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Subarctic Long Term Monitoring and Research

Kevo Subarctic Research Institute

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

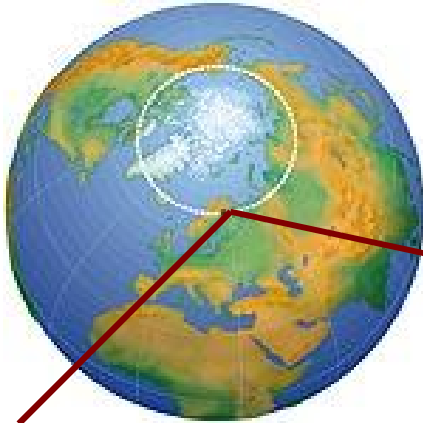


Kevo Subarctic Research Institute



- **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.

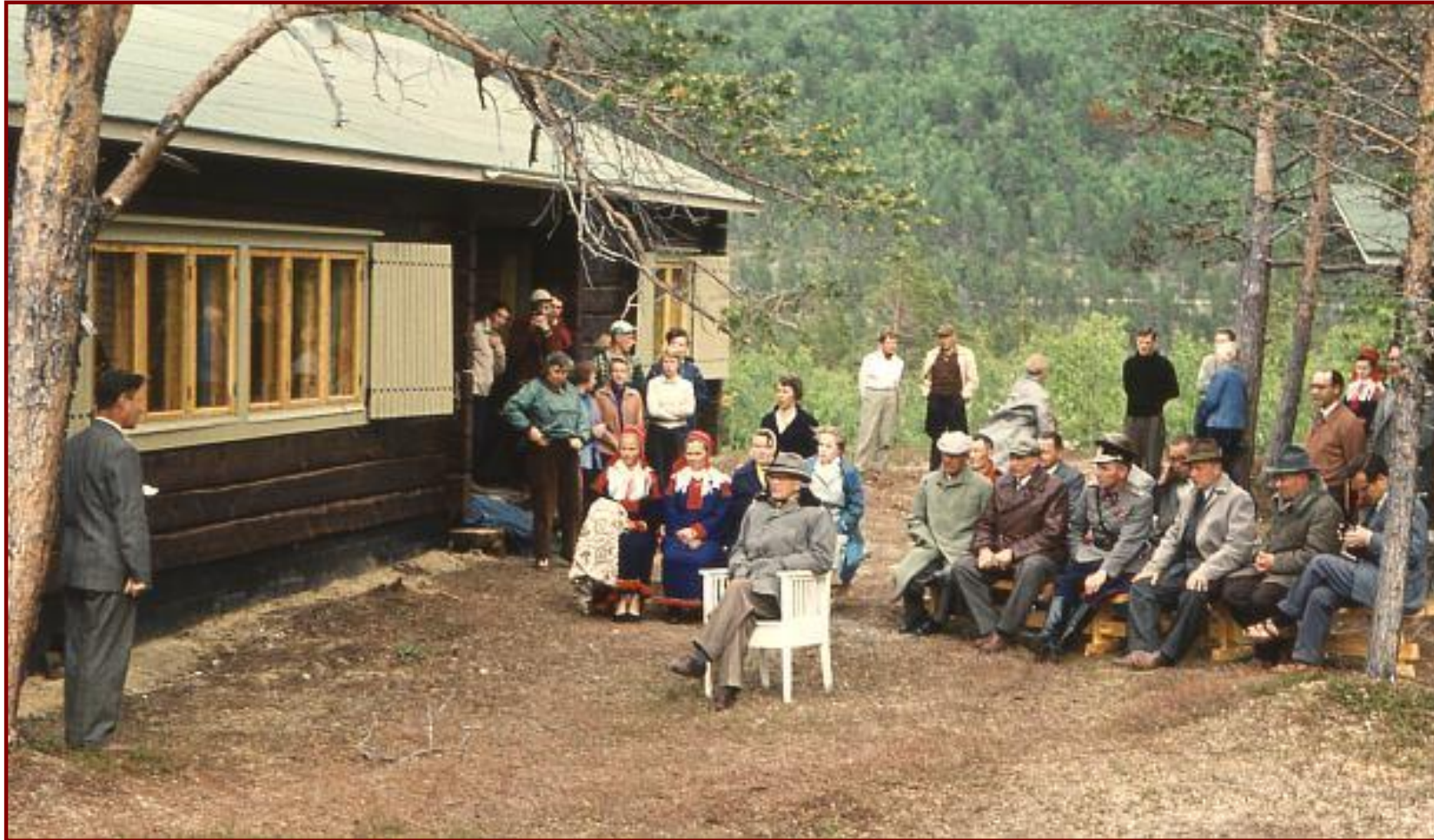
(69°45'N,
27°01'E)



- 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.



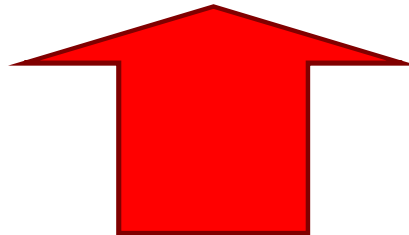
Kevo 1958



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 km² of this over 20 000 km² 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



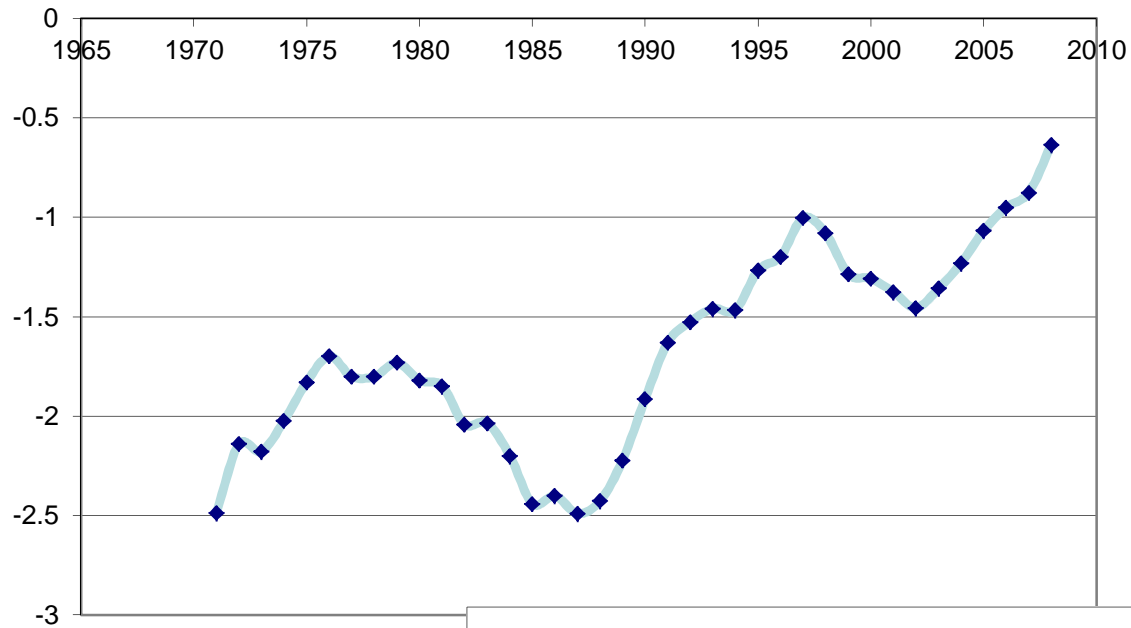


Long-term Monitoring

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-

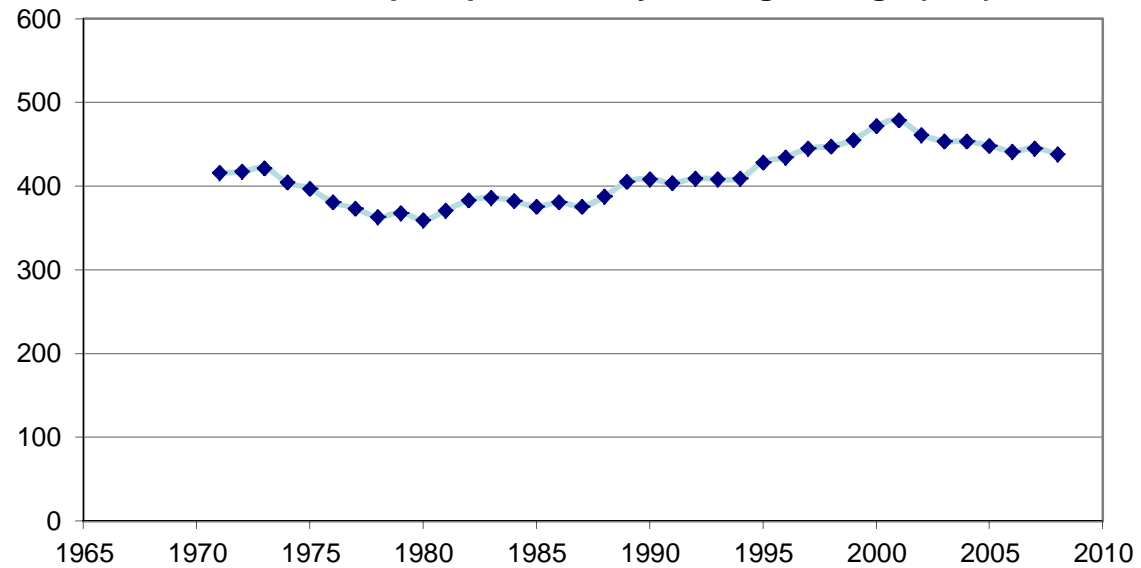


Kevo mean annual temperature 10-y moving average (°C)

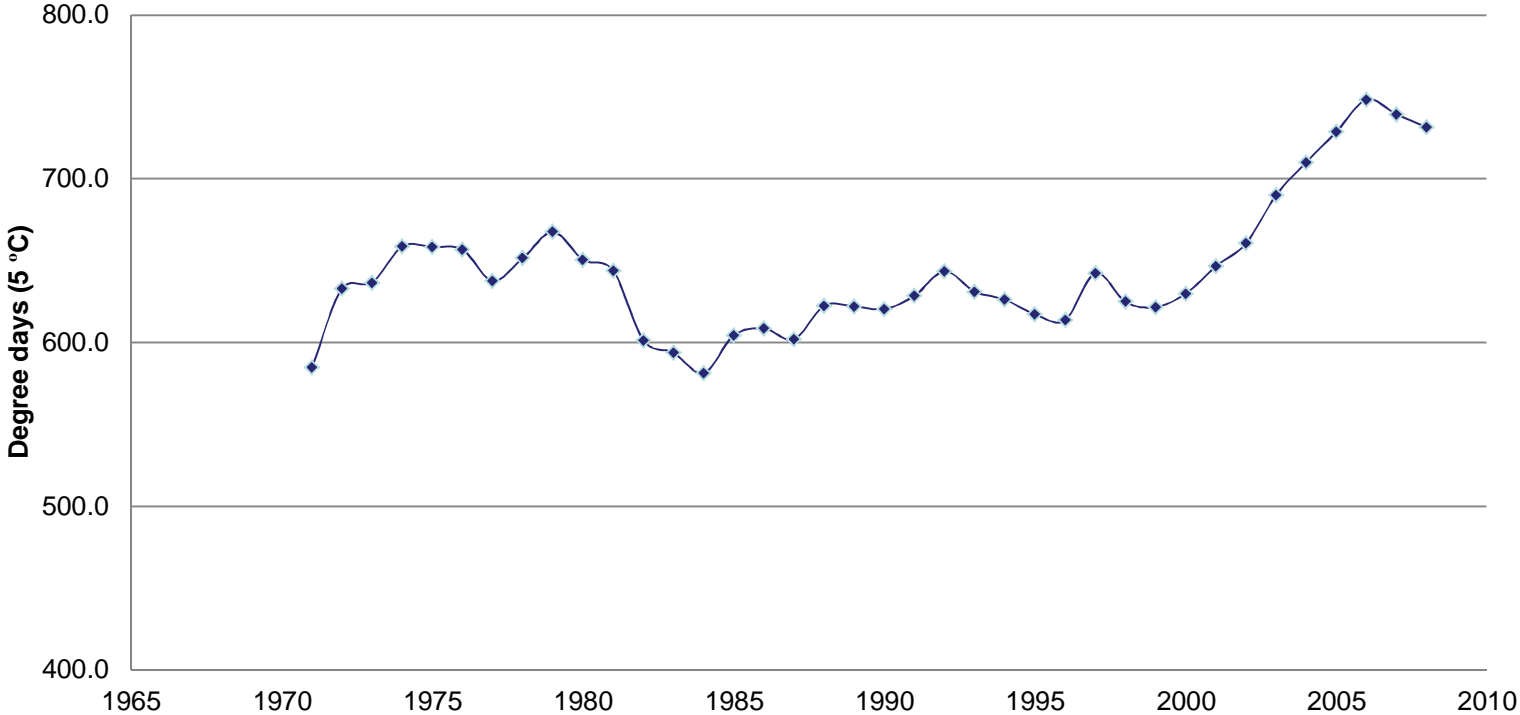


Data from the Finnish Meteorological Institute

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



Thermal sum (dd5°) 10-y moving average

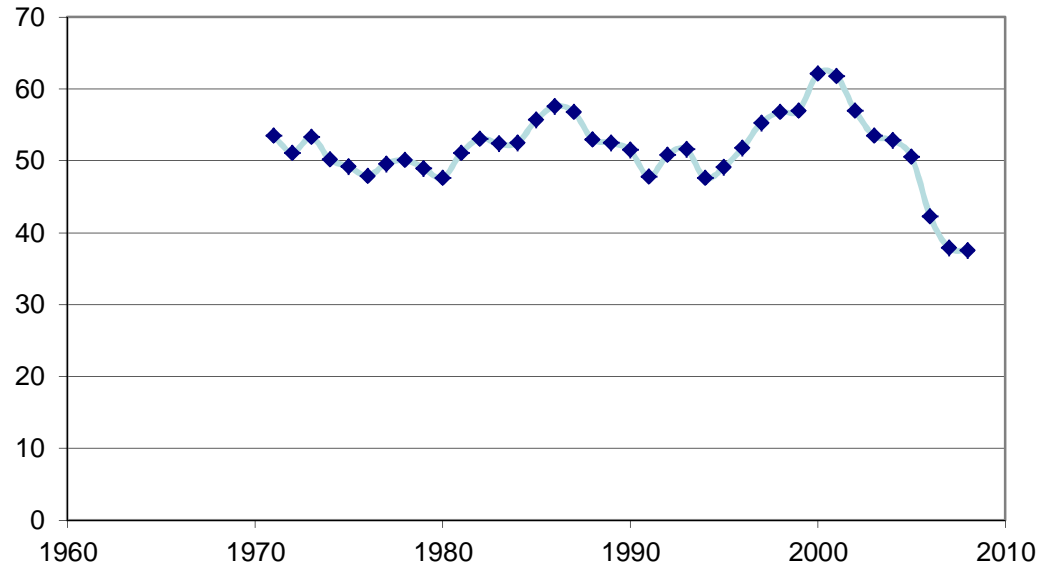


Data from the Finnish Meteorological Institute

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

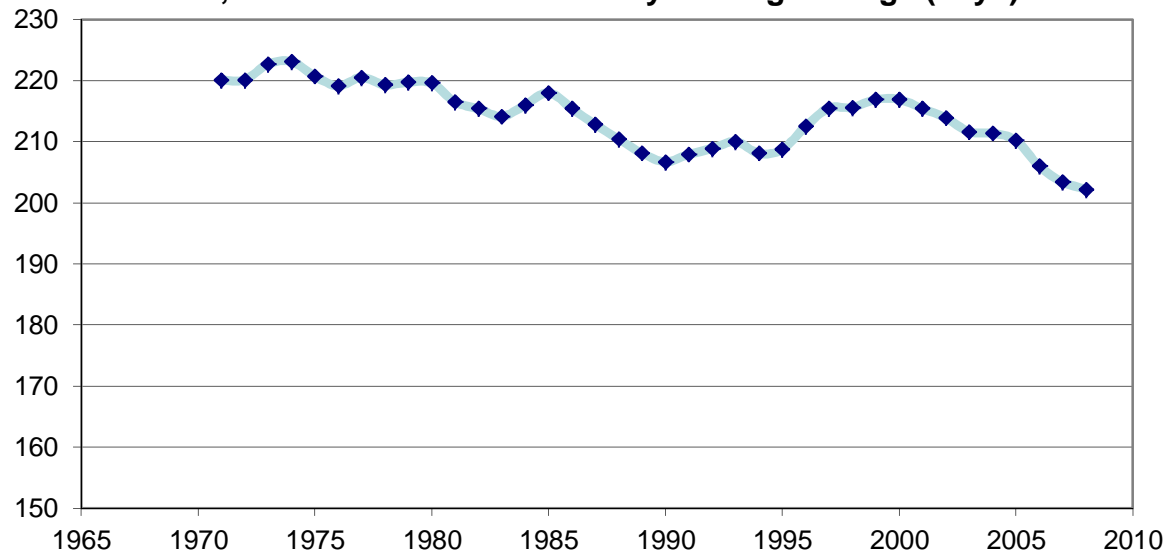


Kevo, snow thickness 1 May 10-y moving average (cm)



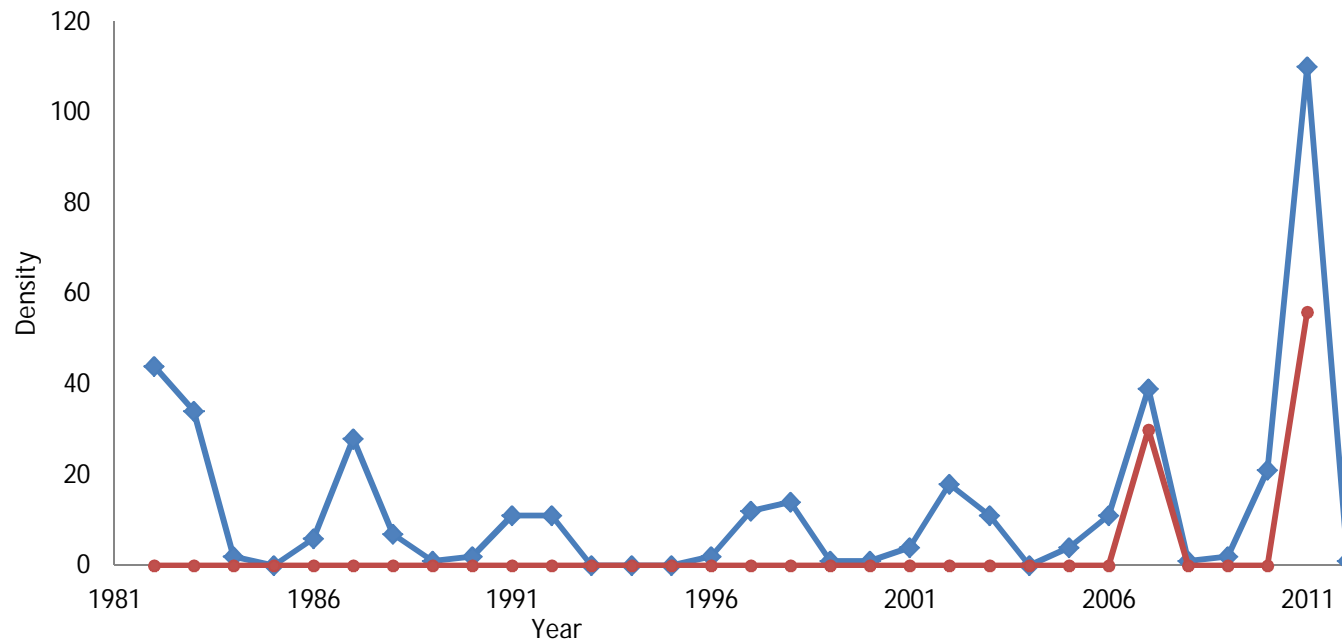
Data from the Finnish Meteorological Institute

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





Rodent population density (late August)



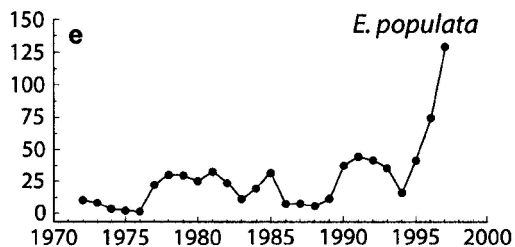
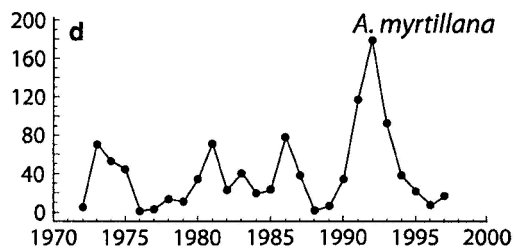
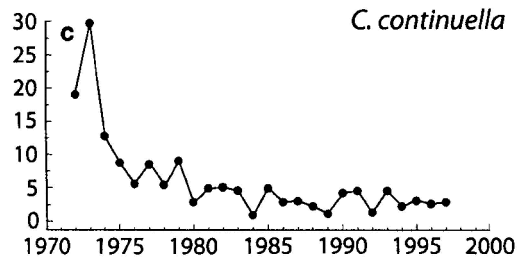
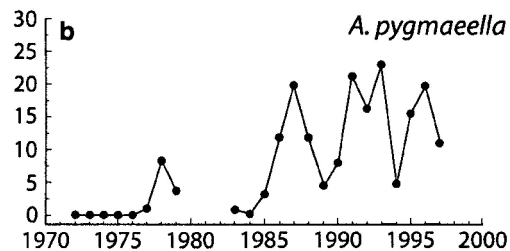
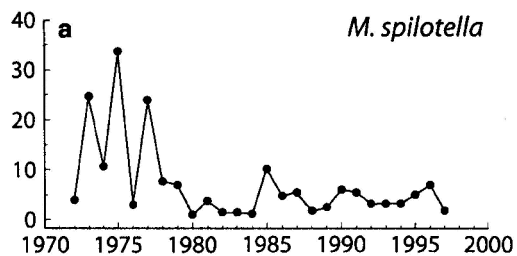
Diverse population trajectories among coexisting species of subarctic forest moths

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



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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.).



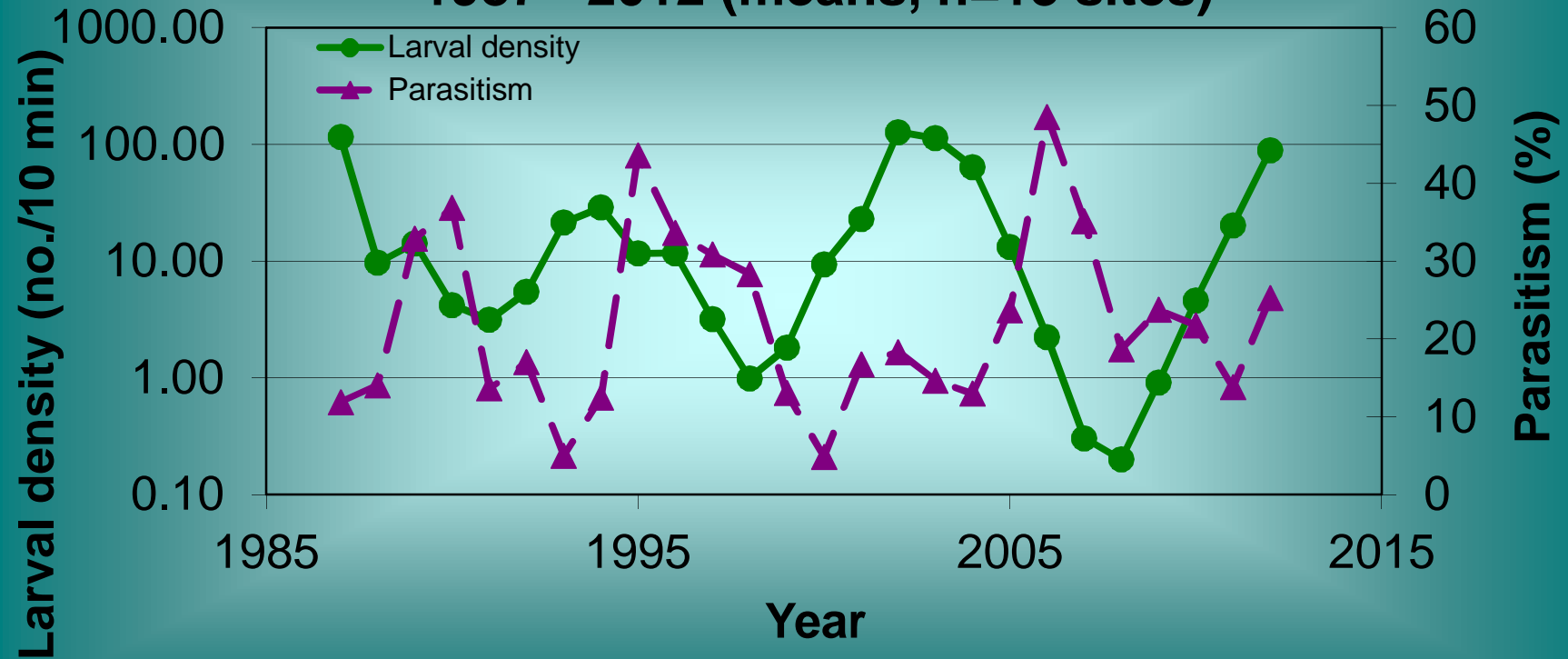
Moth larvae on birch leaf.

The other one infected by parasitic wasp larva.





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



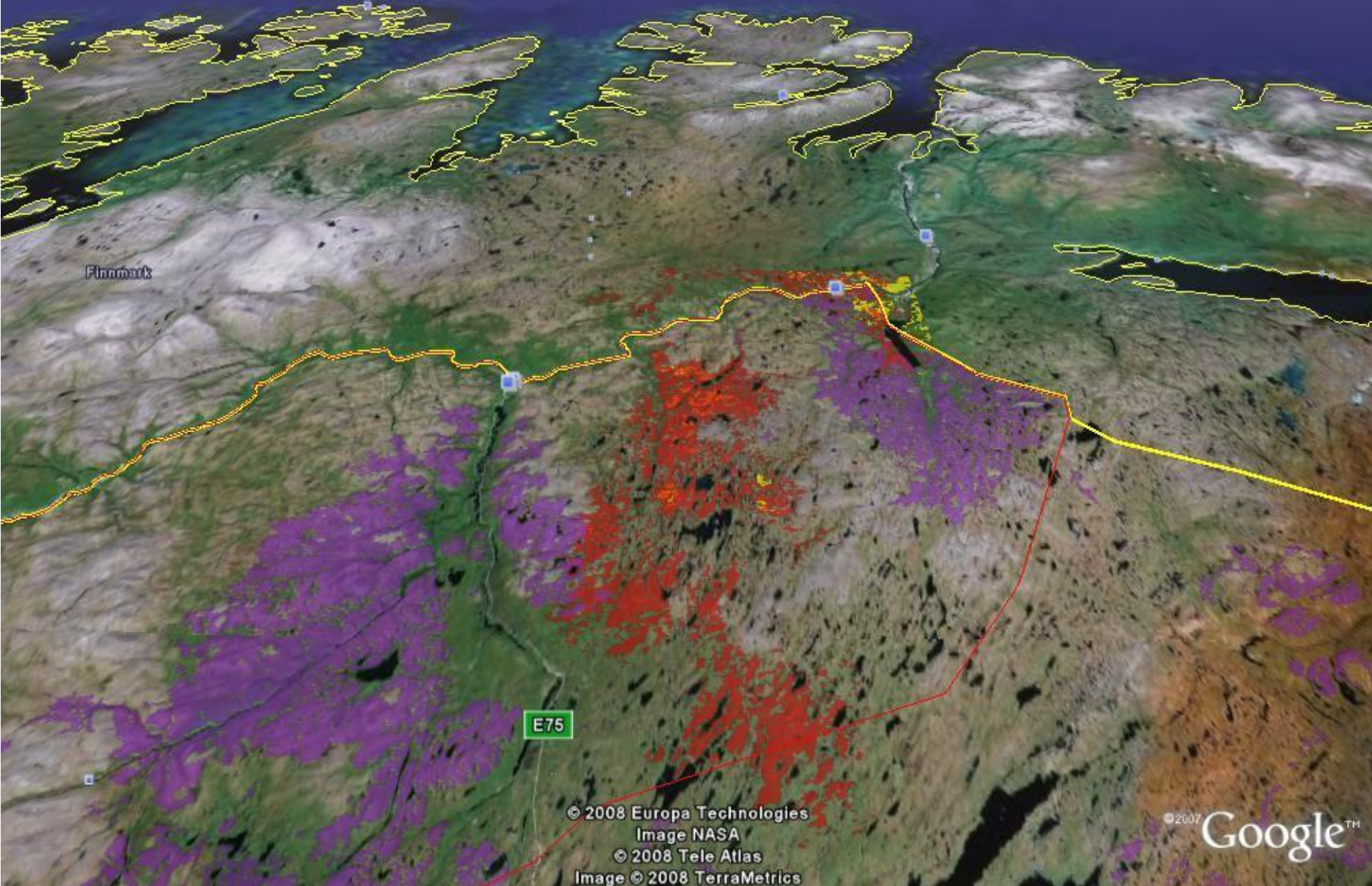
Kai Ruohomäki et al.



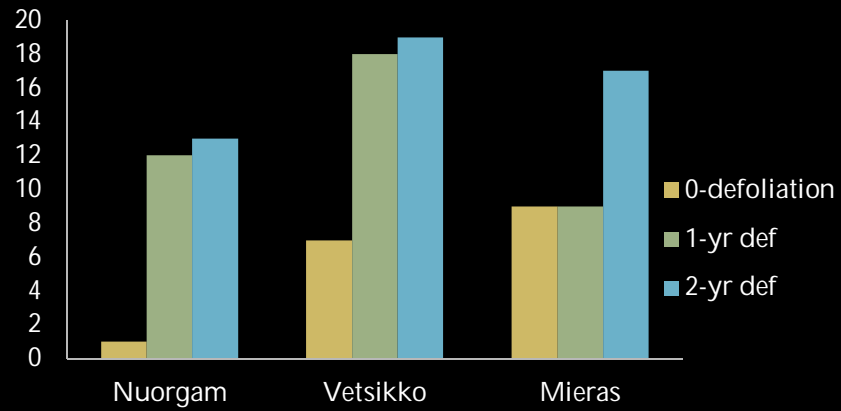
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1960's autumnal moth defoliation

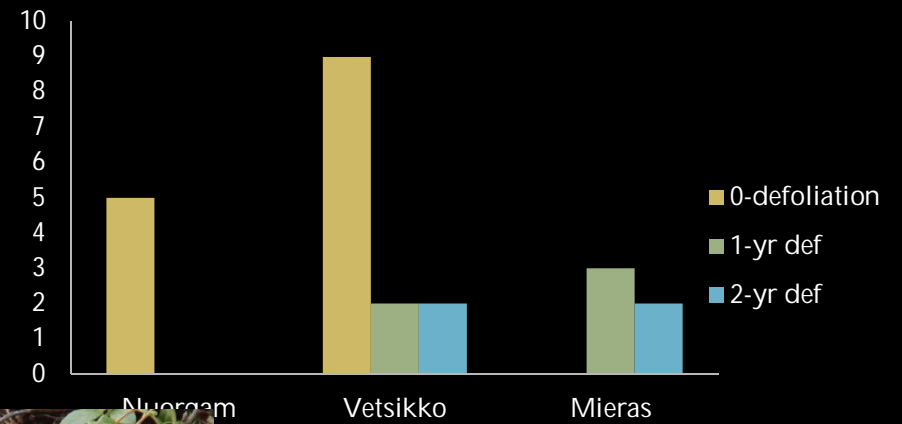
Winter moth defoliation 2008



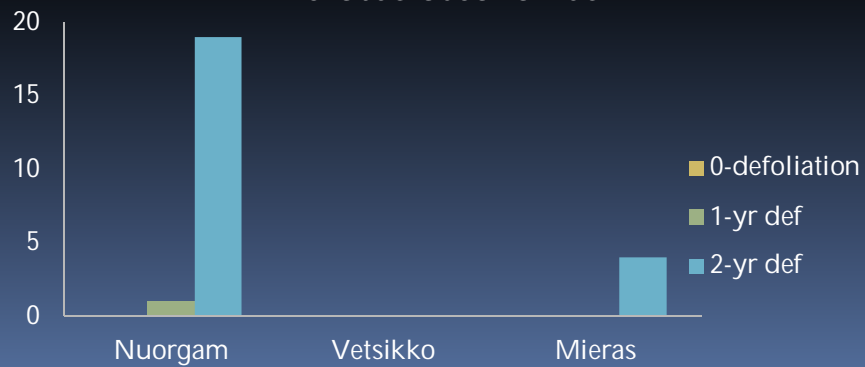
Myodes rutilus



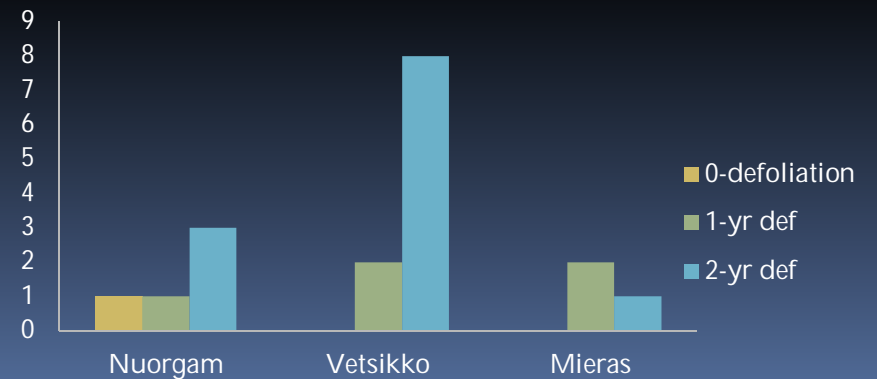
Myodes rufocanus



Microtus oeconomus

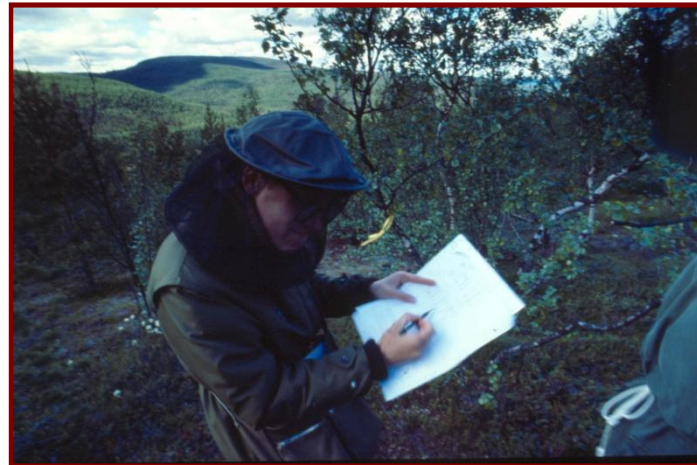


Lemmus



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...



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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

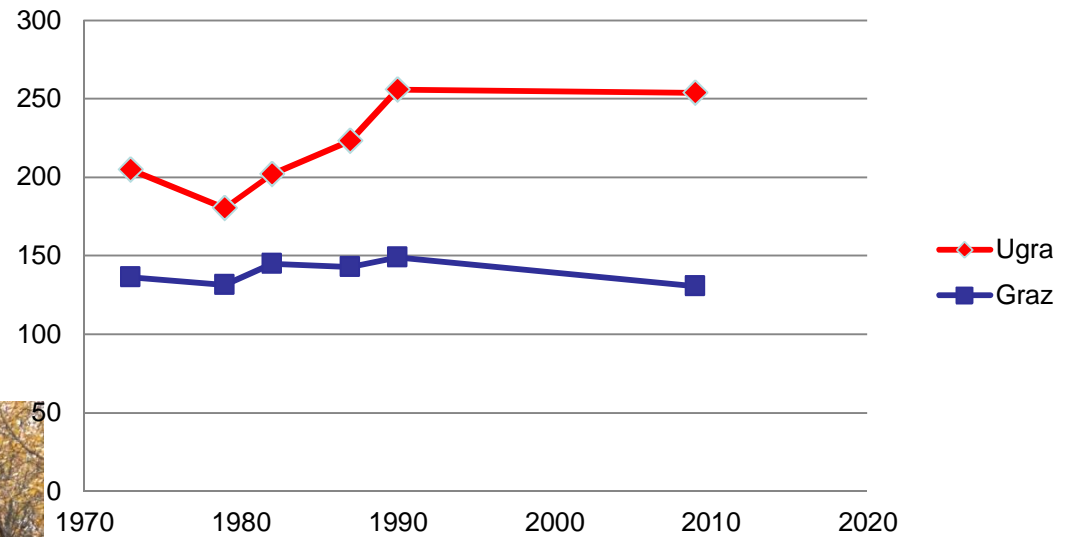
Impact of reindeer on ecosystem processes and biodiversity



1970 exclosures



Number of basal sprouts of birch / 40 m²



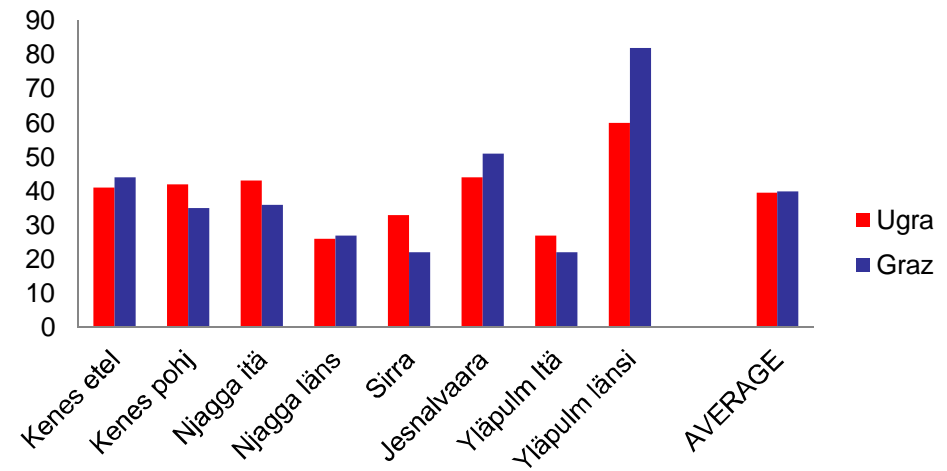
Lehtonen & Heikkinen 1995, Écoscience



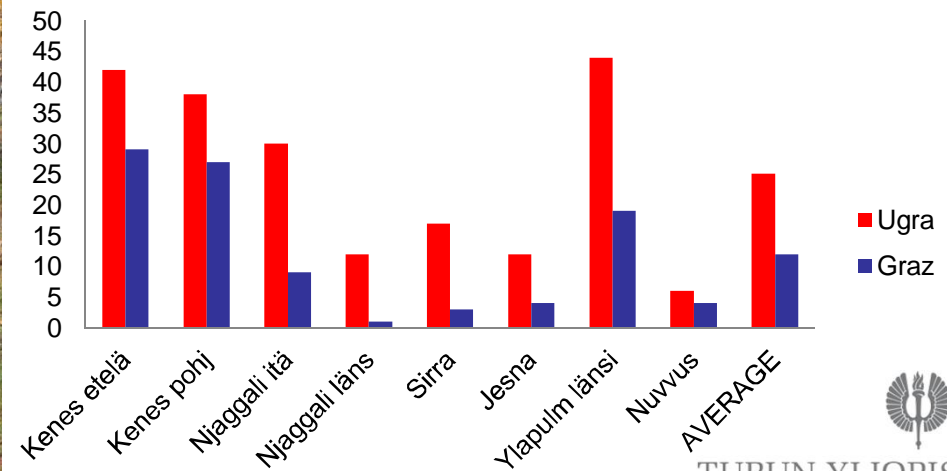
1970 exclosures



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

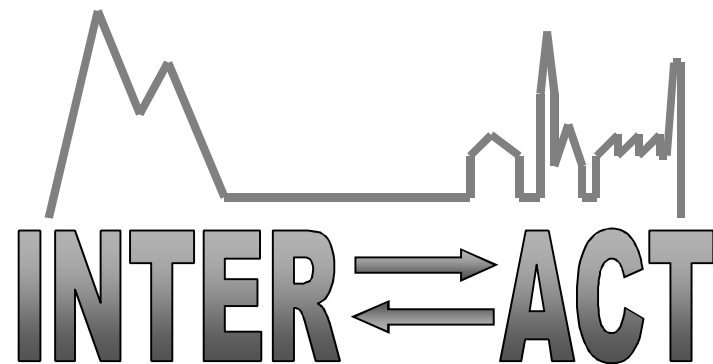
FinLTSER

Finnish Long-Term Socio-Ecological Research Network

SCANNET

Circumarctic Network of Terrestrial Field Bases

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



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**THANK
YOU!**

Photos:

Kevo archives, Saini Heino,
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Nigel Richards, Kai Ruohomäki,
Kari Saikkonen, Otso Suominen,
Ilkka Syvänperä, Elina Vainio

