



# HOKKAIDO UNIVERSITY

Title	Subarctic Long Term Monitoring and Research
Author(s)	Suominen, Otso
Relation	フィンランド-日本 共同シンポジウムシリーズ : 北方圏の環境研究に関するシンポジウム2012(Joint Finnish-Japanese Symposium Series Northern Environmental Research Symposium 2012). 2012年9月10日-14日. オウル大学、オウランカ研究所, フィンランド.
Issue Date	2012-09-10
Doc URL	<a href="https://hdl.handle.net/2115/51375">https://hdl.handle.net/2115/51375</a>
Type	conference presentation
File Information	11_OtsoSuominen.pdf





TURUN YLIOPISTO  
UNIVERSITY OF TURKU



# Subarctic Long Term Monitoring and Research

Kevo Subarctic Research Institute

Otso Suominen (otso.suominen@utu.fi)

<http://www.kevo.utu.fi/>



# Kevo Subarctic Research Institute



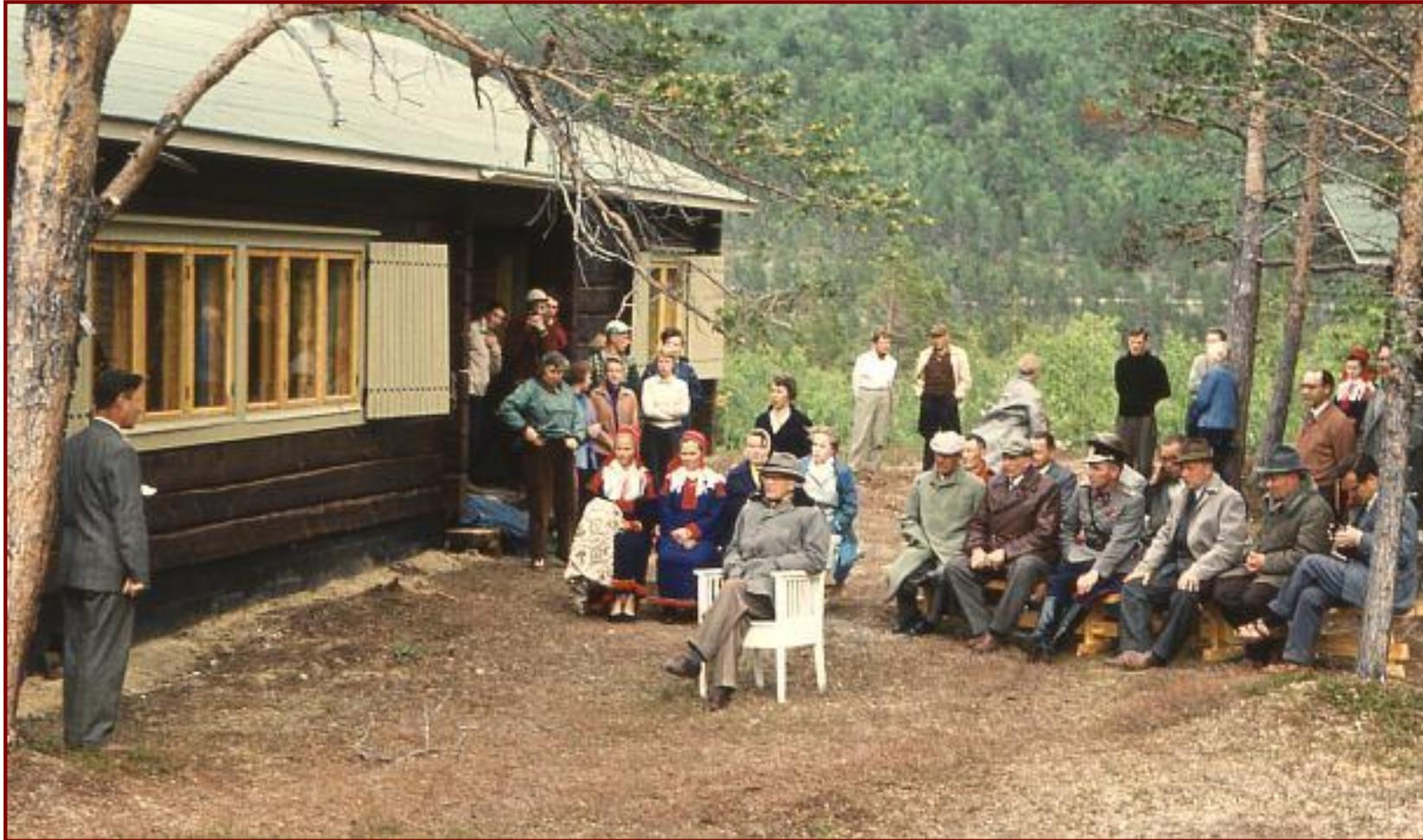
- **Kevo Research Station**, lies about 60 km north of the continuous pine forest line at the subarctic of mountain birch zone at forest-tundra ecotone.
- It is located in Utsjoki, which is the northernmost municipality in Finland and the only one with Sami majority.



- The station has capacity to accommodate about 40 guests (up to 70 in summertime) at a time.
- Station is open year-round and provides laboratories, workshops, a lecture hall, accommodation buildings and saunas.
- There is a weather station of Finnish Meteorological Institute and a seismograph station of Seismological Institute operating at Kevo – both parts of the worldwide standardized measurement networks.
- During the recent years the station has had yearly about 120-200 Finnish and foreign visiting scientist. Yearly over 200 students and teachers participate in the courses held at the station.



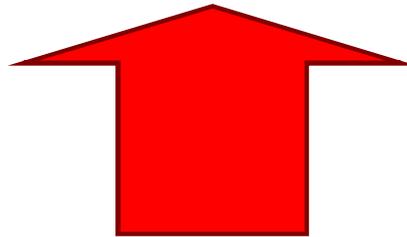
# Kevo 1958



# Research

- Ecology & other Biological Sciences
- Geology & Geography
- Environmental Science

Experimental research on causal relationships behind the observed phenomena in nature



Long term monitoring and mapping data



# Biogeographical Mapping

- Flora of Inari Lapland (Paavo Kallio, Yrjö Mäkinen, Jaakko Nurmi & Unto Laine) 1954-
  - With the present rate the very last km<sup>2</sup> of this over 20 000 km<sup>2</sup> area will be mapped in year 2150
- Bird Fauna of Inari Lapland
- Lepidopterans of Inari Lapland (butterflies and moths)
- Species lists of Inari Lapland  
(<http://www.kevo.utu.fi/tiedostot/eliot/index.html>)

MÄKINEN, Y., LAINE, U., HEINO, S., ISO-IIVARI L. & NURMI, J. 2011:  
Vascular flora of Inari Lapland. 8. Rosaceae and Fabaceae.  
Reports from the Kevo Subarctic Research Station 24: 3-126.



# Palsa mires



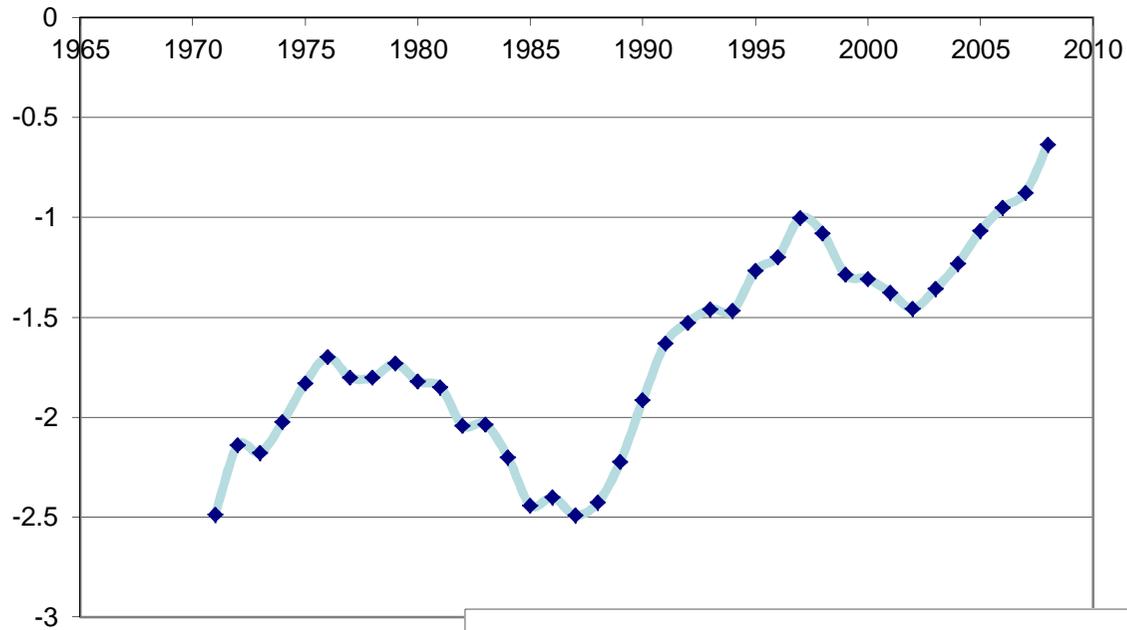


# Long-term Monitoring

1. Vuoskojavri catchment monitoring terrestrial and aquatic data (Economic Commission for Europe monitoring program) 1989-
2. Air quality monitoring – national background reference station (Finnish Meteorological Institute) 1974-
3. Biological long-term monitoring:
  - Lepidopteran population fluctuation and species composition 1972-
  - Vole (rodent) populations (birch forest and tundra) 1981-
  - Population fluctuation and breeding success of the birds of prey 1982-2005
  - Population fluctuation of hole nesting passerine birds 1982-
  - Population fluctuation birch eating insect herbivores 1986-
  - Phenology monitoring (24 species) 1977-
  - Aerobiological pollen monitoring 1976-
  - Pollen deposit monitoring 1982-

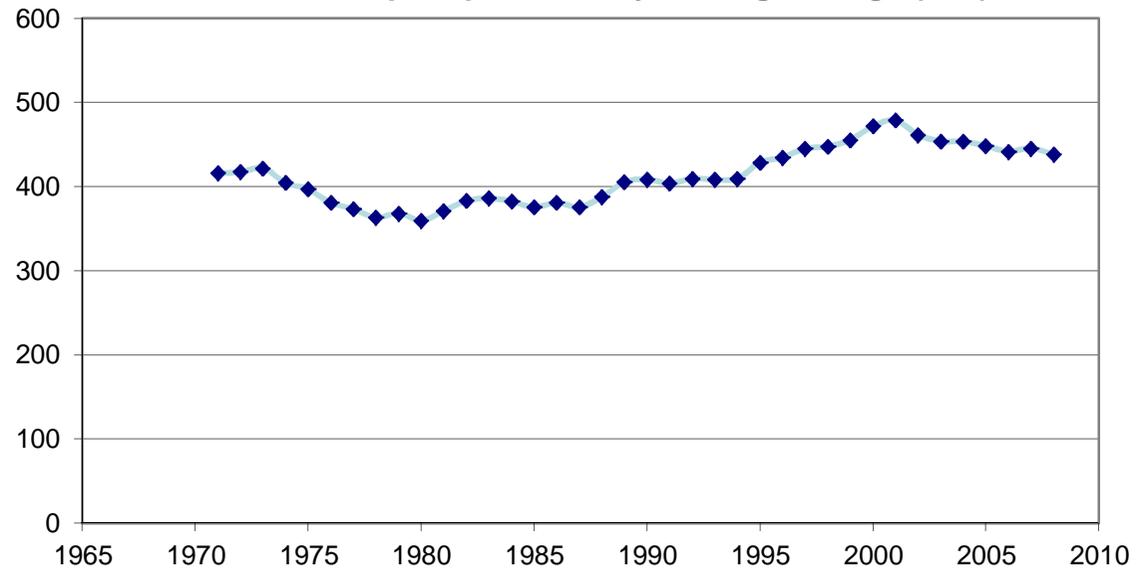


**Kevo mean annual temperature 10-y moving average (°C)**

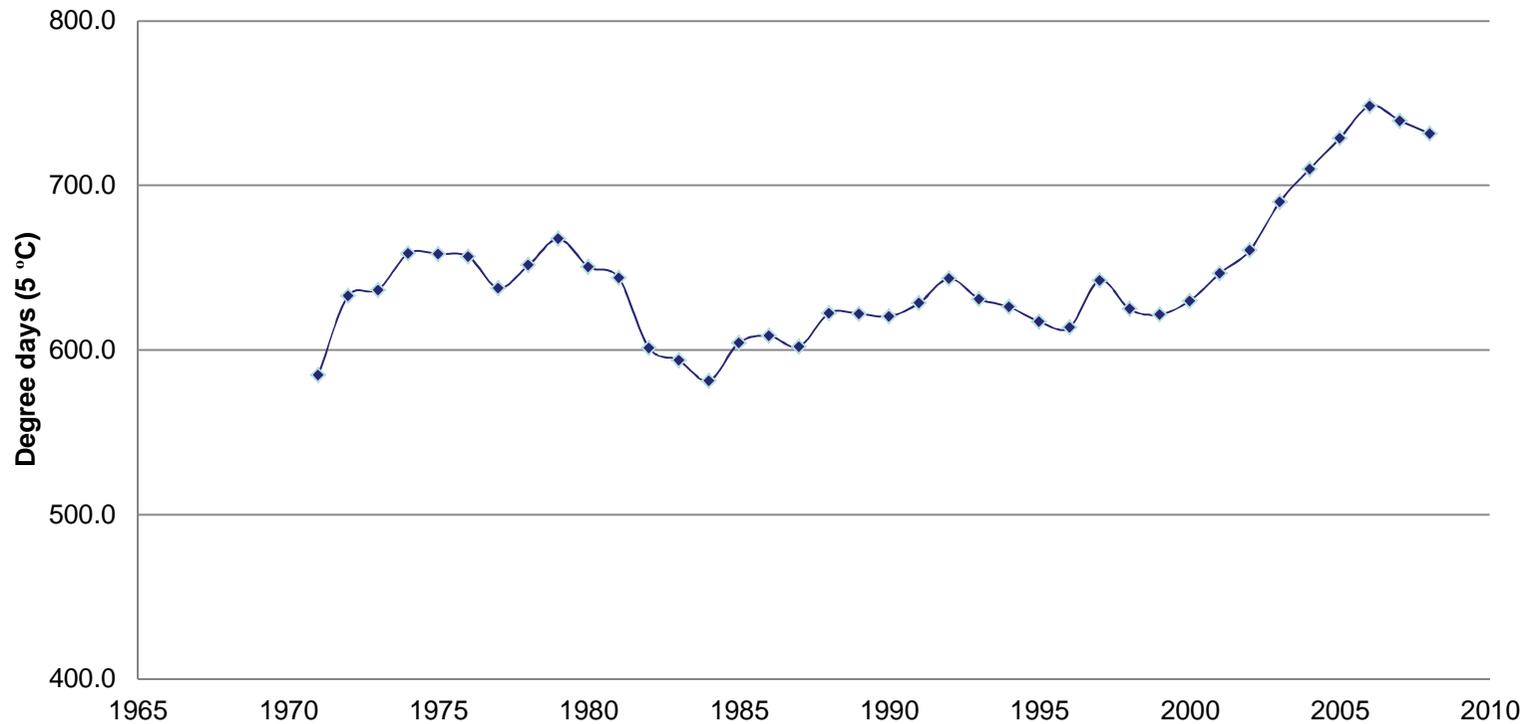


Data from the Finnish Meteorological Institute

**Kevo, annual precipitation 10-y moving average (mm)**



## Thermal sum (dd5°) 10-y moving average



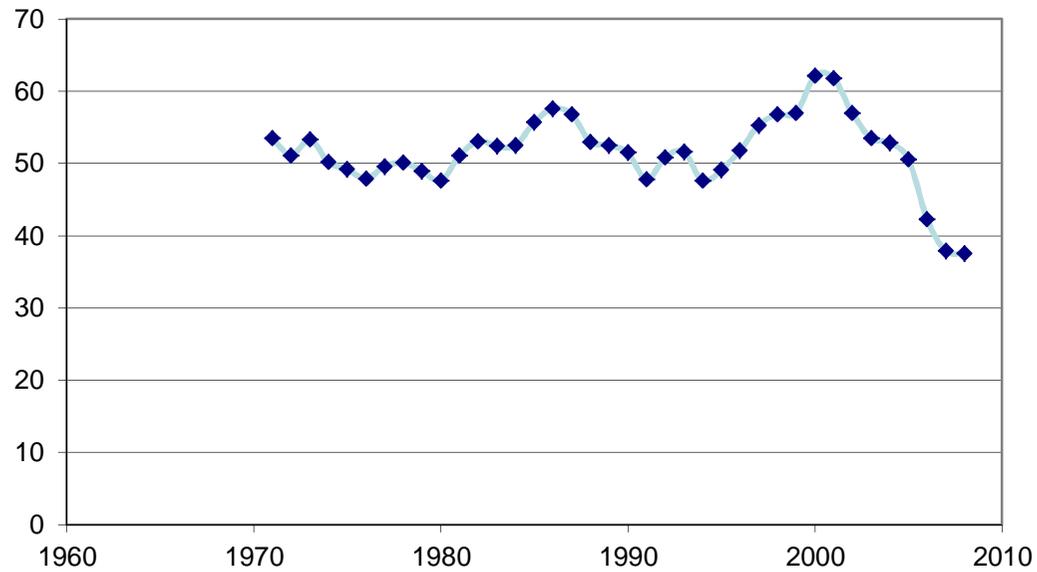
Data from the Finnish  
Meteorological Institute

As a global rule the limit to forest/tree growth is 600 dd



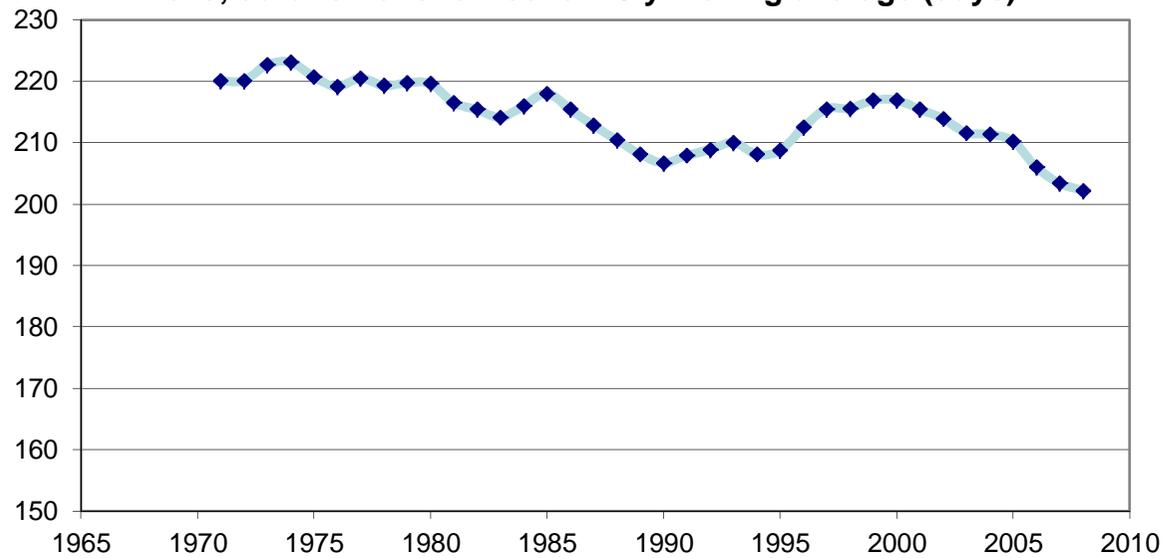
TURUN YLIOPISTO  
UNIVERSITY OF TURKU

Kevo, snow thickness 1 May 10-y moving average (cm)



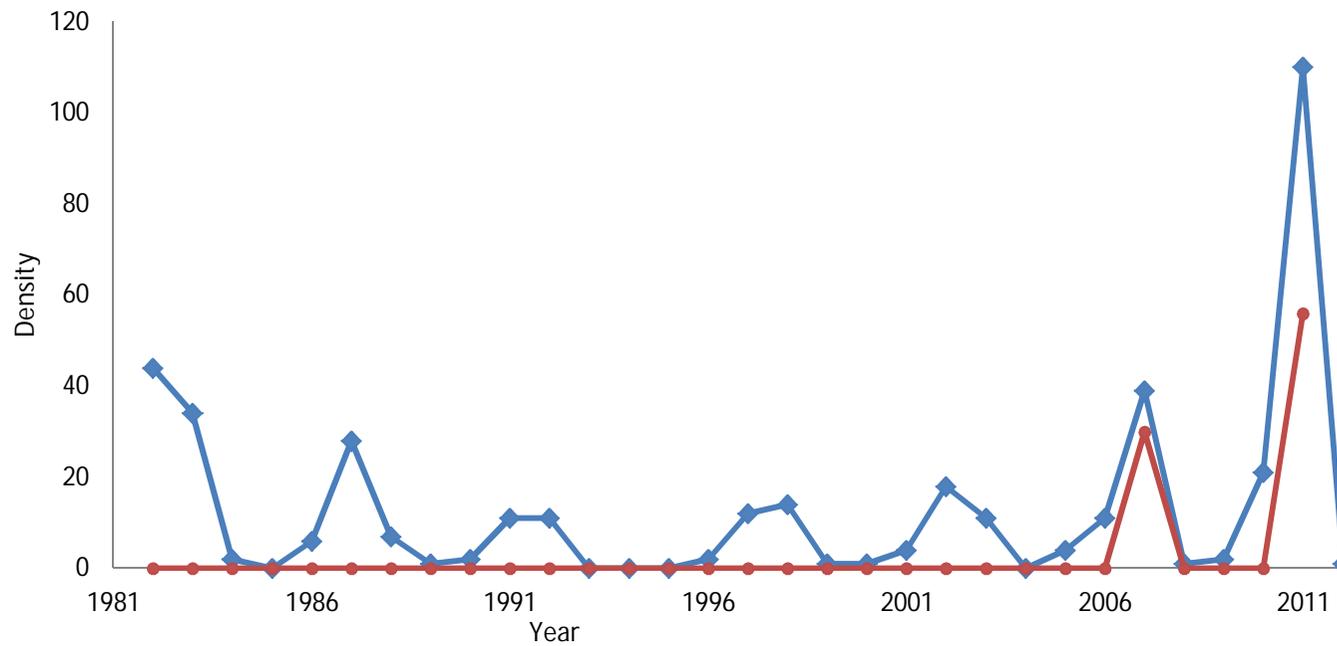
Data from the Finnish Meteorological Institute

Kevo, duration of snow cover 10-y moving average (days)





Rodent population density (late August)



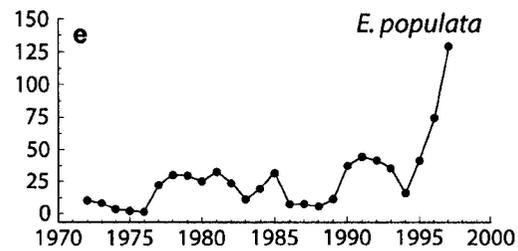
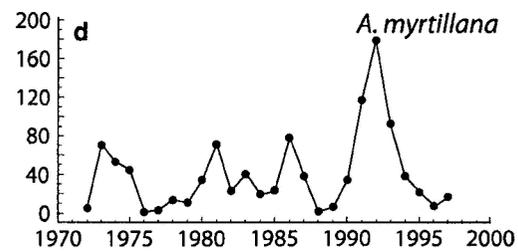
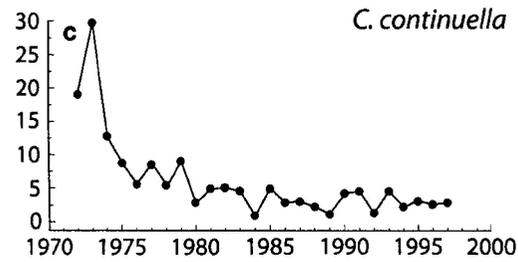
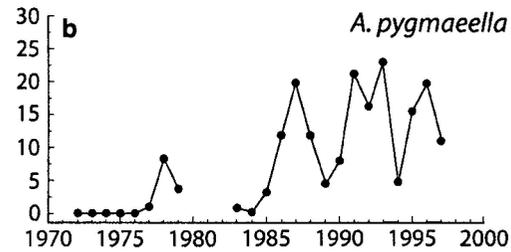
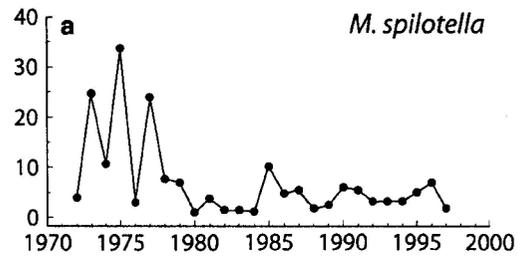
# Diverse population trajectories among coexisting species of subarctic forest moths

Mikhail V. Kozlov · Mark D. Hunter · Seppo Koponen · Jari Kouki · Pekka Niemelä · Peter W. Price

Population Ecology (2010) 52:295–305

Based on Kevo light-trapping records of 232 moth species spanning 26 years (total catch of ca. 230,000 specimens).





# Plant-herbivore interactions and insect population dynamics

- Defoliation by geometrid moth larvae are typical to mountain birch forests
- Cyclic population dynamics with 10 year cycle lead to outbreaks of autumnal moth (*Epirrita autumnata*) and winter moth (*Operophtera brumata*) at parts of northern Fennoscandia.
- It is known from Norwegian coastal areas that winter moth populations often peak 1-2 years after autumnal moth peaks.



# Mapping and monitoring

Mountain birch forest destruction by autumnal moth (1964-65)



=> Herbivory research; "Magna/opo"-project; Erkki Haukioja



TURUN YLIOPISTO  
UNIVERSITY OF TURKU



Winter moth  
(*Operophtera  
brumata*)

Birch forest destroyed by winter moth larvae.

Grasses increase due to fertilizing impact of moth larvae faeces and killing of dwarf shrubs (*Empetrum* & *Vaccinium* spp.).



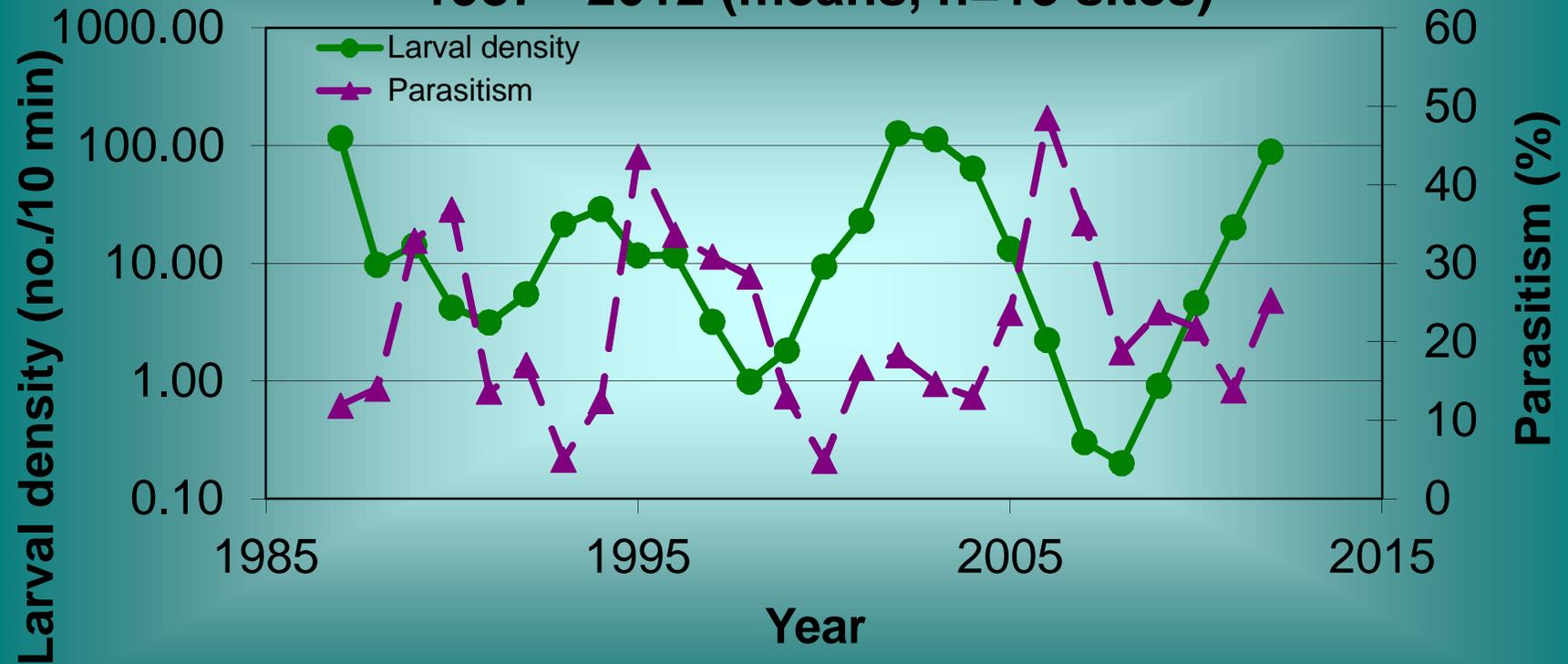
Moth larvae on birch leaf.

The other one infected by parasitic wasp larva.





## Density and parasitism of autumnal moth larvae 1987 - 2012 (means, n=13 sites)



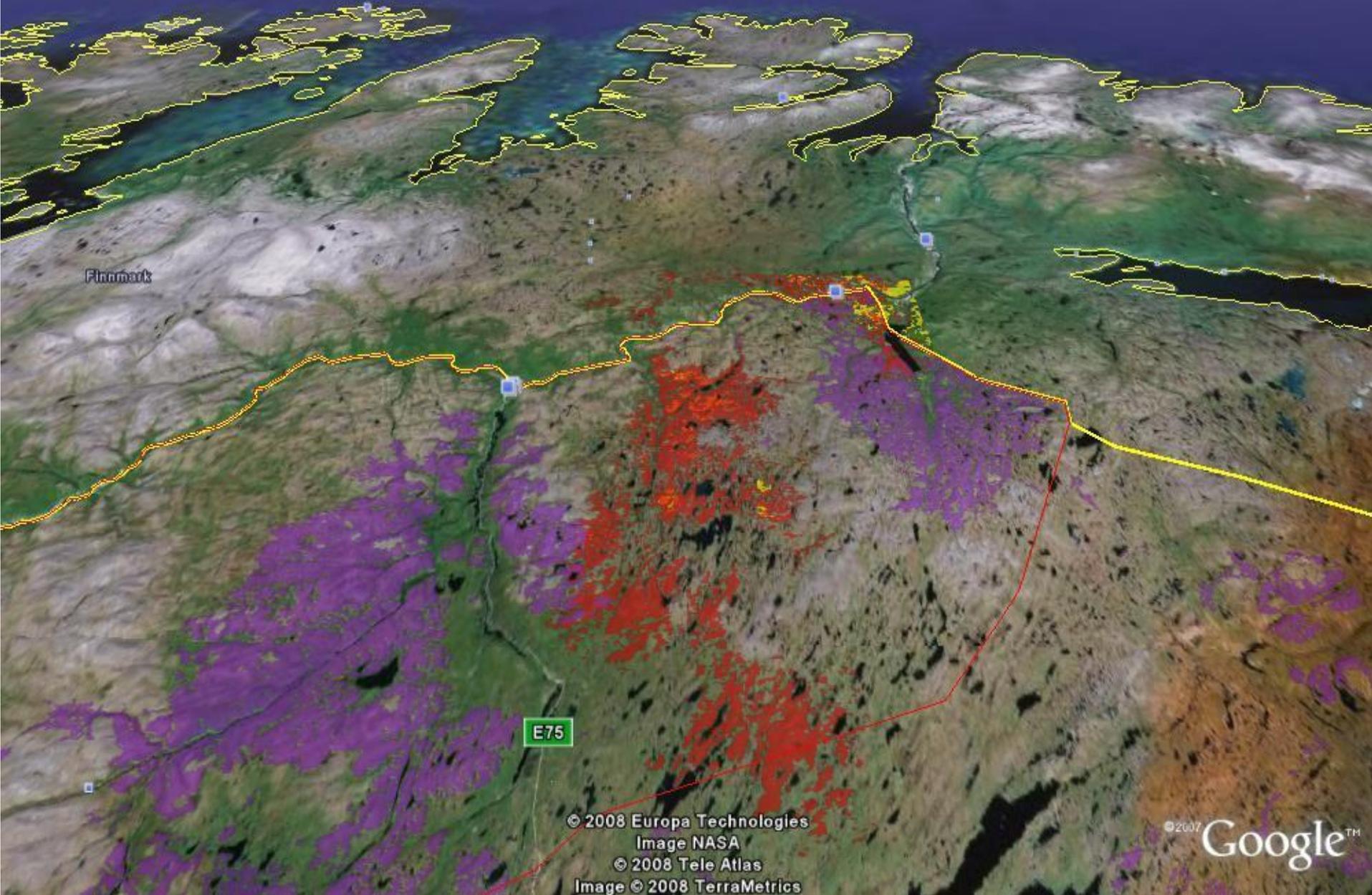
Kai Ruohomäki et al.



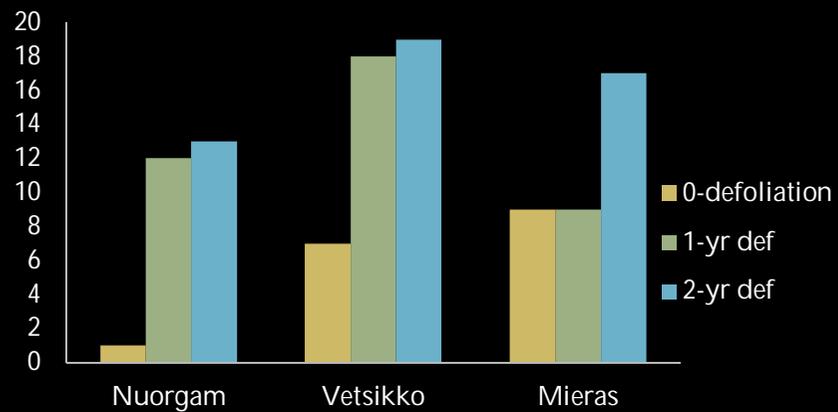
TURUN YLIOPISTO  
UNIVERSITY OF TURKU

1960's autumnal moth defoliation

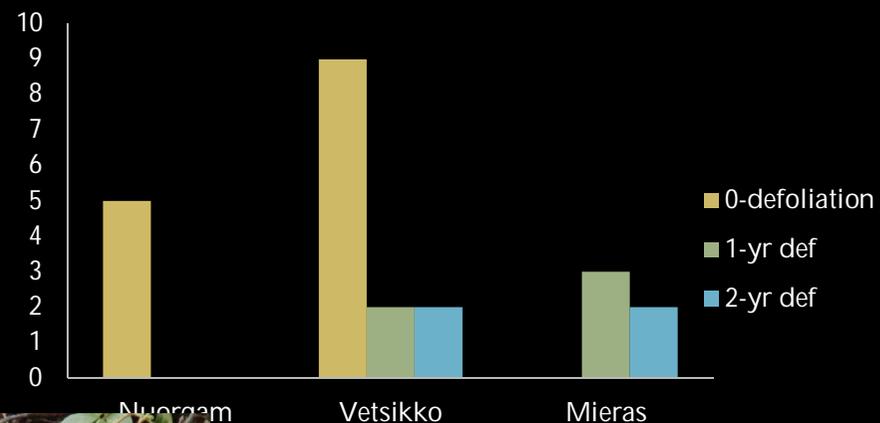
Winter moth defoliation 2008



*Myodes rutilus*



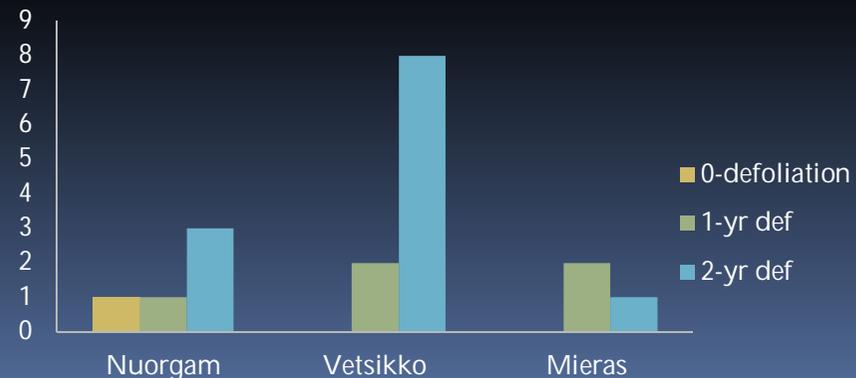
*Myodes rufocanus*



*Microtus oeconomus*

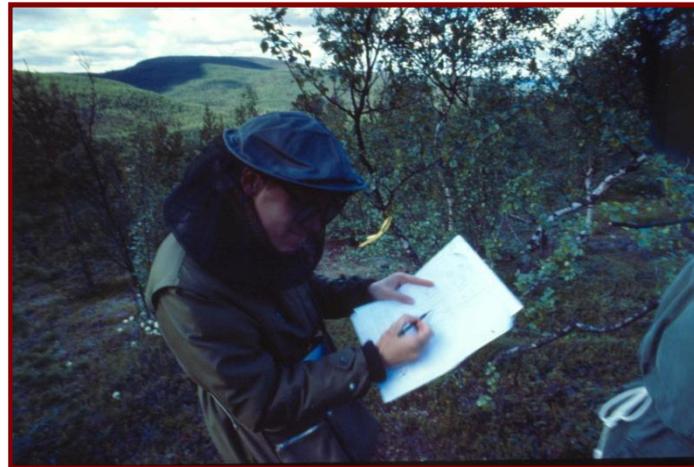


*Lemmus*



# Experimental research

Plant-herbivore interactions and insect population dynamics



# Experimental research

Treeline arboretum (“treeline gardens”)

University of Turku + Finnish Forest Research Institute + Metsähallitus



Birch and coniferous treeline species; survival, growth, flowering, seed production, hybridization...



TURUN YLIOPISTO  
UNIVERSITY OF TURKU

# **BIOGEOGRAPHIC EVIDENCE FOR THE EVOLUTION OF CHEMICAL DEFENSE BY BOREAL BIRCH AND WILLOW AGAINST MAMMALIAN BROWSING**

BRYANT, J. et al. 1989. Am. Nat. 134



# Experimental research

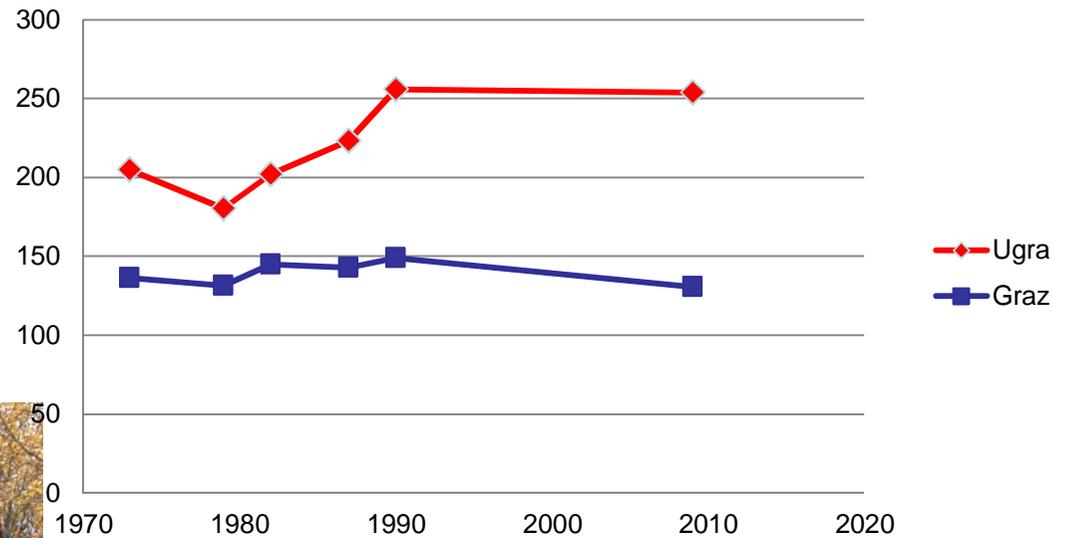
Impact of reindeer on ecosystem processes and biodiversity



# 1970 exclosures



Number of basal sprouts of birch / 40 m<sup>2</sup>



Lehtonen & Heikkinen 1995, Écoscience

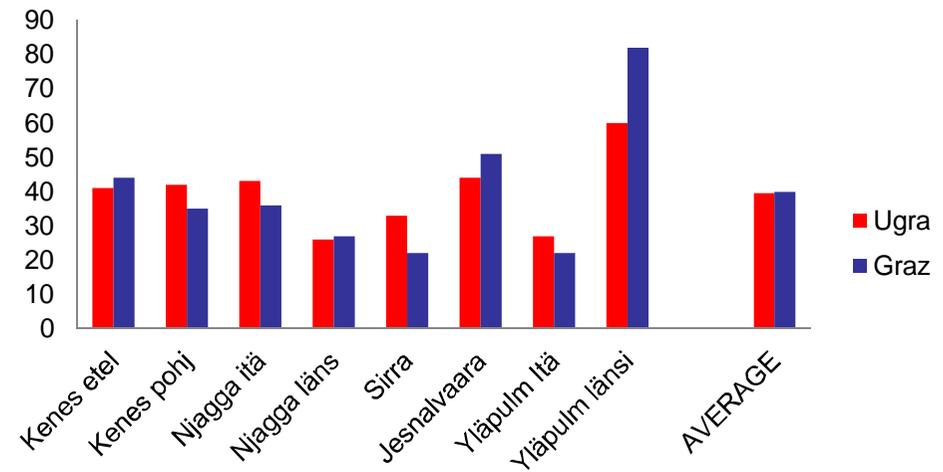


TURUN YLIOPISTO  
UNIVERSITY OF TURKU

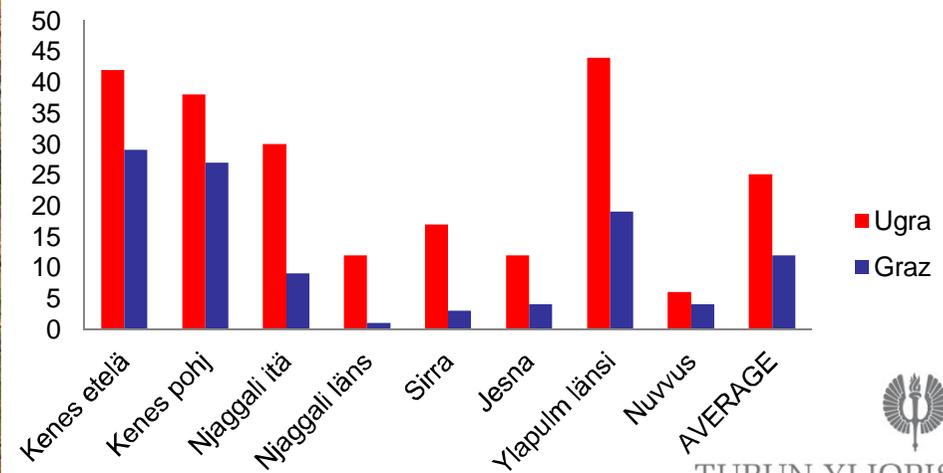
# 1970 exclosures



Birch individuals 1973

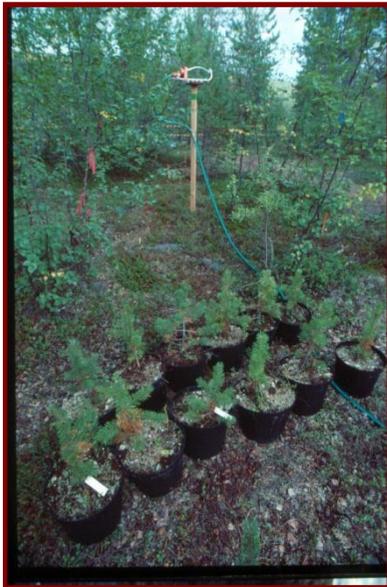


Birch individuals 2009



# Experimental research

## Air pollutants



- Eeva, T. & Penttinen, R. 2009: Leg deformities of oribatid mites as an indicator of environmental pollution. – *Science of the Total Environment* 407(16): 4771-4776.
- Ruuhola, T. et al. 2009. Effects of long-term simulated acid rain on a plant-herbivore interaction. – *Basic and Applied Ecology* 10:589-596.



# Research networks

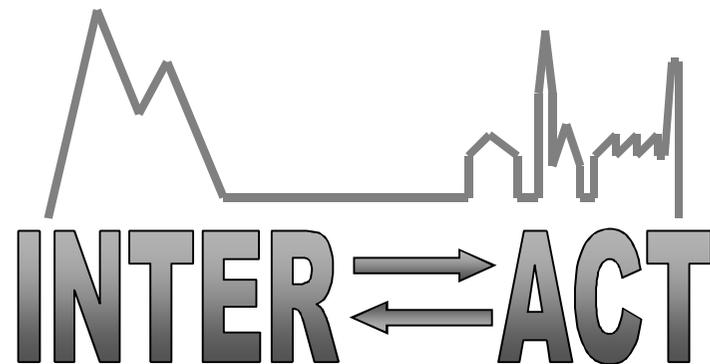
## FinLTSER

Finnish Long-Term Socio-Ecological Research Network

## SCANNET

Circumarctic Network of Terrestrial Field Bases

<http://www.eu-interact.org/>



TURUN YLIOPISTO  
UNIVERSITY OF TURKU



**THANK  
YOU!**

Photos:

Kevo archives, Saini Heino,  
Jussi Heino, Rolf A. Ims,  
Tero Klemola, Kari Mikkola,  
Nigel Richards, Kai Ruohomäki,  
Kari Saikkonen, Otso Suominen,  
Ilkka Syvänperä, Elina Vainio

