from human waste in decentralized wastewater treatment system.

We have two topics in this study: Topic 1) we need to characterize feces nitrogen in the composting material for a control of the recovery rate of nitrogen. Topic 2) the hydrolysis of urea in stored urine should be controlled for higher recovery rate of nitrogen. Urea hydrolysis proceeded by the activity of urease producing bacteria (UPB) from feces. We therefore focused on the fate of the UPB by feces contamination in the toilet bowel in UDCTS. The UPB in contaminated urine by feces (2g-feces/l-urine) was indirectly estimated: the UPB was described by ammonification rates. According to the theory for enzyme reaction, ammonification rate could be determined by three factors without inhibition factor: reaction temperature, concentration of urea and concentration of the UPB.

It was cleared that feces contained the 75% of NXS (biodegradable) and 25% of NXI (originally inert), and 9% of NXIB (inert produced by endogenous respiration) respectively. We therefore concluded that approximately 34% (sum up of NXI and NXIB) of feces nitrogen can be recovered from the composting toilet. We found that the urea hydrolysis depended on the UPB concentration and effect of inhibition factor. However it was not cleared nitrogen recovery rate from stored urine. We still need to study the inhibition factor by $NH_3(aq)$ for the UPB to control the urea hydrolysis for stable condition in stored urine.

Keywords: nitrogen recovery, composting toilet, source separation, nitrogen transformation during the composting process, urea hydrolysis

P-39

Development of the prediction models of concrete structure for structural performance during service life

Kiyofumi Kurumisawa
Graduate School of Engineering, Hokkaido University

The objective is constructing the deterioration model of the concrete structure. Moreover, the durability of the concrete structure that will be constructed in the future is predicted, and an appropriate design and the repair time are clarified. It approaches from the materials level that composes concrete. The deterioration prediction model from the microstructure model with the cement-based materials is constructed, and it proposes the best material and the design for construction. Especially, the permeability and diffusion of the cement-based materials that greatly influences deterioration is examined, and the mechanism is clarified from microstructure.

For this purpose, the technique that the amount and the distribution of each phase in hardened cement paste is evaluated by using backscattered electron image and the element image measured by energy dispersive X-ray analysis, was developed. Moreover, it was also cleared the microstructure of cement paste mixed with fly ash and the blast furnace slag applying this technique. In addition, the technique for predicting the elastic modulus by using the phase distribution image was developed. And the technique that the amount and the distribution of pores in hardened cement paste are evaluated by using

Gallium intrusion method with electron probe microanalysis, was developed. It is cleared that chloride penetration depth of hardened cement paste is evaluated by this method.
To evaluate the amount of chloride in a concrete structure existing by nondestructive because the deterioration diagnosis of an existing building is very important, we developed the prediction method of the difference of the amount of chloride contained in concrete by using the spectrum analysis of the received waveform of the electromagnetic radar.

Keywords: Concrete structure, Durability, Microstructure, Hydration, Transport, Elastic behavior

P-40

Development of analytical model for predicting deterioration process coupled with heat, moisture and substances transfers and chemical reactions of various concretes

Yoshihiko Kishimoto
Graduate School of Engineering, Hokkaido University

Neutralization of concrete occurs as a result of CO2 gas from the air dissolving in the absorbed water, which contains alkaline substances such as Ca(OH)2. Therefore, the ad- or absorbed water is essential to neutralization, and the rate of the neutralization strongly depends upon the moisture regime. When a concrete wall is exposed to rain, it is generally believed that the neutralization is slow because CO2 gas cannot diffuse into concrete. Although rain is assumed to be pure water, rain in Japan is usually acid with a pH of less than 5.6. In this situation, neutralization may proceed faster because CO2 has already dissolved in the atmosphere, and the acid substances can move due to advection of the solution.
From this point of view, permeability is one of the most important parameters in discussing the neutralization of a concrete wall. Furthermore, if the permeability varies depending upon the position in the wall, the neutralization rate may also differ from place to place.
In this study, the permeability of concrete was measured at atmospheric pressure in order to clarify the vertical distribution. The measured result in a test piece with 20 cm height showed clearly a non-uniform vertical distribution of the permeability. The water permeability in the upper part was about two times larger than that in the center part.
Next, a neutralization process in a small-scale concrete wall was simulated under cyclic infiltration of rain and drying, with an assumed vertical distribution of water permeability. The results showed that neutralization was accelerated due to acid rain in regions with a high permeability and retarded in regions with a low permeability. Thus, it can be concluded that the influence of acid rain on neutralization process may differ depending on the position in concrete structure.
After this, proposed analytical model will be extended for application to concrete treated with silane agent, and recycled concrete.

Keywords: concrete, durability, water permeability, advection, chemical reaction

P-41

Feasibility Study of a Low Energy System Utilizing Urban Exhaust Heat With Ground Water as Medium of Thermal Transport

Takao Katsura
Graduate School of Engineering, Hokkaido University

In order to recreate utilizable water resource and maintain area based society, it is necessary to establish small-sized sewage-disposal plants, which can release treated sewage into closed-hand area. In addition, it is possible to utilize exhaust heat from black water by construction of the sewage-disposal plants. As the method, for example, a system utilizing ground water as medium of thermal transport, which cultivates treated sewage into the ground and recovers the exhaust heat in the downstream, is suggested. Since there are a lot of heat demand for heating and hot water supply, to construct such a system is effective from the viewpoint of energy saving, especially cities in the cold region like Sapporo.
In this paper, in order to evaluate the system, a method to calculate ground temperature with ground water flow s shown based on comparing the thermal response for cylindrical heat source calculated by numerical calculation with one for line heat source calculated by the moving line heat source theory.
Next, the outline of the system is proposed and the feasibility study is carried out with the tool including developed

method.

Keywords: Urban Exhaust Heat, Ground Thermal Energy System, Feasibility Study, Design Method, Ground Water Flow

P-42

OPTIMAL SPEED LIMIT BY COST ANALYSIS

Suthipun Thanesuen
Graduate School of Engineering, Hokkaido University

This study is aimed at determining the optimal speed limit for dry summer conditions on Hokkaido roads by using cost analysis including the effects from traffic signal intensity and traffic congestion. In the cost analysis, the components that were involved include time cost, vehicle operating cost, pollution cost, and accidental cost. The unit here was in yen per kilometer per day. Initially, traffic volumes on Hokkaido roads were determined. Then, the relationships between average speed and each cost component was calculated. After that, the summations of overall costs of each average speed were verified so that the optimal average speeds were obtained from the minimum total costs. Then, the effects from traffic signal intensity and traffic congestion were required to calculate the optimal speed limit from the optimal average speed. Finally, the optimal speed limits were obtained, i.e. 60 km/h on urban national highways, 70 km/h on rural national highways, and 90 km/h on urban and rural expressways. This is in contrast to the current existing speed limits of 50 km/h on urban national highways, 60 km/h on rural national highways, and 80 km/h on urban expressways and 100 km/h on rural expressways. In conclusion, it was shown that traffic congestion had less of an effect on average speed due to the low traffic volume of Hokkaido roads. From the cost analysis, time costs and accidental costs had major effects on the results. As the cost analysis included all major components for determining optimal speed limit, these new speed limits can contribute towards improved road safety, increased energy efficiency and a healthier roadside environment. Eventually, as a practical measure, public hearings are necessary to support the new speed limits which are also included in the further study.

Keywords: optimal speed limit, cost analysis, traffic signal intensity, traffic congestion

P-43

Characteristics of irreversible membrane foulant in Ultrafiltration of surface water

Hiroshi Yamamura
Graduate School of Engineering, Hokkaido University

Water treatment using microfiltration (MF)/ultrafiltration (UF) membranes are gaining in popularity all over the world. Although use of membranes in drinking water treatment has various advantages, a major drawback associated with this technology, membrane fouling, has not been addressed yet. Membrane fouling can be divided into two types: reversible fouling and irreversible one. The former can be defined as the fouling that can be cancelled by physical membrane cleaning, whereas the latter needs chemical membrane cleaning to be canceled. Currently, there is still a lack of information as to which constituents contained in feed water would cause irreversible fouling and therefore it is not possible to establish an efficient way to prevent it. In this study, to obtain the information about the constituents that would cause irreversible fouling in/on Polyacrylnitrile membrane (molecular weight cut-off: 100,000 Da), pilot studies were conducted for 30 days from the beginning of October, 2005. As expected, the development of irreversible fouling was observed in increase in trans-membrane pressure in spite of conducting the physical cleaning routinely. After 30 days of continuous operation, to elucidate what constituents caused the irreversible fouling, membrane specimens were taken out from the pilot unit and various types of chemical cleaning were examined. A series of chemical cleaning demonstrated that acid or chelate worked better in flux recovery, whereas sodium hydrate was not effective. This result implied that irreversible fouling might mainly induced by inorganic matter. Based on the chemical analysis, HCl extracts contained a large amount of iron. Consequently, it was found that one of the major foulant that caused irreversible fouling in this study was iron. Also interestingly, not only iron but also a large amount of organic matter was desorbed by HCl solution. The FTIR spectra of the foulants contained in HCl solution exhibited a large carbohydrate peaks around 1080 cm-1, which indicated that carbohydrate could be pointed out to be one of the major foulant as well. Therefore, it could be considered as fouling mechanisms that (1) complexes of iron and carbohydrate plug the macropores or (2) iron and carbohydrate accumulated on/in the

membrane, respectively.

Keywords: Ultrafiltration, Irreversible membrane fouling, iron, carbohydrate

P-44

LIFE PREDICTION FOR CONCRETE UNDER FATIGUE LOADS AND FREEZING-THAWING CYCLES

Koji Matsumoto
Graduate School of Engineering, Hokkaido University

Background
In order to develop sustainable infrastructure system, rational design method for structures against long-term deterioration is required. Hence, we should know when and how structures are damaged and improvement of current life-prediction methods is required. This study focuses on fatigue and frost damage, which are typical deterioration of concrete structure. The aim of this study is to develop new design method, which can consider deformation, damage distribution and combined effect of fatigue and freezing-thawing action during structural service life.
Research plan
This study is composed of five stages. As the first step, macroscopic constitutive model of concrete under fatigue loading is developed. Secondly, mesoscopic fatigue analysis system using Rigid Body Spring Model (RBSM) will be developed. Here, time-dependent mesoscopic constitutive law is proposed. Thirdly, freezing-thawing analysis system using RBSM with truss network will be developed. Here, mesoscopic damage is related to water and temperature change in concrete based on microscopic structure. At the fourth step, both the analytical systems will be combined, and then deterioration of concrete under combined action of fatigue and freezing-thawing can be simulated. Lastly, fatigue life prediction formula, which can take frost damage into account, will be developed for design purposes.
Macroscopic deformational model under fatigue loads (STEP1)
Fatigue loading tests were carried out and they were analyzed with previous experimental data. This activity corresponds to the first step. As a result of summarizing and organizing the experimental data, it was found that concrete under fatigue loading has non-damaging strain as well as damaging strain. Besides, stress-strain model was developed, and then deformation of concrete under fatigue loading could be numerically expressed. However, remaining issue was found, which is, amount of time-dependent plastic strain has not been quantitatively expressed under macroscopic level.
Time-dependent analysis of mortar by RBSM (STEP2)
Time-dependent analyses of mortars by RBSM were carried out as a basic study of fatigue analysis. In general, there are two visco-elastic models, which are Maxwell and Voigt model. In this study, characteristic of each model on results of RBSM analysis were examined through mortar analyses. Consequently, differences of strength and stiffness change from static case between Maxwell and Voigt model were found.

Keywords: concrete structures, life-prediction, fatigue, freezing-thawing, combined action, mesoscopic analysis

P-45

Fate of Pharmaceuticals in Human Excrement During the Composting Process of Feces

Takashi Kakimoto
Graduate School of Engineering, Hokkaido University

We have proposed the Onsite Wastewater Differentiable Treatment System. In this system, household wastewater is separated into three fractions (blackwater, higher load graywater, and lower load graywater), and each is treated separately. The blackwater that may contain pharmaceuticals (PhACs) is treated by a composting toilet using sawdust as a matrix. Our objective in this study is to understand the fate of PhACs in the composting process varying the feces loading ratio on the toilet reactor. The variation of oxygen utilization rate (OUR) indicated the degradation rate of feces in the composting process, and the OUR profiles showed that feces were almost treated in early stage of this process. We also observed the decay of the selected PhACs in this process. The reduction profiles imply that the degradation of PhACs has small relation to the treatment of feces. The degradation rates of all PhACs were almost the same if the feces loading ratio was 5%, and the degradation rates of acidic PhACs were almost the same regardless of the increasing of the feces loading ratio.

But the higher feces loading ratio gave higher degradation rates of basic PhACs. During the process higher feces loading ratio gave the higher ammonia concentration in the sawdust matrices and this resulted in higher pH value. In this experiment, the pH ranged from pH7 to pH9 and in this pH range, acidic PhACs are present as an ionic form. At pH 7, the basic PhACs exists as an ionic form, but at pH 8.5 and 8.8, where we observed the rapid degradation of the basic PhACs, about 10% of the basic PhACs exists as non-ionic form. Therefore we infer that the degradation of the selected PhACs is affected by the dissociation condition. To conclude this study, we obtained following knowledge; (1)Easily biodegradable organic matter (like feces) does not interfere the degradation of the PhACs; (2)The structural difference among the selected PhACs in this study gives insignificant effect on the degradation rate; (3)The dissociation condition may have a significant effect on the degradation rates in the composting process.

Keywords: Composting process, Degradation of Pharmaceuticals, Treatment at source

P-46

Simultaneous Power Production and Wastewater Treatment Using a Microbial Fuel Cell

Kyung mi Chung
Graduate School of Engineering, Hokkaido University

A microbial fuel cell (MFC) converts chemical energy, available in a bio-convertible substrate, directly into electricity. To achieve this, bacterial are used as a catalyst to convert substrate into electrons. Electrons are transferred through an external circuit while the protons diffuse through the solution to the cathode, where electrons combine with protons and oxygen to form water. The objective of this study is to optimize the operation conditions of MFC for simultaneous power production and wastewater treatment.

In this work, the MFC comprised anode and cathode chambers. Between the compartments, a Nafion proton exchange membrane was installed. Glucose (5 mM) was used as carbon source and loading rate was 2.0 ml/min. Electrodes of anode and cathode were consisted of woven graphite. The anode was continuously purged with nitrogen gas to maintain anaerobic condition, while the cathode was sparged with air. Current (I) was calculated at a resistance (R) from the voltage (V) as I=V/R. Power was calculated as P=IV.

Power generation was measured using a series of resistors (1-100000 Ω) to determine the maximum power output as a function of current. The highest power density of 5.0 mW/m2 was achieved at the current density of 23.5-26.0 mA/m2, which was obtained with the resistance of 900 and 800 Ω, respectively. The maximum coulombic efficiency was 11.6 % with a resistance of 500 Ω. The DOC removal rate was 30%. These results suggested the possibility of using MFC to generate electricity and simultaneously treat wastewater, but further progresses in the design and operation of MFC are required in order to accomplish greater overall MFC performance.

Keywords: microbial fuel cell, power density, current density, coulombic efficiency

P-47

Complexation Reactions of Anions on Hydrotalcite Surface

Kazuya Morimoto
Graduate School of Engineering, Hokkaido University

Hydrotalcite is one of the naturally occurring minerals with a formula of [Mg1-xAlx(OH)2] [An-x/n·yH2O]. An- denotes an anion of which the valence is n. It comprises positively charged brucite-like octahedral layers and interlayers filled with anions and water molecules. The positive charge in the octahedral layers is formed by partial substitution of Al3+ for Mg2+. Stacking of the layers occurs and the balancing interlayer anions can be exchanged.

Recently, hydrotalcite has received considerable attention in a variety of fields because of their considerable anion-exchange capacity. It has been used as a sorbent in the removal of various pollutants in aqueous solutions. The mechanism involved has not yet been elucidated specifically surface complexation reactions. This study focuses on anion sorption mechanism in hydrotalcite with a specific regard on surface complexation reactions.

Chloride, nitrate, carbonate, sulfate, phosphate and silicate ions are the sorbates considered in the experiments. Zeta potential and pH measurements were used to monitor the sorption reactions with these ions.

The change in zeta potential of hydrotalcite in distilled water is similarly observed in chloride and nitrate-sorbed hydrotalcite in this study. It indicates that chloride and nitrate ions inspired simply sorption by anion-exchange reaction onto hydrotalcite because that reaction has little influence on zeta potential.

On the other hand, the zeta potential trends for carbonate, sulfate, phosphate and silicate-sorbed hydrotalcite are in contrast. These exhibited lower zeta potential values which would suggest that the point of zero charge (PZC) also shifted to lower pH compared to a pHpzc of more than 11 for hydrotalcite in distilled water. These results suggest that the ions considered in this study formed inner-sphere surface complexes on hydrotalcite surface probably via ligand-substitution reaction. Such reactions are expected to change the physico-chemical properties of hydrotalcite (i.e. increased or decreased stability).

Hydrotalcite has two possible sorption sites indicating that sorption mechanism would vary for different anion species.

Keywords: Hydrotalcite; Sorbent; Zeta potential; Complexation reactions

P-48

Weathering resistivity interpreted from the textures of plutonic rocks

Kouki Kashiwaya

Graduate School of Engineering, Hokkaido University

Void structures observed in weathered Inada granite and Kuroishiyama gabbro were examined using quantitative methods such as multifractal analysis, pore size distribution measurement, and effective porosity measurement. And values characterizing the void structures were correlated with uniaxial compressive strengths (UCS) to reveal the weathering resistivity of the plutonic rocks.

Slope of q-Dq-UCS curved surface showing a relationship of generalized dimension spectra and UCSs is steeper in the granite. It means that the UCS of the granite decreases more drastically than the gabbro when their heterogeneities increase similarly.

The granite has granular texture. Continuous and linear void structures occur through weathering, and their fracture density is relatively small. That is why the void structures in the granite largely contribute to the decrease in UCS but influence on the heterogeneity of the void structure is not so strong. On the one hand, the gabbro is characterized by poikilitic texture. Intra-granular fractures in plagioclase are densely distributed and contribute to the increase in the heterogeneity of the void structure. However, the skeleton of amphibole is not so affected by weathering and thus the strength of the gabbro is maintained.

The results show that the UCS of the granite decreases more easily by weathering than the gabbro when the two plutonic rocks are compared based on their void structures. This indicates that the gabbro has higher weathering resistivity than the granite even though the granite is composed of minerals which have relatively high weathering resistivity such as quartz, and it is attributed to their microscopic void structures.

Keywords: weathering, void structure, multifractal analysis, plutonic rock

P-49

Chloride ion diffusion coefficient of stressed fiber reinforced concrete under loading conditions

Yuki Sakoi

Graduate School of Engineering, Hokkaido University

To examine the chloride penetration into concrete is one of the most important to assess the durability of concrete structures. The concrete structures are always subjected to various loads, prestressing as well as traffic, earthquake and so on. Many cracks exist in the stressed concrete, and it is considered that these cracks accelerate the deterioration caused by chloride ion or other substance penetration. However, only few attempts have been made so far for the chloride penetration into concrete under loading condition. Therefore, it is needed for the durability of concrete structures to examine the effect of loading for the chloride penetration into concrete.

In addition, admixing short fibers into concrete can improve the properties of concrete. As a result of admixing fibers, the concrete can alter development of crack that was caused by loading or environmental effects. Therefore, it is considered

that the chloride penetration into concrete can be reduced due to the mix of short fibers into concrete.
In this study, the chloride penetration into short fiber reinforced concrete under several loading condition was examined. From the results, it was found that the chloride diffusion coefficient (Dnssm) reduced at low stress level under static compressive loading condition, and the Dnssm at around 50% stress level changed to increase, and then the Dnssm increased with the increase of static compressive loading level after that. On the other hand, the change of Dnssm under tensile loading was differed from that under compressive loading level. The Dnssm subjected to tensile stress showed the increase with the increase of tensile stress level after subjected to low tensile stress.
The change of Dnssm for short fiber reinforced concrete showed almost same behavior under both loading conditions, however, the change ratio of Dnssm with the change of stress level differed from that of non- fiber concrete. And it was found that mixing short fibers into concrete could lead to the improvement of chloride penetration resistance under loading conditions.
From these findings, it was confirmed that loading affects the chloride penetration into concrete. And it was suggested that mixing short fibers into concrete could improve the durability of concrete structures due to the increase in resistance of chloride penetration.

Keywords: Short Fiber Reinforced Concrete, Chloride Ion, Diffusion Coefficient, under Loading

P-50

THE CONTRIBUTION OF RPOS TO FORMATION OF ESCHERICHIA COLI BIOFILMS

Akinobu Ito
Graduate School of Engineering, Hokkaido University

It is now apparent that microorganisms undergo significant changes during the transition from planktonic to biofilm growth that possess enhanced resistance to various stresses such as chlorine treatments and antimicrobial agents. It has been suggested that the creation of starved, stationary phase zones in biofilms seems to be a significant factor for biofilm formation. In this study, the role of rpoS gene in Escherichia coli biofilms was investigated which is known to be expressed during entry into stationary phase and stress conditions. To assess the importance of rpoS gene for biofilm formation, we used E. coli MG1655 rpoS mutant strain to perform flow chamber experiment. We found that the rpoS mutant can only form thin biofilms. To further assess the role of the rpoS gene in E. coli, we performed DNA microarray analysis, and it revealed that gene expression pattern of rpoS mutant was different from that of wild type strain. In stationary phase, 193 genes were significantly down-regulated in rpoS mutant, which included genes induced in starvation conditions, genes encoding heat shock proteins, genes induced at high temperature, and osmotically inducible genes. These results suggest that the rpoS mutant is less capable of response and adaptation to stresses than the wild type strain in stationary phase, which might be the reason for the formation of only thin biofilms. In addition, they also suggest that the rpoS mutant shows too much motility even in the stationary phase. It could explain the presence of the actively moving and rotating cells in the early stages of biofilm formation, which might be the reason for E. coli rpoS mutant to be incapable of establishing mature biofilms. Based on these results, we concluded that rpoS gene which is induced in the stationary phase and stress conditions is important for formation of mature biofilms.

Keywords: biofilms, gene expression, rpoS, Escherichia coli, stress response

P-51

Evaluation of char derived from solid waste for fuel recovery and final disposal in landfill

In-Hee Hwang
Graduate School of Engineering, Hokkaido University

Carbonization is a kind of thermal treatment process to produce carbonaceous materials, so-called char, under inert atmosphere. In this work, chars derived from various municipal and industrial solid wastes were evaluated from the standpoint of fuel recovery and thermal pretreatment before landfilling.
The quality of char as a fuel definitely depends on the composition of input wastes. The higher the ratio of woody biomass in raw wastes, the better the quality of the char produced. The estimation equation of char heating value by

using its weight fraction of fixed carbon (FC) and volatile matter (VM) was derived; estimated heating values showed a good correlation with measured ones (R2=0.957). Regarding quality improvement of char, the pulverization and sieving method effective in separation of incombustibles rather than ash. From the application of coal cleaning or separation techniques (ex: sink-floatation, froath floatation, and oil agglomeration in liquid) for ash removal from char, char particles existed as compounds of combustibles and ash. Moreover, char particles have a tendency to coagulate in water. These characteristics indicate that wet separation using an aqueous solution likely reduces efficiency due to particle coagulation. Further ash separation should be studied for improving char quality. On the other hand, most char met a 0.5 wt% chlorine criterion allowing it to be utilized as shaft blast furnace fuel after water washing.
Carbonization has an excellent effect on reduction of organic matter disposed in landfills. Releasing of heavy metals such as chrome, cadmium, and lead decreased remarkably by carbonization regardless of the type of raw waste at JLT-13 leaching test. However, it was found that metal leaching from carbonization residue could be changed somewhat by landfill environment such as aerobic or anaerobic condition through column tests.
From these results, carbonization might be considered as a feasible option for pre-treatment before landfills, as well as for fuel recovery.

Keywords: Carbonization, char, quality improvement, pre-treatment for landfilling

P-52

Advanced Application of Jig Separator for Plastic Material Recycling

Kunihiro Hori
Graduate School of Engineering, Hokkaido University

Development of mechanical separation of different plastics is essential in planning and constructing a recycling plant that processes scrapped electric appliances or automobiles. The authors have improved TACUB jig as a plastic separator. Jig separation for plastics of smaller sizes (0.5-3 mm) but similar specific gravities was performed using polyvinyl chloride (PVC), polyethylene (PE), acrylonitrile butadiene styrene (ABS), and acrylicplastics from scrapped plastic rods and electric wires. At the minimum difference in the specific gravities of 0.03, a higher grade product over 99% was still obtained. The pulsation of frequency and amplitude for smaller size plastics is lesser than that for coarser plastics. Based on the results, jig separator was applied to the following process.
For the plastics from scrapped copy machines containing polystyrene (PS),ABS, and polyethylene terephthalate (PET), high grade (>99%) of each plastic was recovered in the two cells of the jig, where PET is recovered from the first cell as bottom product, and ABS and PS from the second cell as bottom and upper layer products, respectively. Their sizes ranged from 3.5-10mmand their specific gravities were 1.03, 1.22 and 1.71 for PS, ABS, and PET respectively. Based on the results a recycling plant for processing scrap office and home appliances had been constructed.

Keywords: Jig, Gravity Concentration, PVC, Waste Plastics, Recycling

P-53

Value material collection by wet process sorting method from various shredder dusts

Yutaka Kuwayama
Graduate School of Engineering, Hokkaido University

----no abstruct

P-54

Sustainable Development

Stephen Lincoln

School of Chemistry and Physics, University of Adelaide

A flow chart is presented which shows a model of the interdependencies in sustainable development which may be used in education. The model is centered on population. Current projections suggest that population will level out about 10 billion a little before 2100 and that a decline will occur thereafter. In seeking to sustainably support the present population and its anticipated growth many interdependent factors must be considered [1]. These factors are collected into four major components for convenience: water, food, energy and disease. The interdependence of these components occurs through a wide range of factors exemplified by deforestation, climate change, biodiversity, zoonolysis, biotechnology, fertilizer use, fossil fuel use and alternative energy sources. These considerations are presented in a pattern useful for giving an overview of sustainable development to students at universities.

[1] S.F. Lincoln, Challenged Earth: An Overview of Humanity's Stewardship of Earth, Imperial College Press, London, 2006.

P-55

Point and Non-point Source Pollution of Dahuofang Reservoir Catchment Based on a GIS Model and Its Integrated Water Management

Tao Hua

College of Environmental Science and Engineering, Nankai University

As a strategic and critical surface water resource for the Liao River basin, Dahuofang Reservoir is also an important water resource for Shenyang in Liaoning Province.China. However, in recent years, eutrophication has been reported in its water due to both point and non-point source pollution.

This research was performed to identify the main factors influencing its water quality. In this research, an ArcView hydrology extension script was employed to construct a point and non-point source pollution model based on basic information that has been collected.

The current situation and the future tendency of water pollution in the catchment were identified and suggestions were proposed to enhance the integrated water management which aims to improve the water quality for Dahuofang Reservoir.

P-56

Soil organic carbon, nitrogen and microbial biomass under Larix gmelinii forest in different latitude of Northeast China

Fuchen Shi

College of Life Sciences, Nankai University

Larix gmelinii forest plays a very important role in both environmental protection and economic development in northern China. We compared soil organic carbon (SOC), nitrogen (N), and microbial biomass in L.gmelinii forest along the latitude in northeast China. Surface SOC, total N and microbial biomass of soil samples collected from L. gmelinii forest along the latitude grads ascending decreased significantly. Surface SOC content decreased from 10.56% to 5.30% along the latitude, and N decreased from 0.88% to 0.29%. In surface soil, the highest microbial biomass carbon (MBC) was 4805.16 mg/kg which located in N44° 22′ , and the lowest MBC was 161.49 mg/kg which located in N53° 33′ . Surface soil microbial biomass nitrogen (MBN) also varied from 1038.54 mg/kg to 99.55 mg/kg with latitude ascent. The ratios of microbial biomass to SOC and N In the southern study sites were significantly higher, when compared to the northern study sites' ones. Differences among sites became less pronounced in subsoil. There were positive and significant correlations between SOC, total N and microbial biomass. The study showed that the tested soil characteristics, both abiotic and biological, significantly liner correlated with the latitude.

Keywords: Larix gmelinii; Latitude; Soil organic carbon and nitrogen; Microbial biomass

P-57

Sustainable production in aquaculture: innovation of closed recirculation aquaculture system and its ripple effects

Rie Goto-Kazeto [1], Etsuro Yamaya [1], Yasuaki Takagi [2]

1/Nanae Fresh-Water Lab, Field Science Center for Northern Biosphere, Hokkaido University,

2/Graduate School of Fisheries Sciences, Hokkaido University

The present human industrial activities have great impacts on our environment through emissions of carbon dioxide and other chemical pollutants. Such 'environmentally high-cost' human activities now threaten sustainability of our food production. This general undesirable formula is also applicable to the present fishery production.

In 2003, total fishery production was reported to be 132.2 million tones, of which 41.9 million tones from aquaculture practices and 90.3 million tones from capture. Because of decreasing and/or conservation of fishery resources, aquaculture production has been extremely growing compared to capture, about 67 % growth in volume from 1990 to 2003. However, present aquaculture operations (open water system) have serious environmental impacts, such as water pollution by wasted feeds and feces. Although aquaculture production in the last decade has given it increased importance in the modern food supply, there are growing needs to introduce environmentally low-impact system for sustainable food production.

Recently, closed recirculation aquaculture system is concerned as most desired technology for future aquaculture. There are a lot of benefit of environmental preservation, cost saving and prevention of fish diseases. Further more, in spite of global climate change or regional weather change, stable production is engaged in this system. However, a lot of issues appear to be resolved to practically introduce this system. For one, closed recirculation system are much more expensive to construct, install, and maintain than the open water system.

In this study, the issues of introducing closed recirculation system will be raised and discussed from the aspect of fisheries, environmental sociology and international economics.

P-58

Science, participatory research and sustainable land use

William Smith

The University of Auckland

Illustrating on-going research to integrate science into decision-making by farmers on sustainable land use.

P-59

A Study on the Wetland Dynamic and Its Relation with Cropland Reclamation in Sanjiang Plain, China

Kaishan Song, Dianwei Liu, Bai Zhang, Zong Ming Wang, Cui Jin, Yuedong Guo

Northeast Institute of Geography and Agricultural Ecology, Chinese Academy of Sciences,

Using remote sensing interpretation, we obtained four periods of land use data sets from 1976 to 2005. Based on these data sets, this study analyzed the dynamics of the wetland land cover and the conversion between wetland and other land use types of Sanjiang Plain in the past 30 years with GIS spatial analysis. It shows that the wetland in Sanjiang Plain has been severely damaged; the wetland area decreased by 37.72% from 1976 to 1986, by 15.54% from 1986 to 1995, and by 30.97% from 1995 to 2005, which shows that the situation of wetland loss had much slowed down in1986 to 1995, but in recent years, the reclamation speed still very high. It was showed by conversation matrix that most wetland losing was the result of reclamation, and only small part of lost wetland was converted into grassland and forest. Still, it found that cropland contributed the main part for wetland area increasing for aimless reclaimed cropland was converted into wetland during flood inundation. Both demographic and resource management policies reason were analyzed for the wetland reduction. The result showed that population increasing was the main reason for wetland reduction in the past decades since P.R. of China foundation. Though the speed of wetland loss decreased during the later period, the reclamation of wetland still happened, so the practicable protection measurement of the wetland in Sanjiang Plain should be reinforced further.

Keywords: Wetland, Sanjiang Plain, remote sensing, GIS

P-60

Salinized wasteland monitoring in Daan County, Northeast China, Using GIS and remote sensing

Zong Ming Wang, Bai Zhang, Kaishan Song, Xiaoyan Li, Ming Chen, Jianping Li, Fang Li, Hongtao Duan
Department of RS and GIS, Northeast Institute of Geography and Agricultural Ecology, Chinese Academy of Sciences

Western part of Northeast China has suffered substantial land degradation during past decades, due to human impact under climatic variations. We presents an integrated study of expansion process of salinized wasteland in Daan County, a typical salt-affected area in Northeast China, by using Geographical Information System (GIS) and remote sensing. Our study explored that, from 1954 to 2004, the salinized wastland in study area have increased by 135995 ha, and now cover 32.31% of the total area, in the meantime grassland has decreased by 104697 ha and covers only 13.15% of land area. Grasslands, croplands and swamplands were found the three main land use types converted into salinized wasteland. Land use/cover changes show that between 1954 and 2004, 48.6% of grasslands, 42.5% of swamplands, and 14.1% of croplands were transformed to salinized wasteland, respectively. Lastly, the major factors influencing salinized wasteland expansion and land use/cover changes are also explored. In general, climatic factors supplied a potential environment for soil saliniztion. Human-related factors, such as policy, population, overgrazing, and intensified and irrational utilization of land and water resources are the main causes of salinized wasteland expansion.

Key words: Salinized wasteland expansion; Land use change; GIS; Remote sensing; Daan County, Northeast China

P-61

International trade of Recyclable Resources in Thailand

So Sasaki
Japan Society for the Promotion of Science

Recently, in Asian Regions there has been active trade of Recyclable Resources. Several Studies have been made on International trade of Recyclable Resources from Japan to China, but little is known about that other Asian countries. This paper is intended as an investigation into International trade of Recyclable Resources in Thailand and the efforts of the Thai government. As a result, it has been understood as follow. First, Thailand was received the influence of the demand for Recyclable Resources in China. Second, there are some second-hand goods import limitations in Thailand. However, third, Thai government is doing flexible correspondence to International trade of Recyclable Resources under certain conditions. To put it briefly the concept of International trade of Recyclable Resources in the future, Thailand shows some suggestive cases.

P-62

Biotechnology Innovations and Patent Protection

Dae Hwan Koo
College of Law, Seoul National University, Korea

Is patenting biotechnology desirable to encourage biotechnology innovations in the light of economic perspective? To answer to this question, it is necessary to consider both the characteristics of biotechnology innovations and the impact of patenting biotechnology (e.g. DNA, gene fragments, etc) to the biotechnology industry as well as the international relationship between developed and developing countries.

P-63

Temporal Variability of the Volume Transport through the Korea Strait and the Tsugaru Strait and the Tsugaru Strait

Hanna Na [1], Kuh Kim [1], Shoshiro Minobe [2]
1/School of Earth and Environmental Sciences, Seoul National University,
2/Division of Earth and Planetary Sciences, Graduate School of Science, Hokkaido University

The volume transports (VT) through the Korea Strait and Tsugaru Strait are estimated from linear regressions between

transport data and the sea level difference (SLD) across the straits. As the sea level data along the Korean and Japanese coasts have been measured for several decades, the VTs can be estimated for a long period during which the sea level data are available. For the Korea Strait the SLD was calculated between Pusan and Moji. The transport data by the submarine cable was used to get the conversion equation from the SLD to the VT (Lyu and Kim, 2003). The atmospheric pressure effect and the baroclinic part of SLD were removed before computing the conversion equation. For the Tsugaru Strait Tappi and Yoshioka were selected to calculate the SLD. The conversion equation for the Tsugaru Strait was obtained by using the transport data from the vessel mounted ADCP (Ito et al., 2003). The mean value of the VT from 1984 through 2004 is 2.5 Sv for the Korea Strait and 1.5 Sv for the Tsugaru Strait is 1.5 Sv. It is found that variance of the VT through the Korea Strait during this period is partitioned 33 %, 23 % and 44 % for seasonal, interannual and intraseasonal time scales respectively. Partition for the Tsugaru Strait is 59 %, 16 % and 25 % for the same temporal scales. Forcing for these temporal variation is under investigation by examining statistical relations between transports and various atmospheric and oceanic parameters.

P-64

Argo for long-term ocean variability and climate research

Kuh Kim, Jong Jin Park
School of Earth and Environmental Sciences, Seoul National University

Argo is a global array of 3,000 free-drifting profiling floats that measures the temperature and salinity of the upper 2000 m of the ocean. This allows, for the first time, continuous monitoring of the temperature, salinity, and velocity of the upper ocean, with all data being relayed and made publicly available within hours after collection.

We are increasingly concerned about global change and its regional impacts. Sea level is rising at an accelerating rate of 3 mm/year, Arctic sea ice cover is shrinking and high latitude areas are warming rapidly. Extreme weather events cause loss of life and enormous burdens on the insurance industry. Globally, 8 of the 10 warmest years since 1860, when instrumental records began, were in the past decade. These effects are caused by a mixture of long-term climate change and natural variability. Their impacts are in some cases beneficial (lengthened growing seasons, opening of Arctic shipping routes) and in others adverse (increased coastal flooding, severe droughts, more extreme and frequent heat waves and weather events such as severe tropical cyclones).

Understanding (and eventually predicting) changes in both the atmosphere and ocean are needed to guide international actions, to optimize governments' policies and to shape industrial strategies. To make those predictions we need improved models of climate and of the entire earth system (including socio-economic factors). Lack of sustained observations of the atmosphere, oceans and land have hindered the development and validation of climate models. An example comes from a recent analysis which concluded that the currents transporting heat northwards in the Atlantic and influencing western European climate had weakened by 30% in the past decade. This result had to be based on just five research measurements spread over 40 years. Was this change part of a trend that might lead to a major change in the Atlantic circulation, or due to natural variability that will reverse in the future, or is it an artifact of the limited observations? In 1999, to combat this lack of data, an innovative step was taken by scientists to greatly improve the collection of observations inside the ocean through increased sampling of old and new quantities and increased coverage in terms of time and area. (from www.argo.ucsd.edu)

P-65

Issues and opportunities in sustainable management of water through the community based organizations in South Asian Countries - A case study in Sri Lanka -

Kandula Pathma Kumara
Faculty of Agriculture, Dept. of Agricultural Engineering, University of Peradeniya

In developing countries there are lots of problems in managing the water supply schemes. The Community based organization (CBO) has came into consideration as a solution for problems. But there are enough experiences for identifying issues and opportunities that can be used as a lesion to have sustainable water management schemes in the region. This study was based on the evaluation on the CBO's.

Hokkaido University International Symposium on Sustainable Development

Organizing Committee

Chairperson	Mutsuo Nakamura	President, Hokkaido University
Co-Chairperson	Takeshi Kishinami	Executive and Vice President, Hokkaido University
Committee Members	Hiroshi Saeki	Executive and Vice President, Hokkaido University
	Yoshihito Osada	Executive and Vice President, Hokkaido University
	Masaaki Hemmi	Executive and Vice President, Hokkaido University
	Tadayuki Hayashi	Executive and Vice President, Hokkaido University
	Kenichi Iyama	Executive, Hokkaido University
	Hajime Endoh	Executive and Director General, Hokkaido University

Program Committee

Chairperson	Takeo Hondoh	Professor, Institute of Low Temperature, Hokkaido University Global Manager, Hokkaido University Initiative for Sustainable Development
Committee Members	Motoyoshi Ikeda	Professor, Faculty of Environmental Earth Science, Hokkaido University (HUISD)
	Hiroshi Kida	Director, Research Center for Zoonosis Control, Hokkaido University Professor, Graduate School of Veterinary Medicine, Hokkaido University
	Mamoru Kobayakawa	Professsor, Graduate School of International Media and Communication, Hokkaido University
	Mitsuru Osaki	Director, Sustainability Governance Project (SGP), Hokkaido University Professor, Research Faculty of Agriculture, Hokkaido University
	Yoshimasa Watanabe	Professor, Graduate School of Engineering, Hokkaido University
	Fumikazu Yoshida	Professor, Graduate School of Public Policy, Hokkaido University

Secretariat Office

Hokkaido University International Symposium on Sustainable Development

Hokkaido University Initiative for Sustainable Development (HUISD)
International Affairs Division, Hokkaido University

Kita 8, Nishi 5, Kitaku, Sapporo 060-0808
Tel +81-(0)11-706-2093 Fax +81-(0)11-706-2095
E-mail: kouryu@general.hokudai.ac.jp
http://www.hokudai.ac.jp/huisd/