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Hokkaido-Finland Days: A Bridge for Northern Cooperation
28 October 28 - 2 November 2011

Monday, 31 October 2011 10:00-

"Northern Environmental Research Symposium"

09:30 - Registration & Reception
MC, Heikki Mäkipää, Director, The Finnish Institute in Japan

10:00 - 10:30 **Keynote Address**:

- "Cooperation in the Arctic: Finland's Arctic Policy", Hannu Halinen, Northern Affairs Ambassador

10:30-10:45 **Introduction Address**:

- "Environment in the North: Challenges for multidisciplinary research and education", Kari Laine, Thule Institute, University of Oulu (Kari.Laine@oulu.fi)

10:45-12:15 Session 1: Ice and Climate Change

- "Floating ice platform for winter observations in freezing lakes and coastal waters", Kunio Shirasawa, Institute of Low Temperature Science, Hokkaido University (kunio@lowtem.hokudai.ac.jp) & Matti Leppäranta, Department of Physics, University of Helsinki (matti.lepparanta@helsinki.fi)
- "Cooperation between the Nordic countries and Japan in advanced ice sheet and glacier modeling", Ralf Greve, Institute of Low Temperature Science, Hokkaido University (greve@lowtem.hokudai.ac.jp) & Thomas Zwinger, CSC – IT Center for Science (thomas.zwinger@csc.fi)
- "Arctic climate and sea ice history - perspectives from the central Arctic Ocean sediment record", Kari Strand, Thule Institute, University of Oulu (kari.strand@oulu.fi)

12:15-13:30 Lunch Break

13:30-15:10 Session 2.1: Biodiversity and Environmental Protection in the North

- "Influence of clear-cutting on the chemistry of runoffs in a mixed forest watershed under heavy snowfall, Hokkaido, Japan", Fuyuki Satoh, Field Science Center for Northern Biosphere, Hokkaido University (f-satoh@fsc.hokudai.ac.jp)
- "Silvicultural challenges with considering structural patterns and dynamics of natural forests", Toshiya Yoshida, Field Science Center for Northern Biosphere, Hokkaido University (yoto@fsc.hokudai.ac.jp)

- “Simulated warming effects on plant-insect interactions in a cold temperate region”, Masahiro Nakamura, Field Science Center for Northern Biosphere, Hokkaido University (masahiro@fsc.hokudai.ac.jp)
- “Elevational and latitudinal variation in species richness of sawfly gallers and willows in Japan”, Heikki Roininen, Department of Biology, University of Eastern Finland (heikki.roininen@uef.fi)
- “International collaborative study on ecology and evolution in plant-insect interactions”, Shunsuke Utsumi, Department of General Systems Studies, University of Tokyo (csutsumi@mail.ecc.u-tokyo.ac.jp)

15:10-15:25 Break

15:25-16:05 **Session 2.2: Environmental Protection across the Borders**

- “Land ocean linkage and its conservation in the Amur-Okhotsk region: lessons from Baltic Sea”, Takayuki Shiraiwa, Institute of Low Temperature Science, Hokkaido University (shiraiwa@lowtem.hokudai.ac.jp)
- “Spearhead themes for research station collaboration between Oulu and Hokkaido universities effects of forestry, ecology of ice and LTER”, Riku Paavola, Thule Institute, University of Oulu (riku.paavola@oulu.fi)

16:05-16:25 **Concluding Session: Challenges for Cooperation**

- “Northern research and innovation platform – Promoting cooperation between Finland and Japan”, Päivi Iskanius, Thule Institute, University of Oulu (paivi.iskanius@oulu.fi)

16:25-17:00 **Discussion:** Moderator Heikki Mäkipää, The Finnish Institute in Japan

Floating ice platform for winter observations in freezing lakes and coastal waters

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Abstract

An automatic observation float has been designed, tested and utilized for wintertime investigations in lakes and coastal waters. The float can be deployed in a lake during the open water season, so that it is capable to collect data continuously throughout the period of freeze-up and further on during the ice season. The float is anchored to the bottom so that it should be stable in the freeze-up period. The instrumentation includes a 2-m mast for measurements of the atmospheric boundary layer and radiation balance, thermistor strings and PAR sensors down from the water surface for measurements in ice and water, and an independently anchored current meter and CTD sensor. The float has been utilized in several lakes in Finland and in Santala Bay in the Baltic Sea in 1999–2011 with very good results. The data have been used for investigations of the lake heat fluxes, ice formation and melting, and light transfer in the snow–ice–water system. The data have also served as the calibration and validation data in the development of an advanced thermodynamic lake ice model including the layers of snow, slush, snow-ice and congelation ice. In addition, they have been utilized in the modelling the winter circulation in an ice-covered lake. This measurement system will be a suitable platform in further collaborative physical–biological investigations of freezing lakes and landfast ice in coastal regions.

Cooperation between the Nordic countries and Japan in advanced ice sheet and glacier modeling

Ralf Greve[1], Thomas Zwinger[2]

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Abstract

An ice sheet is a grounded ice body with an area greater than 50,000 km^2. The only current ice sheets on Earth are in Antarctica and Greenland, while during the maximum of the last glacial period about 21,000 years ago the Laurentide ice sheet covered much of Canada and North America, the Fennoscandian ice sheet covered northern Europe and the Patagonian ice sheet covered southern South America. Smaller grounded ice bodies, depending on their size, are termed ice caps or glaciers, their number exceed 100,000, and they exist on all continents. Ice sheets, ice caps and glaciers feature gravity-driven free surface flow ("glacial flow"), controlled by pressure, internal stresses, temperature and basal friction.

Since the late 1970s, numerical modeling has become established as an important technique for the understanding of ice dynamics. Ice sheet, ice cap and glacier models are particularly relevant for predicting their possible response to climate change and consequent sea level rise, and thus a number of such models have been developed over the years. Recent observations actually suggest that ice dynamics could play a crucial role in predicting future sea level rise under global warming conditions. Despite this great relevance, ice sheet and glacier modeling is still heavily underrepresented within the domestic and international climatology communities, compared to the large efforts made into atmosphere and ocean research. The need for further research into the matter was even explicitly stated in the Fourth Assessment Report (AR4) of the United Nations Intergovernmental Panel on Climate Change (IPCC): "Dynamical processes related to ice flow not included in current models but suggested by recent observations could increase the vulnerability of the ice sheets to warming, increasing future sea level rise. Understanding of these processes is limited and there is no consensus on their magnitude." (IPCC 2007).

In this talk, recent and ongoing collaborative efforts between the Nordic countries (in particular Finland, Norway, Sweden and Denmark) and Japan on ice sheet, ice cap and glacier modeling will be reviewed. This includes the application of models of various complexities to problems of past, present and future states and changes (including response to global

warming) of the Antarctic and Greenland ice sheets, the Austfonna ice cap on Svalbard and a crater glacier in Kamchatka.

Influence of clear-cutting on the chemistry of runoffs in a mixed forest watershed under heavy snowfall, Hokkaido, Japan

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Abstract

The global environmental change caused by human activity is supposed to alter the life and the situation of those living in northern region drastically. A couple of subjects are lying to protect our surroundings in the North, the thinning of sea ice due to global warming, the land use change through the development of tourism, the destruction of forest caused by acid deposition and/or commercial logging operation. Hokkaido and Finland have several similarities about natural conditions (cold and snowy climate, abundant boreal forest, the presence of sea ice, deer and reindeer etc.), though Hokkaido locates relatively lower latitude compared with Finland. From this point of view, it is natural that the researchers of both sides join together and discuss those facing environmental problems.

The Hokkaido University Forests has the vast area of forests (ca. 70,000ha) in Hokkaido, which ranged from boreal forest to warm temperate forests, and is the largest experimental station in Japanese university system. Many environmental and ecological studies have been conducted in the University Forests. In addition, long term monitoring researches have been launched during last two decades in our forests and produced lots of useful data for global environmental and ecological monitoring system.

In this context, the Hokkaido University Forests can contribute the collaborative research and projects through the environmental and ecological fields concerning to boreal forests. Especially, what we consider as an adequate cooperation is about the impact of human activities such as global warming, acid deposition, forest fire, logging operation and so on. Long term monitoring sites are set up to estimate the forest disturbance caused by human impacts in the University Forests.

As an example of possible collaborative research, I will focus on the long term field experiment about the influence of logging operation, which includes timber harvesting and the scarification of ground surface, on the elution process of the forest watersheds. To demonstrate the relationship between the forest disturbance and the response of watersheds, a large spatial scale of practical research is introduced in the watersheds. Commercial logging and its influence on the surrounding environment is one of the common subject to Japan and Finland. In order to discuss this subject, it is

necessary that the forest vegetation and environmental condition are similar as much as possible between the targeted areas. In this meaning, only Hokkaido can make a comparative research with Finland about this subject in Japan.

Silvicultural challenges with considering structural patterns and dynamics of natural forests

Toshiya Yoshida

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Abstract

Both Japan and Finland are forest-rich countries. The percentages of forests to the total land are close to or more than 60%, which are the highest among advanced nations. However, the importance of forestry, a primary industry, in the society is quite different; forestry is responsible for 5% of GDP (25% of its exports) in Finland, besides only less than 0.1 % in Japan. The stagnation in Japanese forestry is attributable to several reasons (e.g. precipitous topography in general, segmentalized land-ownership), but it is essentially as a result of industrial policy, by which domestic timber demand is largely (40%) met by imports. Anyhow, sustainable use of rich forest resources would be a common interest of both countries.

Increased timber production cause a conflict with conservation issues in a country. Finland have already faced the conflict,and the society have tried to seek a solution. For instance, a retention system, where several live-trees (per hector) are purposely preserved in a cutting, is widely applied instead of clear-cutting during the decade. The retained green trees are expected to work as a ’biological regacy’of the ecosystem. However, ecological studies suggested that more comprehensive retention is required to sustain ecosystem services.

In this context, a technical experience in Japan would provide useful information. In Hokkaido, many of forests have been managed with single-tree selection cutting since the Japanese settlement period. This method had been introduced to sustain timber resources with economic efficiency, but, at the same time, could be more compatible to the conservation issues because it can maintain original conditions of primary forests. In the collaboration study with Finnish researchers, we’ll first examine similarities and differences of forest structural patterns and dynamics between forests of Hokkaido and Finland. In particular, we’ll focus on spatial structure of primeval forests in comparison of that of managed forests. We’ll discuss the possibility to introduce single-tree selection cutting to the Finnish forests. The study also contribute to modify the Japanese traditional system, to make harmony more with conservation issues.

Simulated warming effects on plant-insect interactions in a cold temperate region

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Abstract

Temperature increases of global warming are predicted to be greater at higher latitudes and impact virtually all chemical and biological processes. Ecosystem responses to global warming will be complex and varied in time and space due to direct and indirect effects of them. Field ecological manipulations of global warming are conducted to determine response of whole terrestrial ecosystems to an environmental variable in a manner that mimics climate change. Recently, ecologists from around the world have begun filed manipulations of global warming. Most studies have focused on effects of experimental warming on soil respiration, net N mineralization, and aboveground productivity of understory plants. In contrast, the trophic interactions in changing climate conditions are poorly known. Researches on warming experiments focused initially on the responses of plants and, to a much lesser extent, on those of a second trophic group. Temperature is identified as the dominant abiotic factor affecting insect herbivores. In forests, most biological activities and species diversity are concentrated in the canopy, rather than in the understory. To understand how soil and branch warming affect herbivory via changes in leaf traits on canopy trees of *Quercus crispula* (18-20 m in height), we measured leaf traits (e.g. LMA, nitrogen, and total phenolics) and herbivory using a canopy crane. The branch warming did not affect herbivory of canopy foliage. However, the soil warming decreased herbivory of canopy foliage. The soil warming altered canopy leaf traits; nitrogen content and lignin decreased but total phenolics and condensed tannin increased. The decrease in herbivory can be explained by cellulose, total phenolics, and lignin in canopy foliage. These results suggested that plastic response of canopy leaf traits to the soil warming may decrease abundance of insect herbivores in forests. This is contrary to what would generally be expected according to mathematical modeling and laboratory investigations considering about direct effects of global warming on insect herbivores.

Elevational and latitudinal variation in species richness of sawfly gallers and willows in Japan

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Abstract

Species richness of willow species and galling sawflies living on them were examined in latitudinal and altitudinal gradients in six Japanese river systems from Hokkaido to southern Honshu. Mortality factors of gallers including plant based mortality, parasitoids and inquilines during larval development were studied by dissecting sampled galls under a microscope. The association between environmental factors, mortality factors and local diversity of galling sawflies and their willow hosts were studied. Species richness of sawfly gallers and their host plants decreased towards the south. Species richness of gallers was lower in the delta area at lower altitudes than at higher altitudes. Different mortality factors, plant based mortality, parasitoids or inquilines, showed no significant trends with latitude or altitude. Although some parasitoids showed a weak correlation with latitude and altitude, but overall survival of larvae was not correlated with latitude or altitude. Among sawfly gall types, *Pontania proxima*-type was distinct by having high plant-based mortality. The observed pattern of increasing diversity with increasing latitude is opposite to that in many other animals and plants. This pattern is unlikely explained by larval survival different mortality factors since they showed no difference in latitudinal or altitudinal gradient. A possible explanation of the pattern may be the decreasing host plant richness with other host related factors, like increased habitat fragmentation and decreased abundance of host plants towards the south. In addition, leaf flush of host plants and egg laying of galling sawflies might be better synchronized in north with high seasonal but predictable resource availability. I will also present future direction for biodiversity studies.

International collaborative study on ecology and evolution in plant-insect interactions

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Abstract

Collaborative research in science has been conducted for over 300 years, which international collaboration having grown in importance throughout the past century. International collaboration offers some important opportunities and advantages in ecological research. This is because ecosystems have complexity, variety, and ubiquity across boarder, and the insights of a variety of disciplinary experts are required to understand these ecosystems. In particular, today, our societies face global problems, including biodiversity loss, climate changes, and biological invasion, in which multidisciplinary, international approaches are needed.

In my talk I will introduce two topics of our collaborative studies on ecology and evolution in plant-insect interactions: (1) biodiversity and microevolutionary divergence in a community context, and (2) plant genetics and insect population dynamics of exotic species in their native range.

First, we have conducted collaborative study between Japan and Finland. In this collaboration we have investigated how species diversity of herbivorous insects affects trait evolution of a community member. Despite growing concerns of biodiversity loss, the question of how biodiversity influences evolutionary dynamics within species remains understudied. *Plagiodera versicolora* is a specialist leaf beetle on willow trees (*Salix* spp), and is widely distributed across Eurasia, including Japan and Finland. We found that the leaf beetle populations in Japan evolutionally developed divergent adaptive foraging traits, depending on local herbivore community structure. We also confirmed a similar pattern in Finland. Our results suggest that changes in local biodiversity may rapidly change evolutionary trajectories of species, and that this may be ubiquitous phenomenon.

Second, we have conducted collaborative study between Japan and US to investigate interactions between the tall goldenrod (*Solidago altissima*) and its specialist aphid (*Uroleucon nigrotuberculatum*), both of which are exotic species in Japan from North America. We examined consequences of genotypic diversity of the tall goldenrod for spatial population dynamics of the aphids in their native range. As a result we found that plant genotypic diversity increased population size of the aphid due to enhancement of movement. Motivation of the collaboration arises from the following reasons: (1) genetic variation and spatial spreading dynamics are important issues in biological invasion processes, (2)

knowledge and collection of a variety of *Solidago* genotypes are accumulated in the US collaborator's lab, and (3) comparison of ecological and evolutionary dynamics between native and introduced range may provide insights toward management of exotic species as well as fundamental ecological theory.

Land ocean linkage and its conservation in the Amur-Okhotsk region: lessons from Baltic Sea

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Abstract

Hokkaido University and Research Institute for Humanity and Nature conducted ***The Amur-Okhotsk Project 2003-2009*** (AOP) which attempted to create a new global environmental concept referred to as the "Giant" fish-breeding forest (GFBF) by expanding the traditional Japanese idea of Uotsuki-Rin (fish-breeding forest), which related upstream forest with the coastal ecosystem both physically and conceptually. The AOP found that primary production in the Sea of Okhotsk and Oyashio region depended on dissolved iron transported from the Amur River and its watershed. Therefore, the Amur River basin can be recognized as the GFBF of the Sea of Okhotsk and the northern North Pacific (Oyashio open water). This is the first discovery of positive relationship between land river basin and open water ecosystem.

The sustainability of the GFBF is, however, currently threatened by global warming trend and excessive land-use changes. Decreasing sea ice in the Sea of Okhotsk leads to weakening of thermohaline circulation that transports the dissolved iron from Amur River mouth to the northern North Pacific. Rapid shrinkage of wetland due to reclamation in the Amur River basin leads to decrease in dissolved iron production rate in its tributary. Both trends are most likely to decrease the primary production in the Sea of Okhotsk and the Oyashio open water in the future.

The key problem in conserving the GFBF system is how to establish a multilateral cooperative framework in this politically delicate region. There have already been some bilateral frameworks, including the formal joint-monitoring program between China and Russia after the Songhua River (a tributary of Amur River) accident involving a petrochemical company in the Chinese province of Jiling in 2005, and the cooperative program on the research, conservation and sustainable use of the ecosystems in the Sea of Okhotsk signed by Russia and Japan in 2009. However, there has been no multilateral governmental framework concerning the GFBF encompassing Mongol, China, Russia and Japan.

At this stage, joint-monitoring, data exchange and mutual communication at an academic level are necessary as a starting point for the protection of the GFBF system. For this purpose, we established the ***Amur Okhotsk Consortium*** in 2009 as a multinational academic network

to discuss the conservation and sustainable use of the GFBF. The network can be thought of as comprising “epistemic communities”; Peter Haas proposed that such networks of knowledge-based experts could help states identify their interests, frame issues for collective debate, propose specific policies, and identify salient points for negotiations. Our attempt is strongly motivated by the history of the environmental protection of the Baltic Sea from marine pollution for over 30 years. We started to communicate with Helsinki Commission and Finish Environmental Institute （SKYE）since 2009 and learned the history how the Helsinki Convention was established and realized over 30 years.

The Baltic Sea and the Sea of Okhotsk are symmetrical if one overviews Eurasia above Russian Federation. They are the western and the eastern marginal sea of the continent. Japan needs to study Finish experiences and knowledge how they developed the relationship with Russia and its neighboring countries to protect the Baltic Sea.