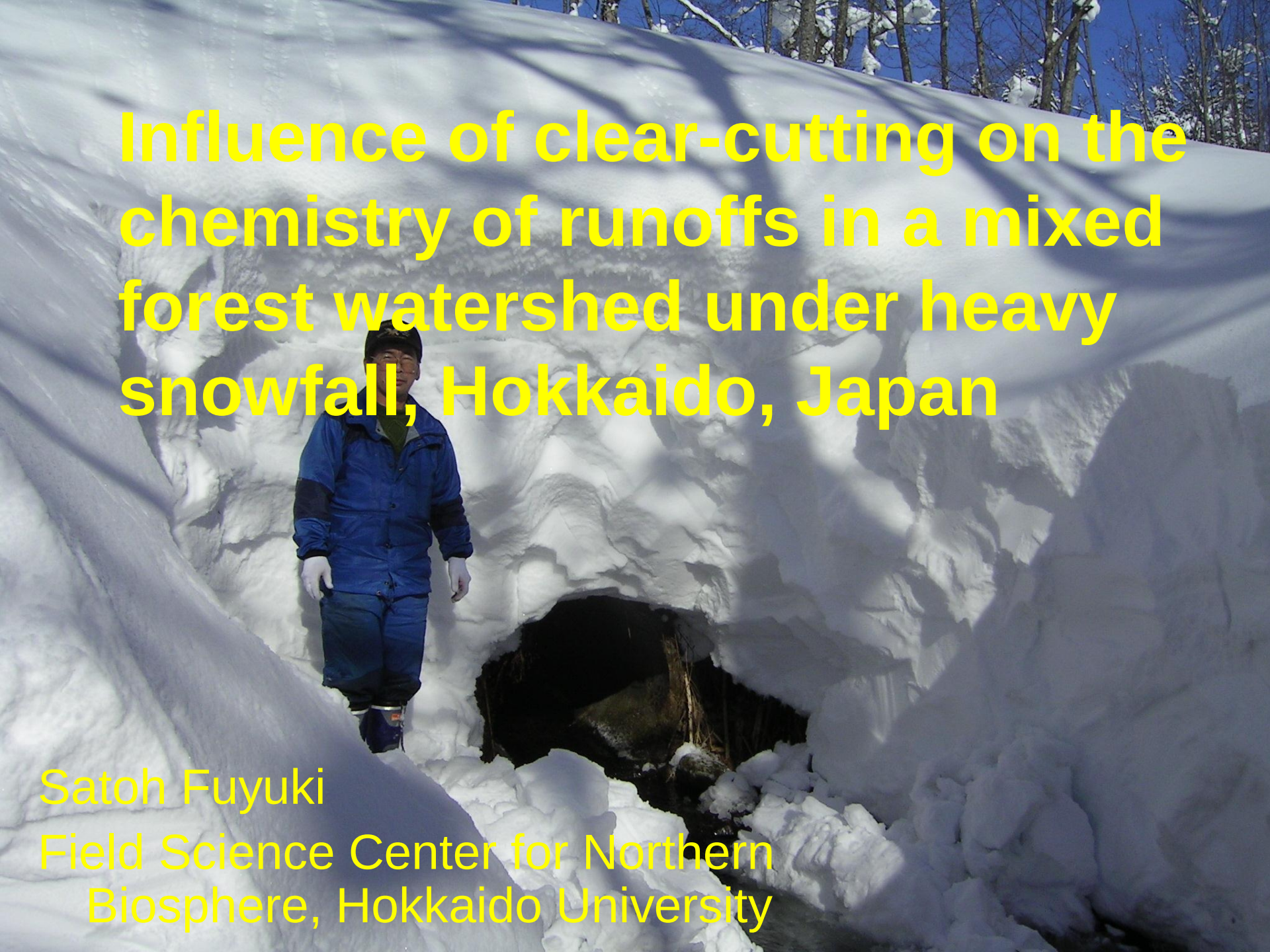


Influence of clear-cutting on the chemistry of runoffs in a mixed forest watershed under heavy snowfall, Hokkaido, Japan

Satoh Fuyuki

Field Science Center for Northern Biosphere, Hokkaido University

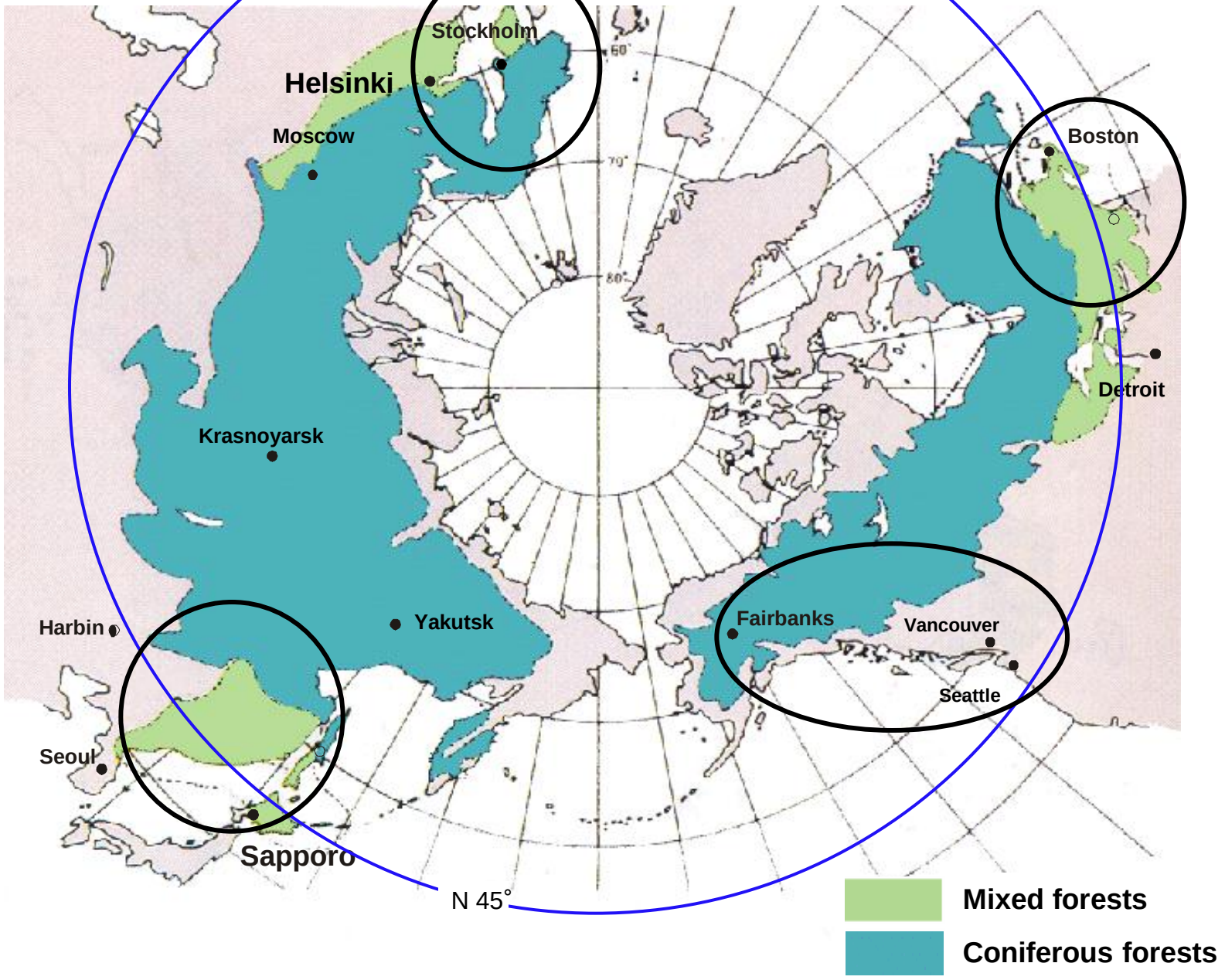
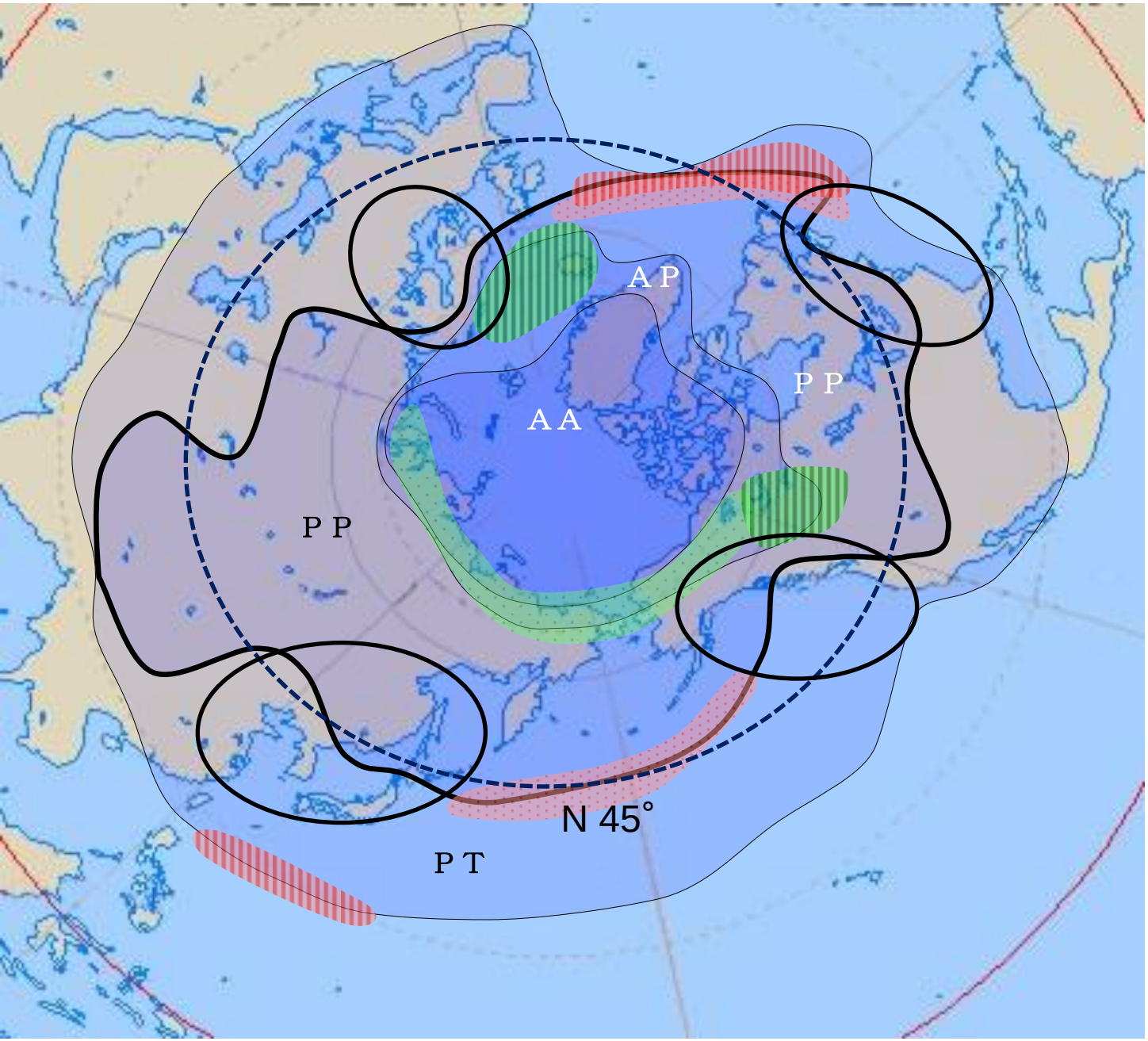


Fig. Boreal forests in Northern hemisphere and major cities in marginal area



Front

- Arctic front(Jan)
- Arctic front(Jul)
- Polar front(Jan)
- Polar front(Jul)

Air mass

AA ： Jan＋Jul Arctic
AP ： Jan Arctic＋Jul Polar
PP ： Jan＋Jul Polar
PT ： Jan Polar＋Jul Tropical

Seasonal change of air mass and fronts

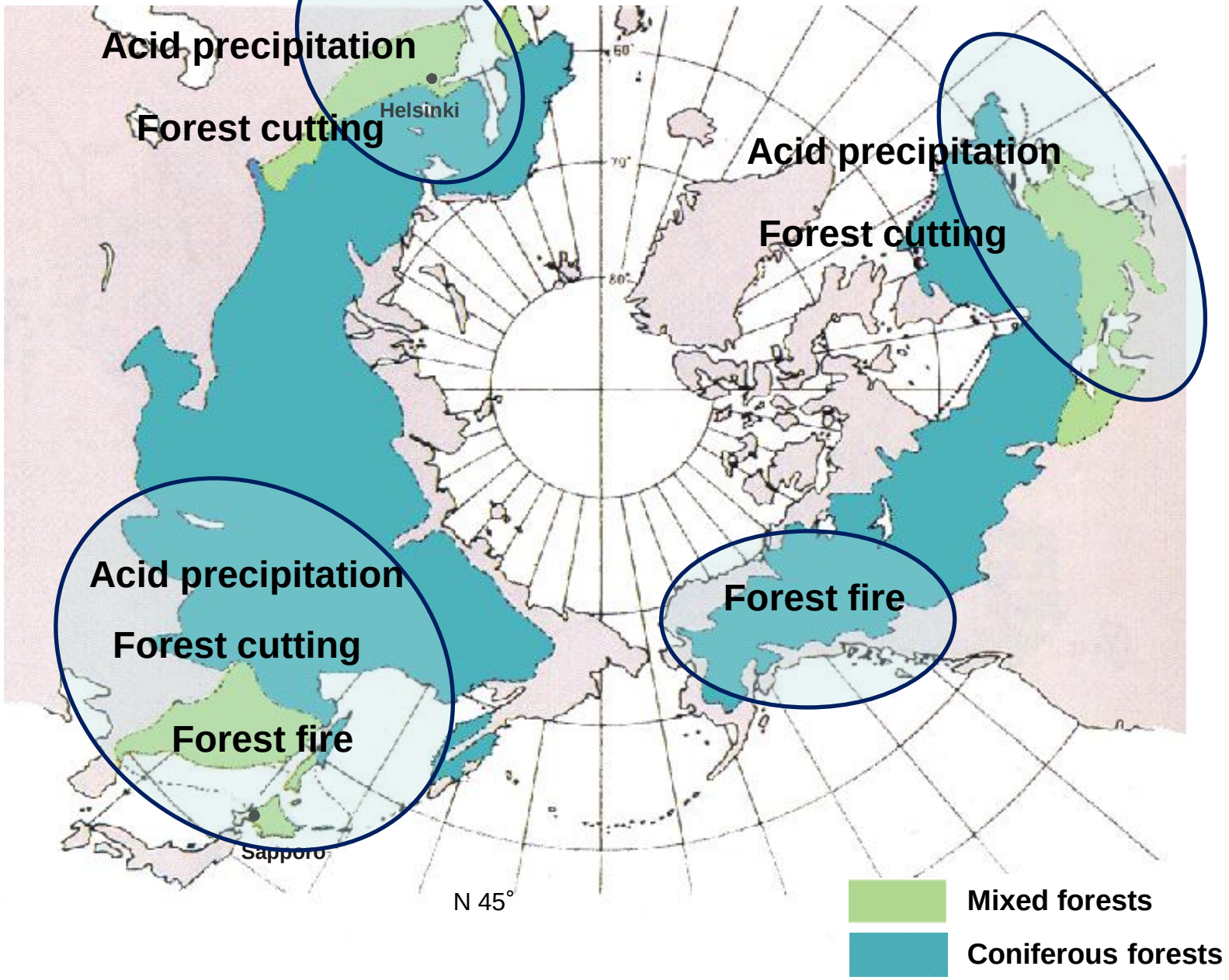


Fig. Human impacts in marginal area

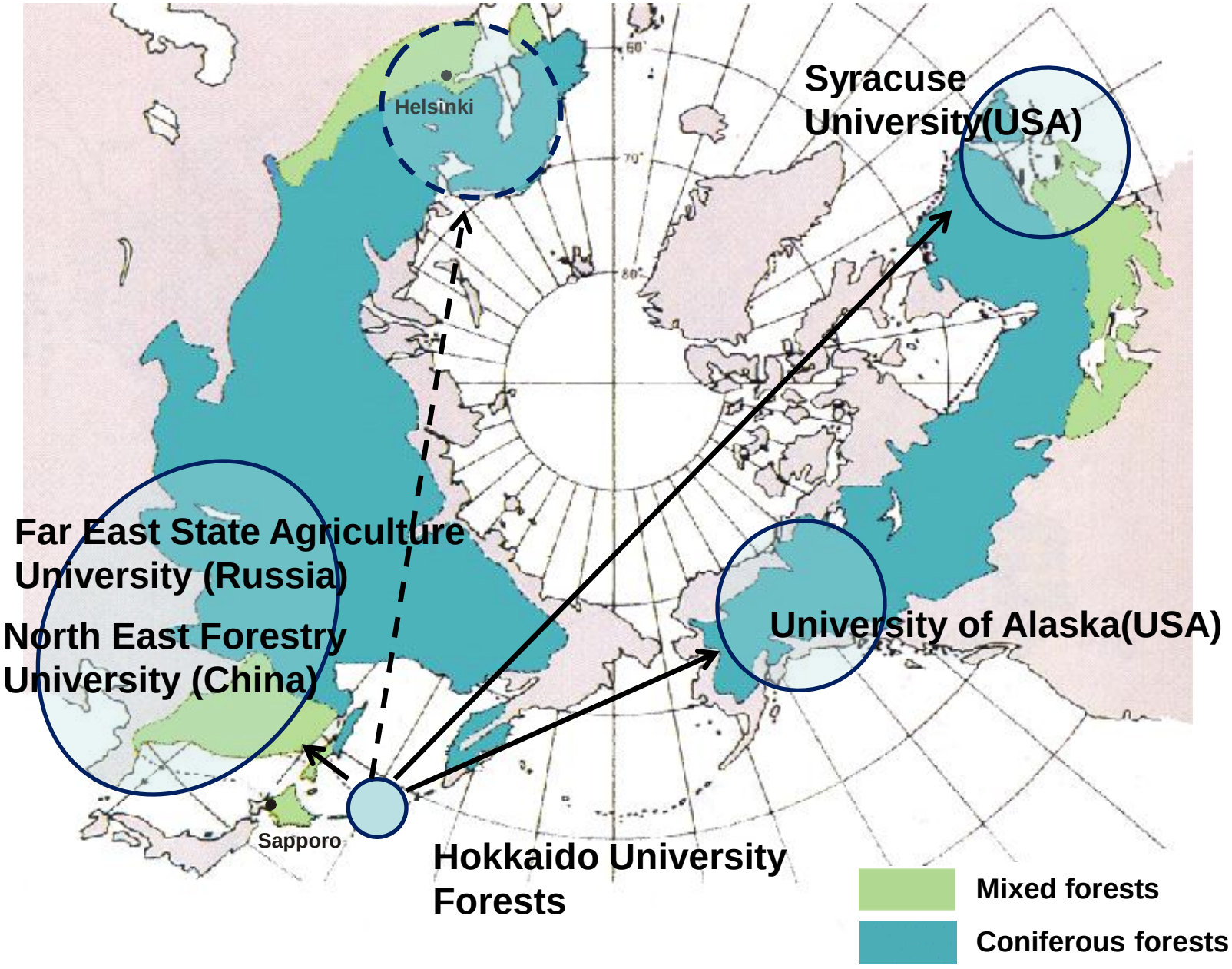
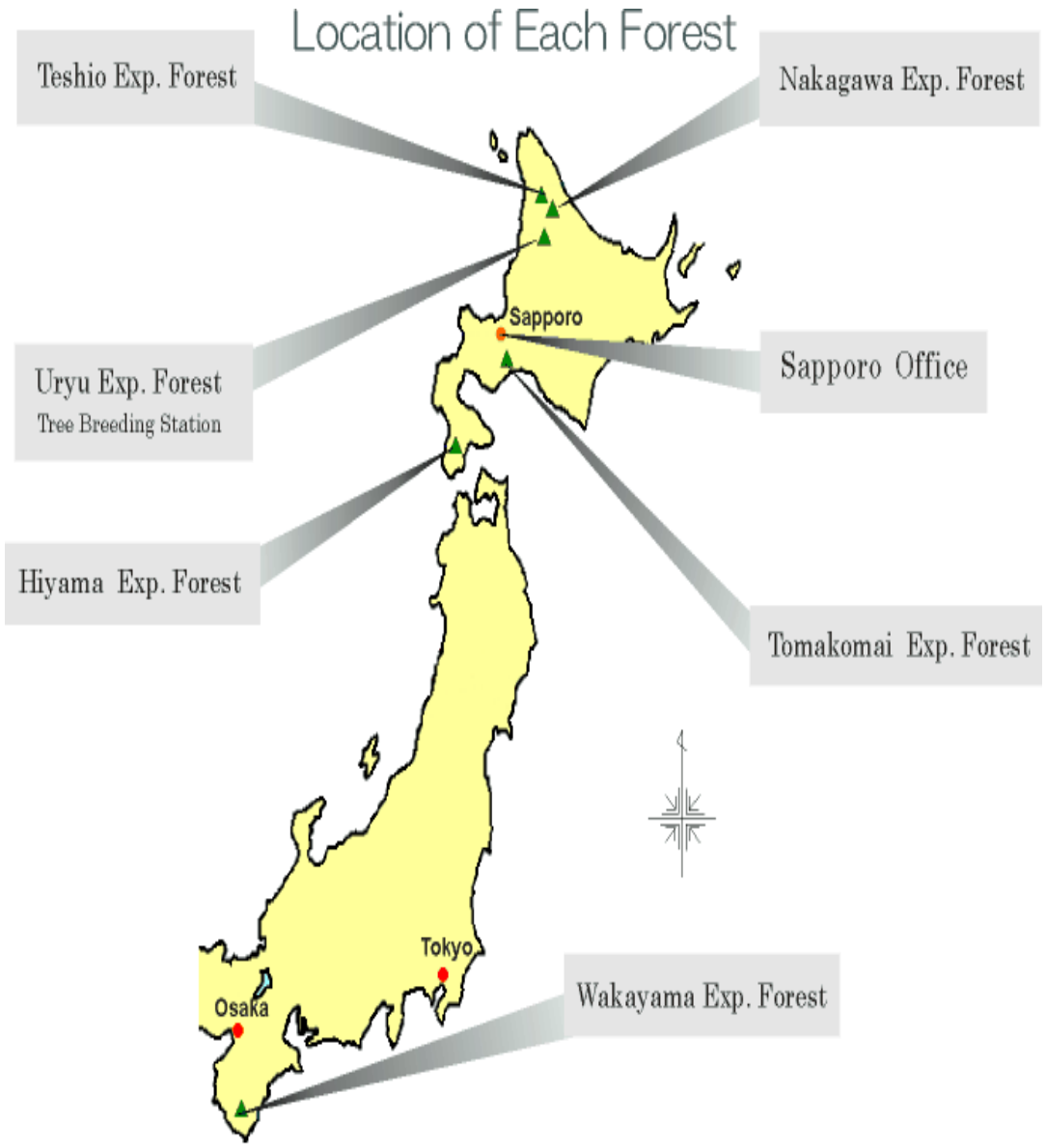


Fig. Cooperative research with Hokkaido University Forests



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.

A spruce Forest on serpentine rock area in Teshio Exp. Forest

A mixed forest in Nakagawa Exp. Forest

An oak forest in Uryu Exp. forest

Afforested area after several big forest fire (Teshio exp. Forest)

CO2 flux monitoring site (Teshio exp. Forest)

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 monitoring net system.

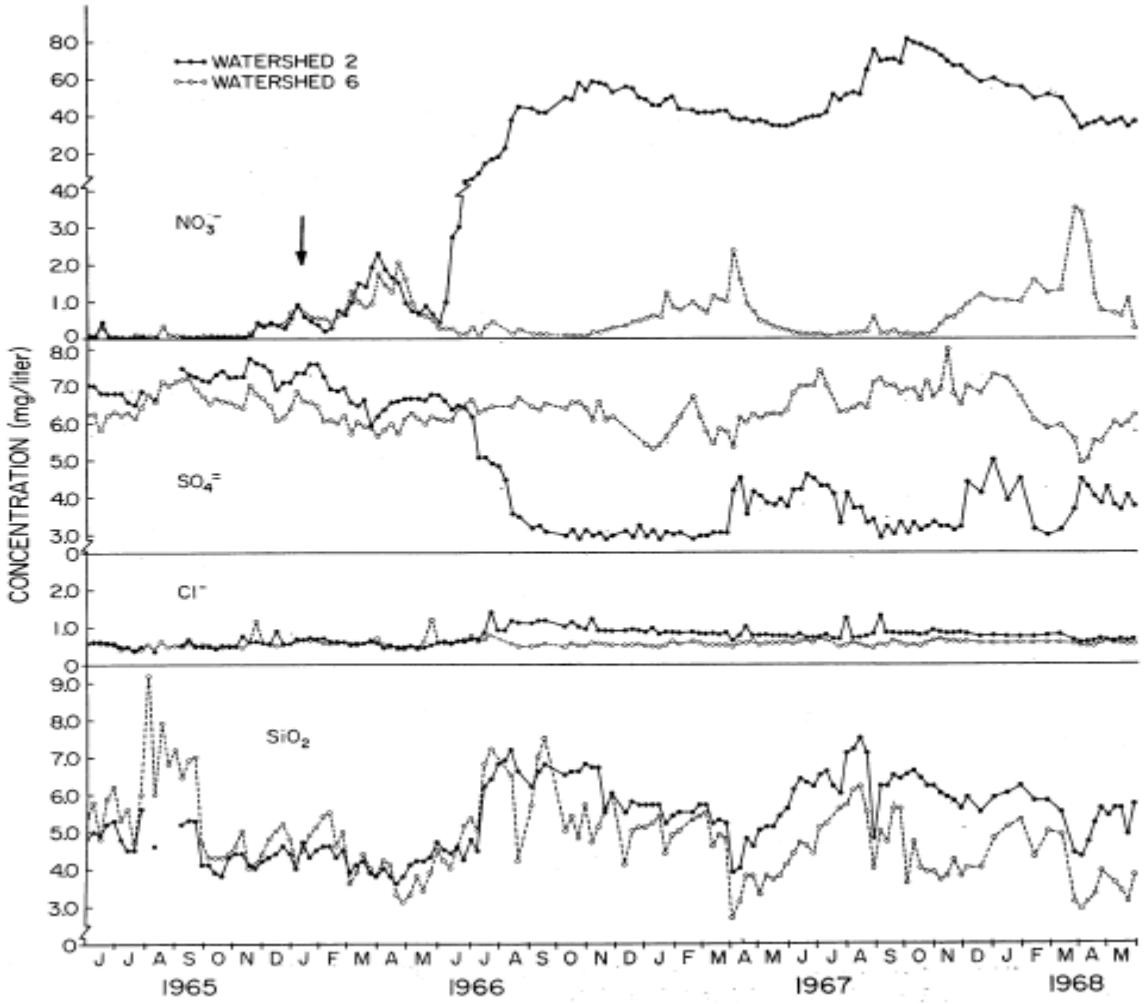
One of the possible joint research subject is the function of boreal forests and the influence of human impacts (acid precipitation, logging operation, forest fire etc.).

In order to discuss this subject, the long term monitoring concerning to mineral or nutrient cycling in forest watersheds is important.

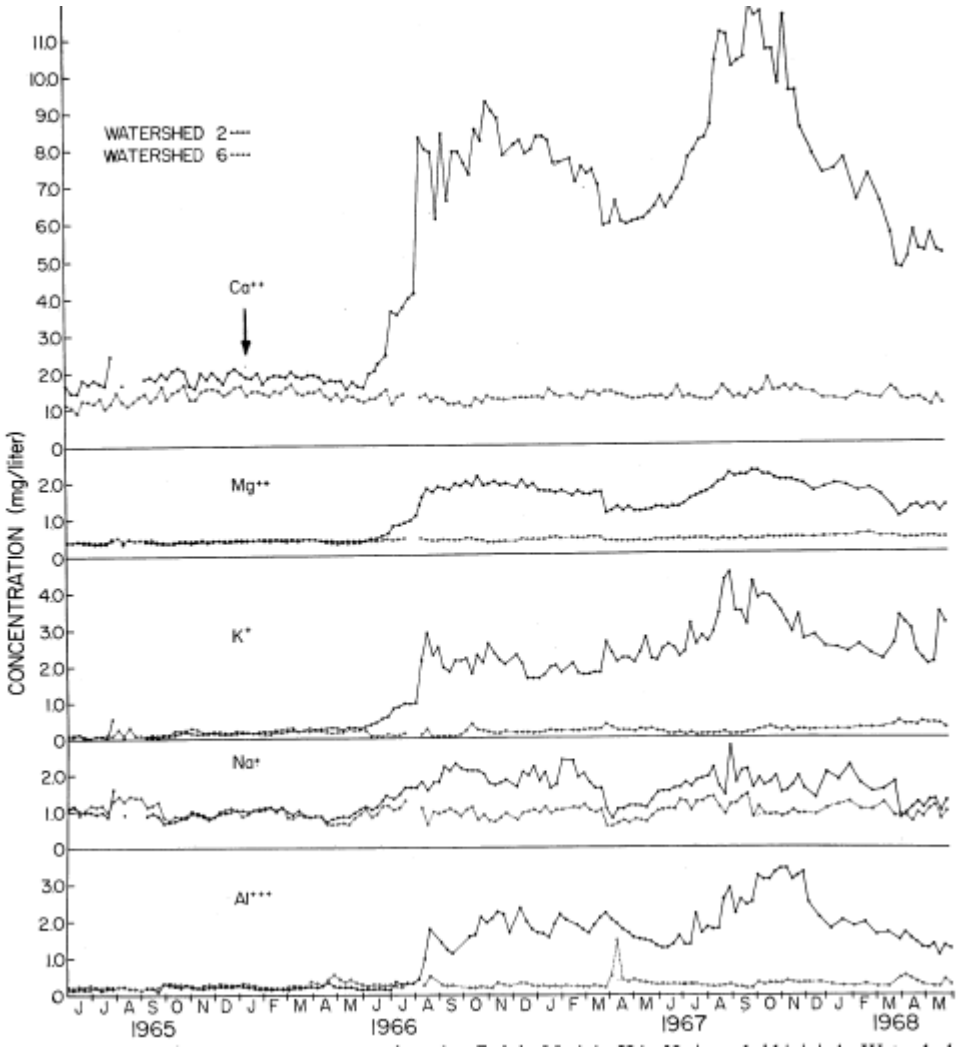
Forest vegetation and climate condition are required to be similar as much as possible between the targeted areas.

In this meaning, only Hokkaido can make a comparative research with Finland in Japanese Archipelago.

Forestry is major industry in both Finland and Hokkaido. But its impact for mineral cycling in forest watersheds is drastic and leads to environmental problems in the lower reaches of watershed (Eutrophication of rivers and lakes).



The concentration of anions before and after clear-cut (Hubberd brook in northeast USA)



The concentration of cations before and after clear-cut (Hubberd brook in northeast USA)

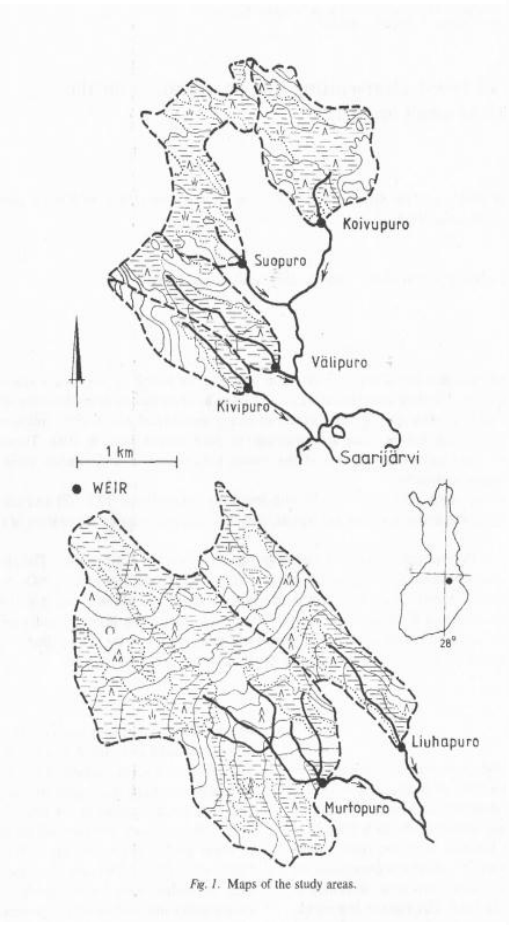
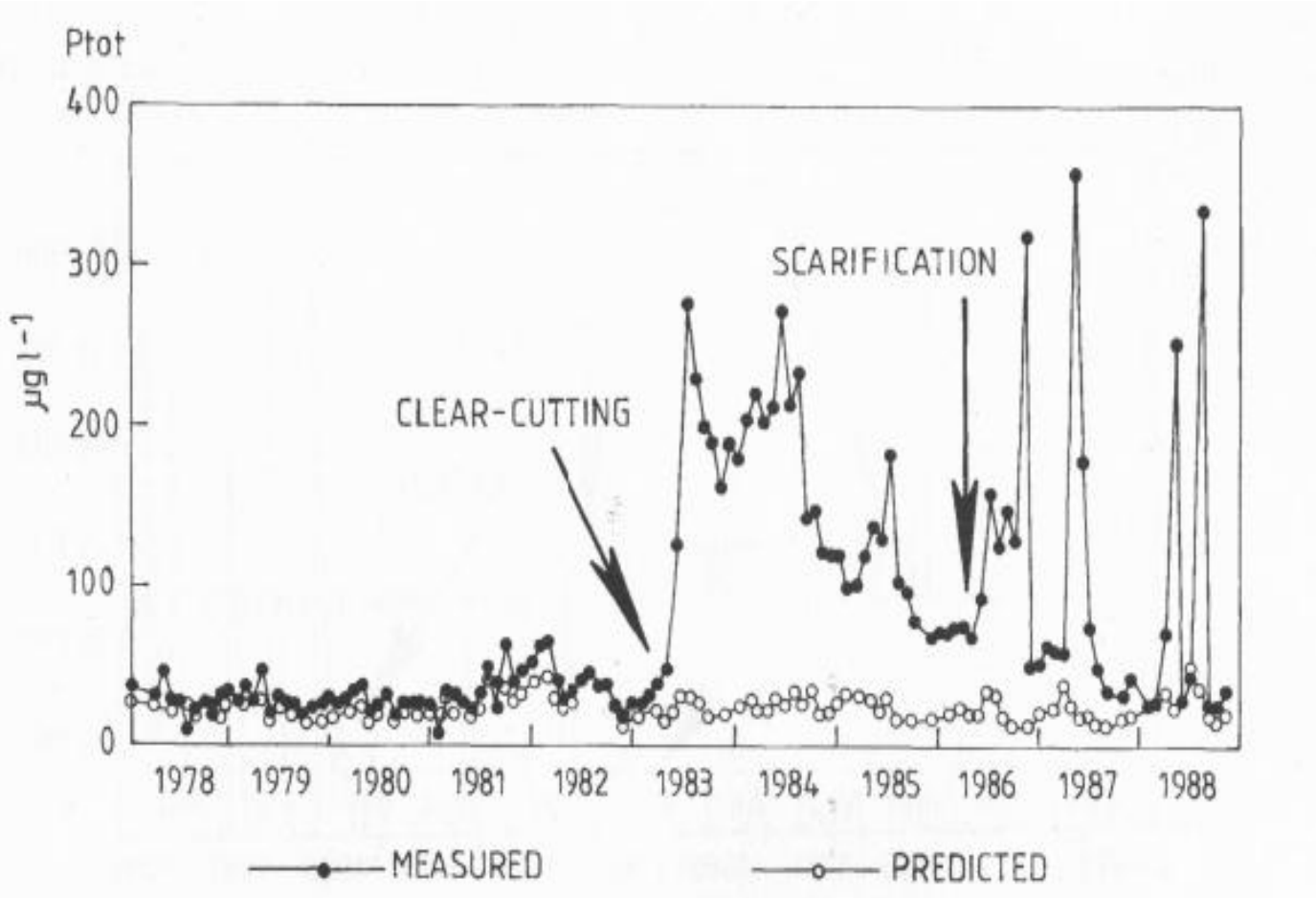


Fig. 1. Maps of the study areas.



The same results is also reported in the forest of Finland

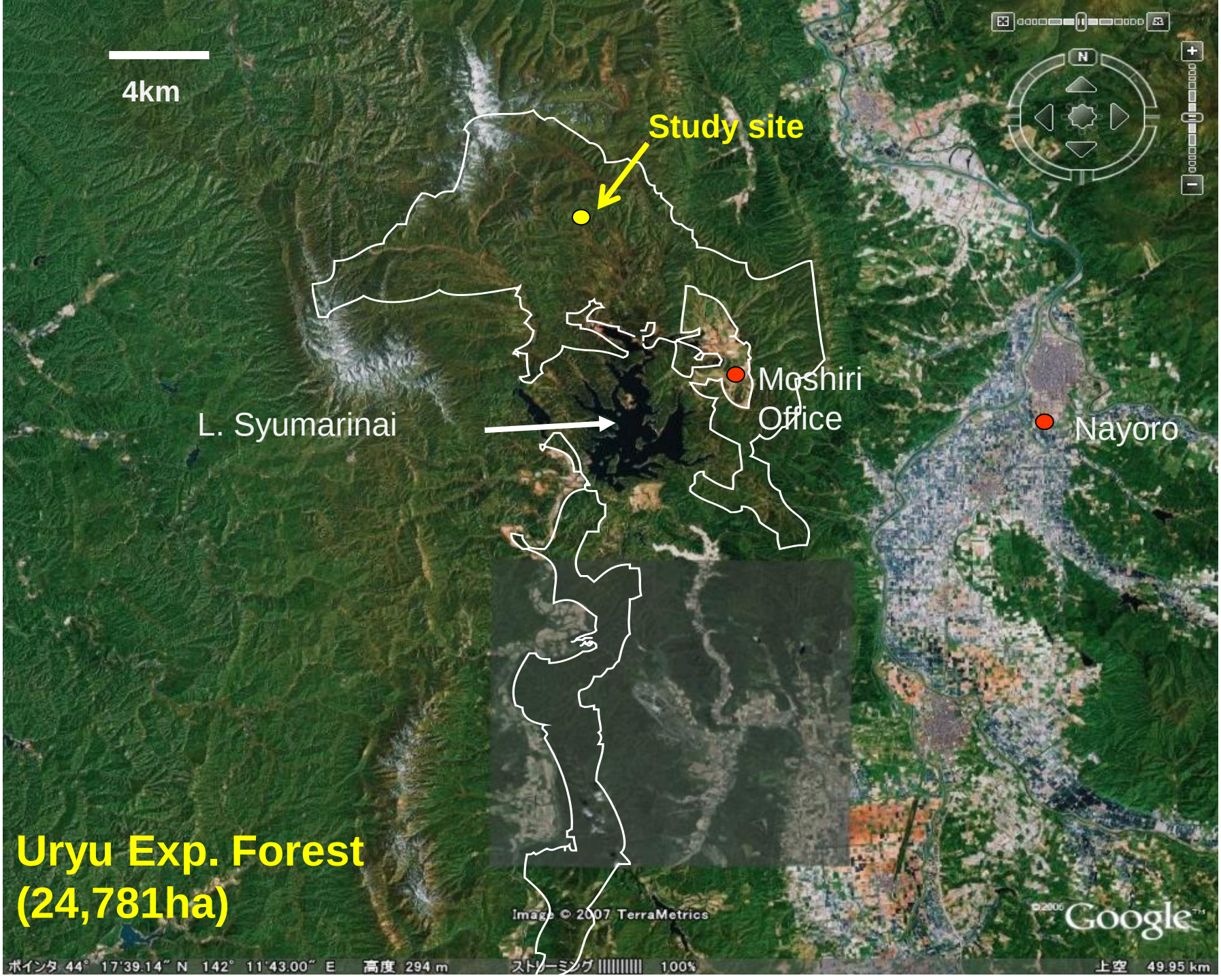
(Valtimo and Sotkamo: eastern Finland)

Logging operation in the research site

A Similar long term field experiment is conducted in Hokkaido University Forest, which includes timber harvesting and the scarification of ground surface, on the elution process of the forest watersheds.

A water weir at the research site

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.


4km
Study site
Moshiri
Office
L. Syumarinai
Nayoro
Uryu Exp. Forest
(24,781ha)
Image © 2007 TerraMetrics
©2006 Google
ポインタ 44° 17'39.14" N 142° 11'43.00" E 高度 294 m
ストリーミング 100%
上空 49.95 km

Outline of the site

Temp. (Ann. Mean) 3.1℃

Precipitation 1390mm

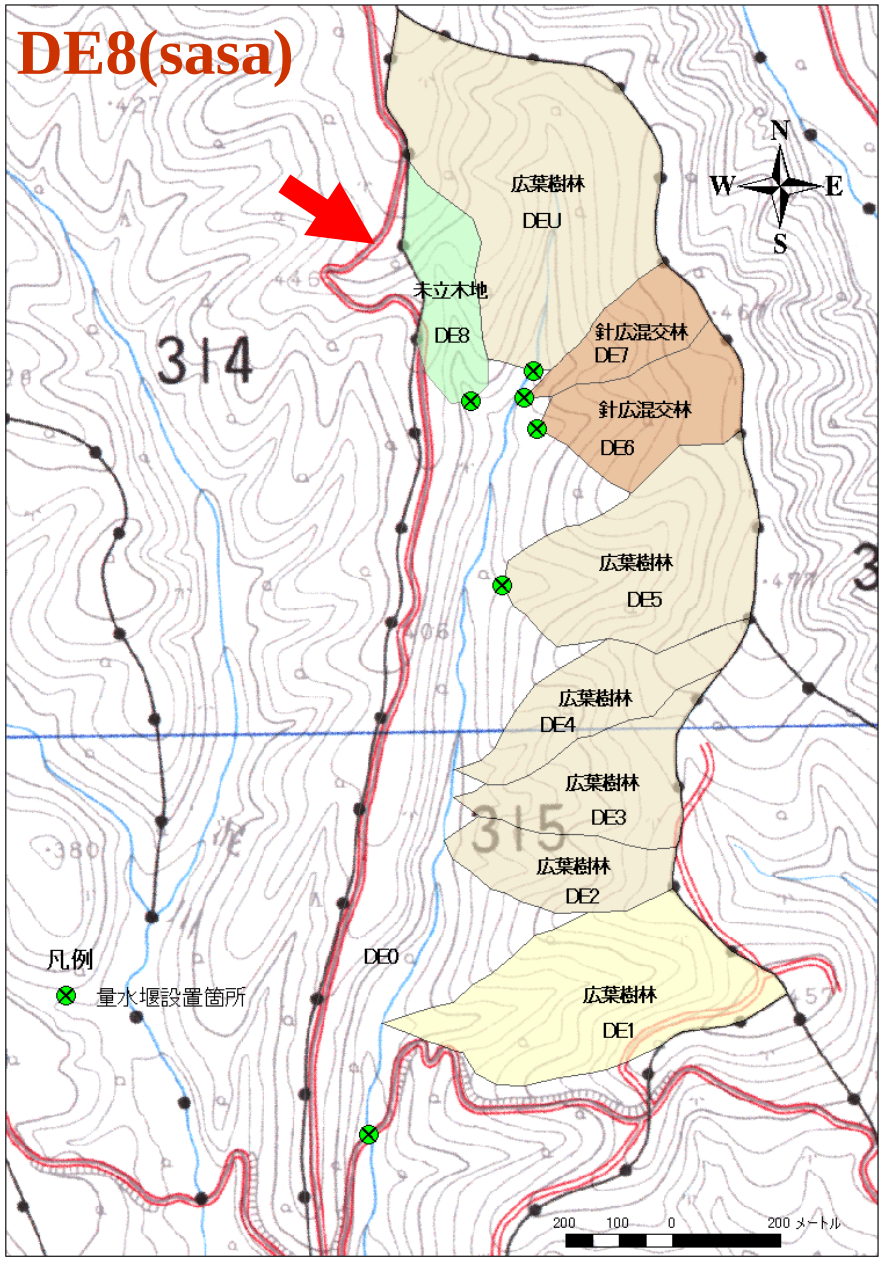
Snowfall 800mm

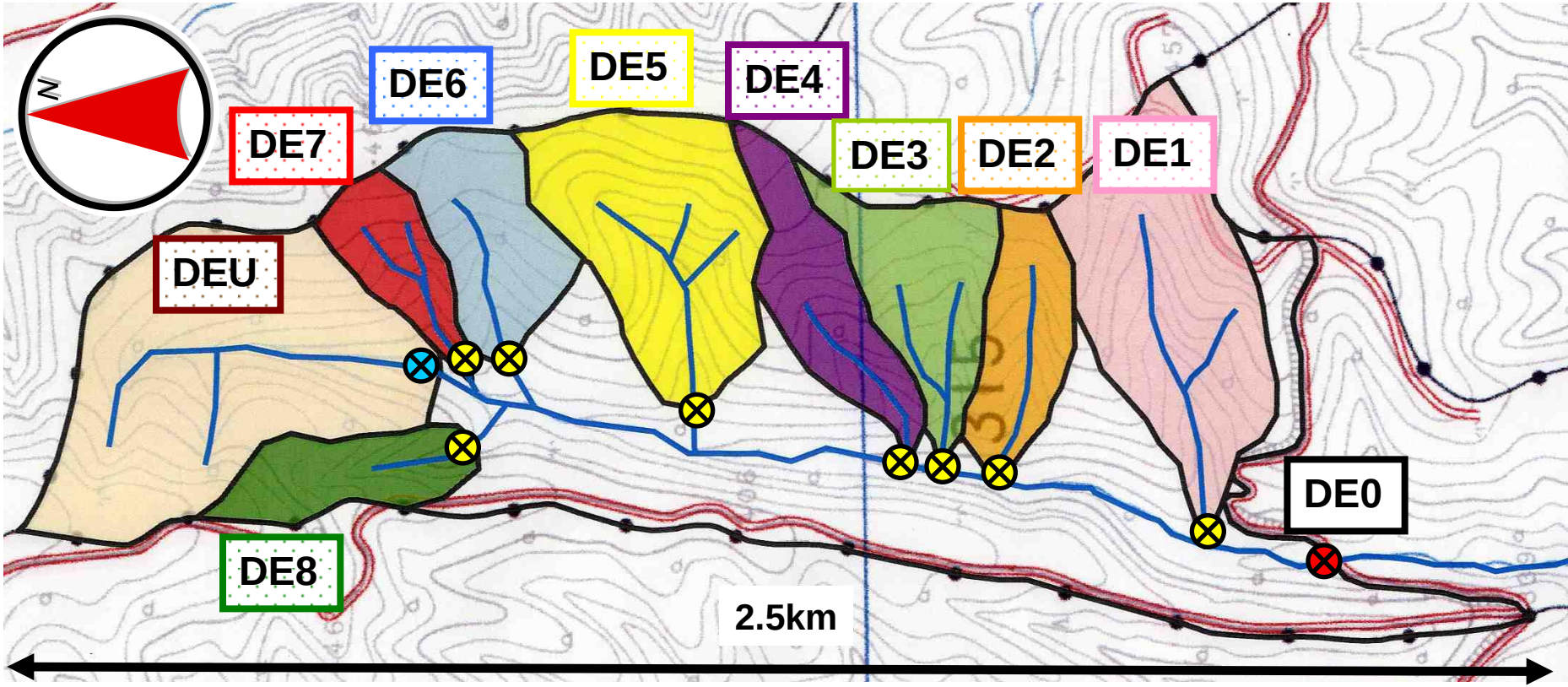
Snow pH 5.05

Surface geol. Andesite

Soil Acid brown forest soil

Mixed forest (Abies sachalinensis, Betula ermanii etc.) except DE8





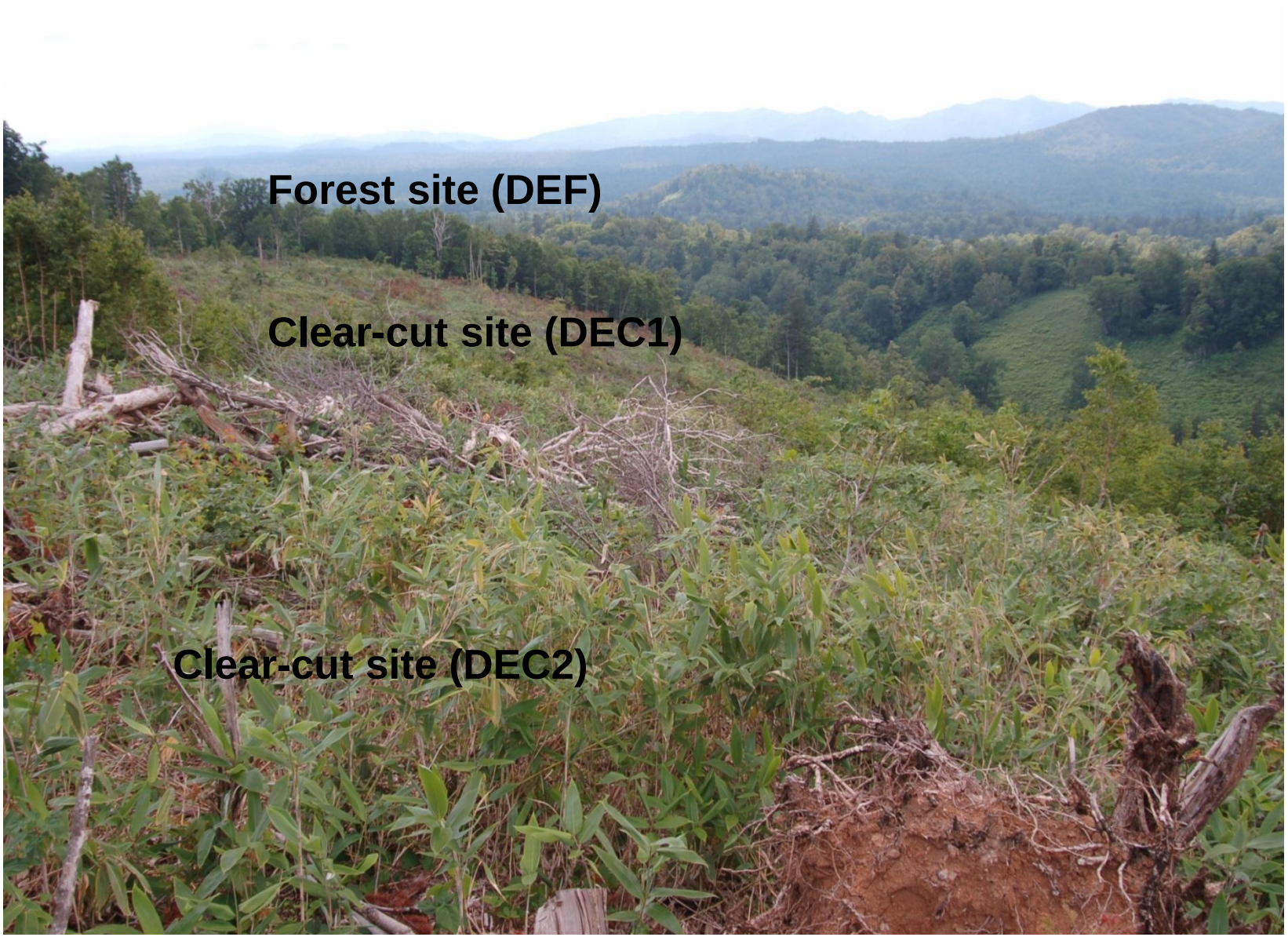
Area of each site

(ha)

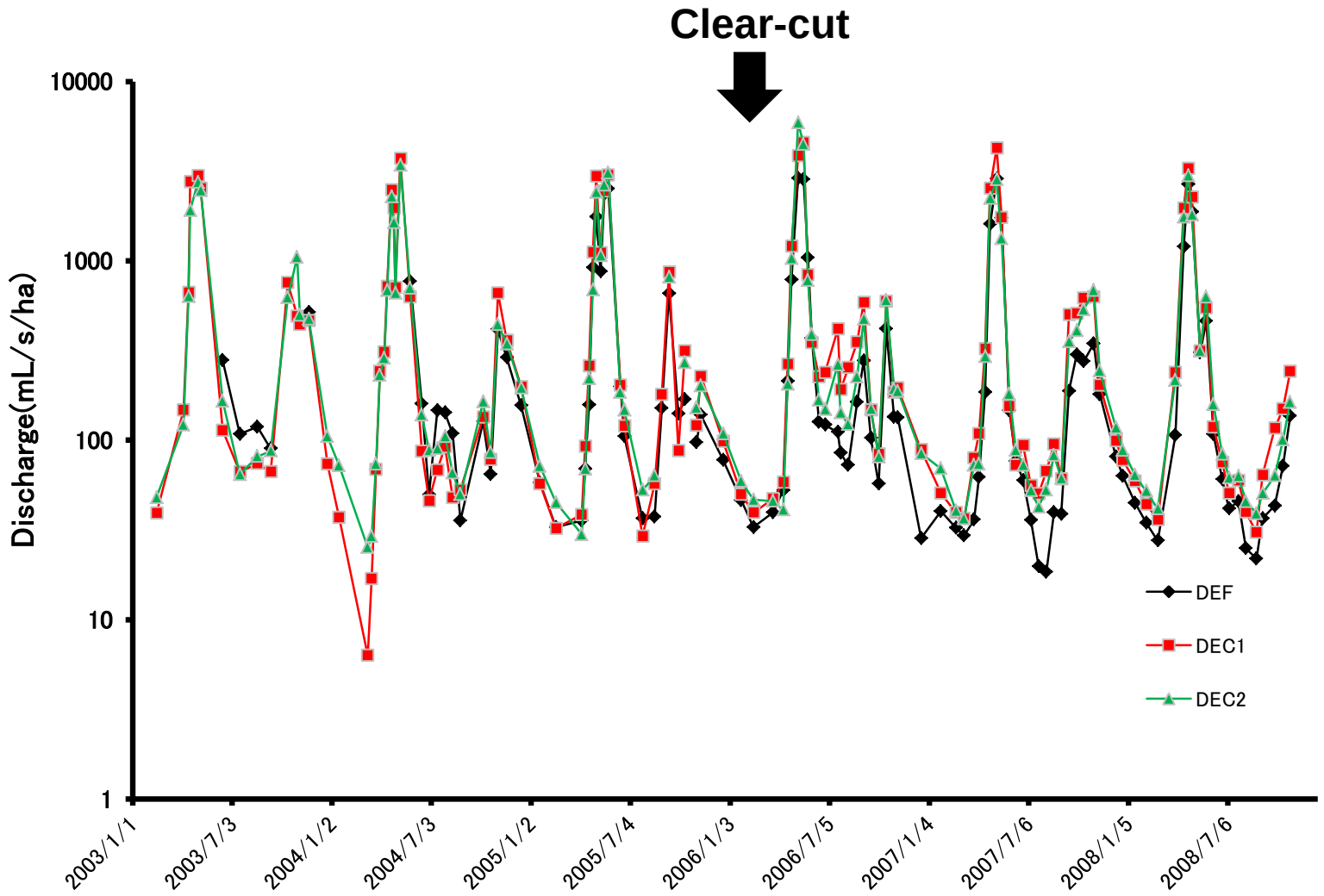
Basin	DEU	DE8	DE7	DE6	DE5	DE4	DE3	DE2	DE1
Area	19.4	6.2	3.9	5.9	13.7	4.7	5.4	4.8	12.9

Weir1(partial flume)

Weir2(notch)

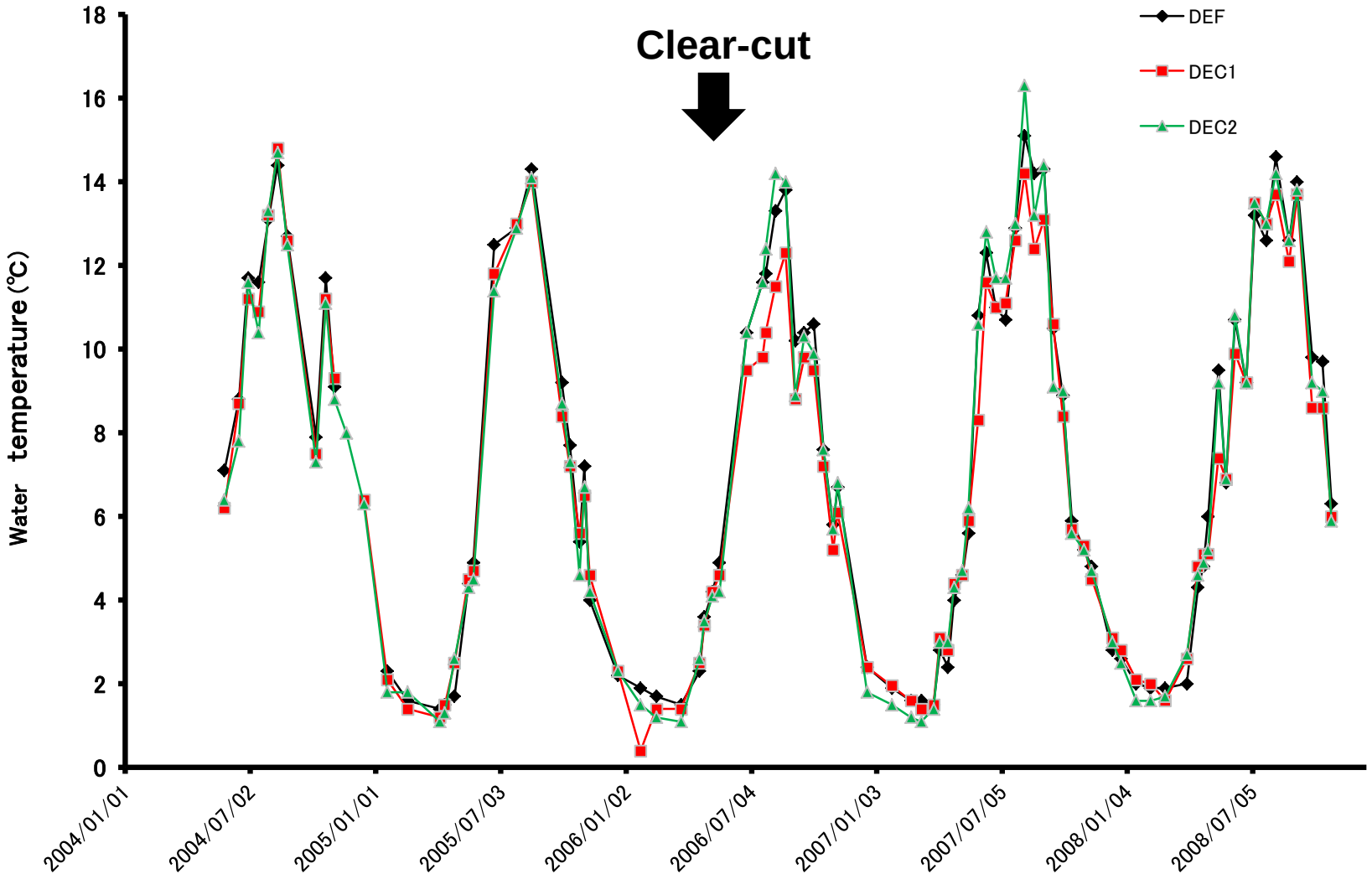


Research site after clear-cut (forest floor is covered dense sasa (Sasa kurilensis)



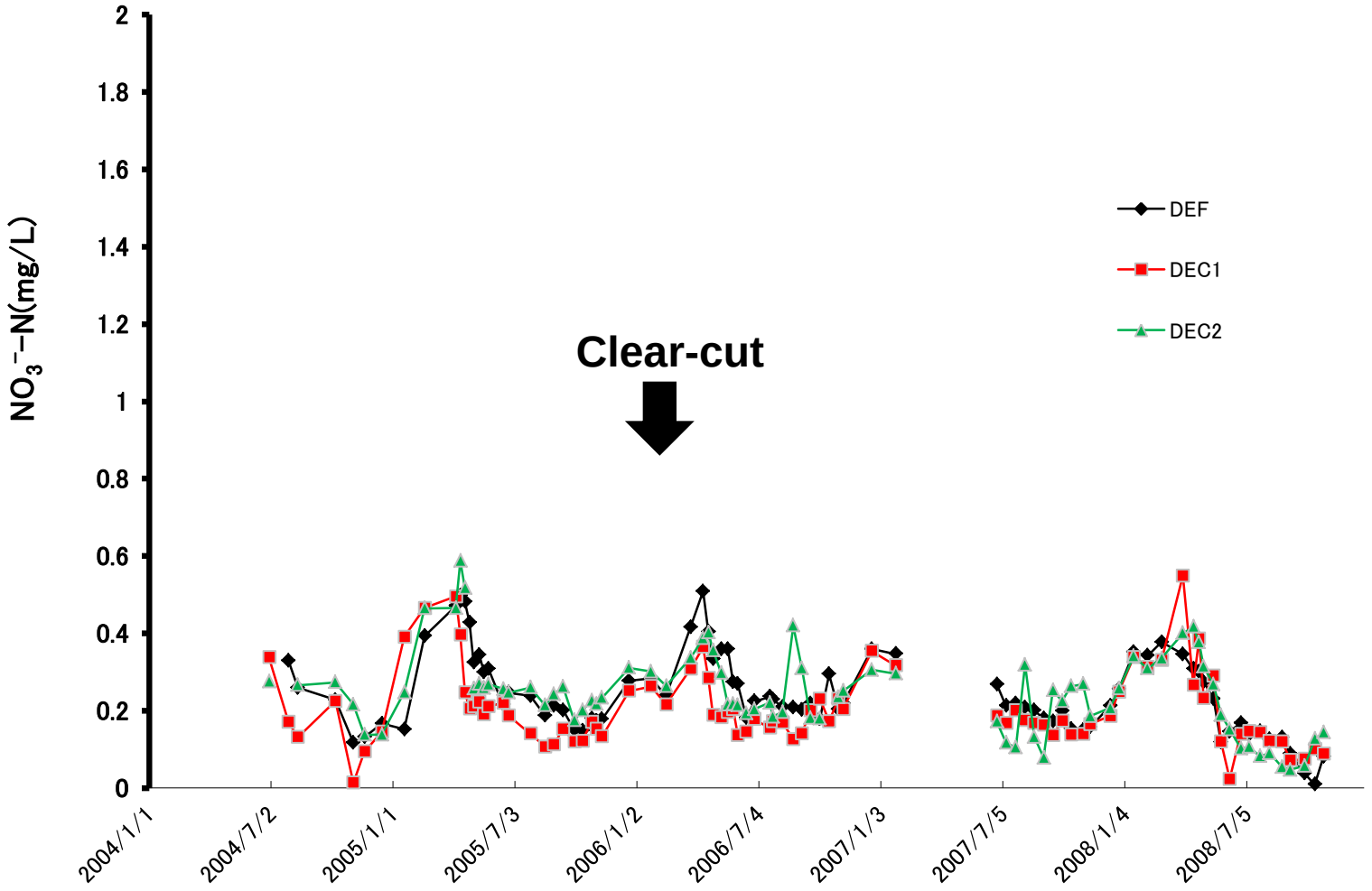
The long term change of discharge in the research site

(DEF: forest site DEC1,DEC2: clear-cut site)



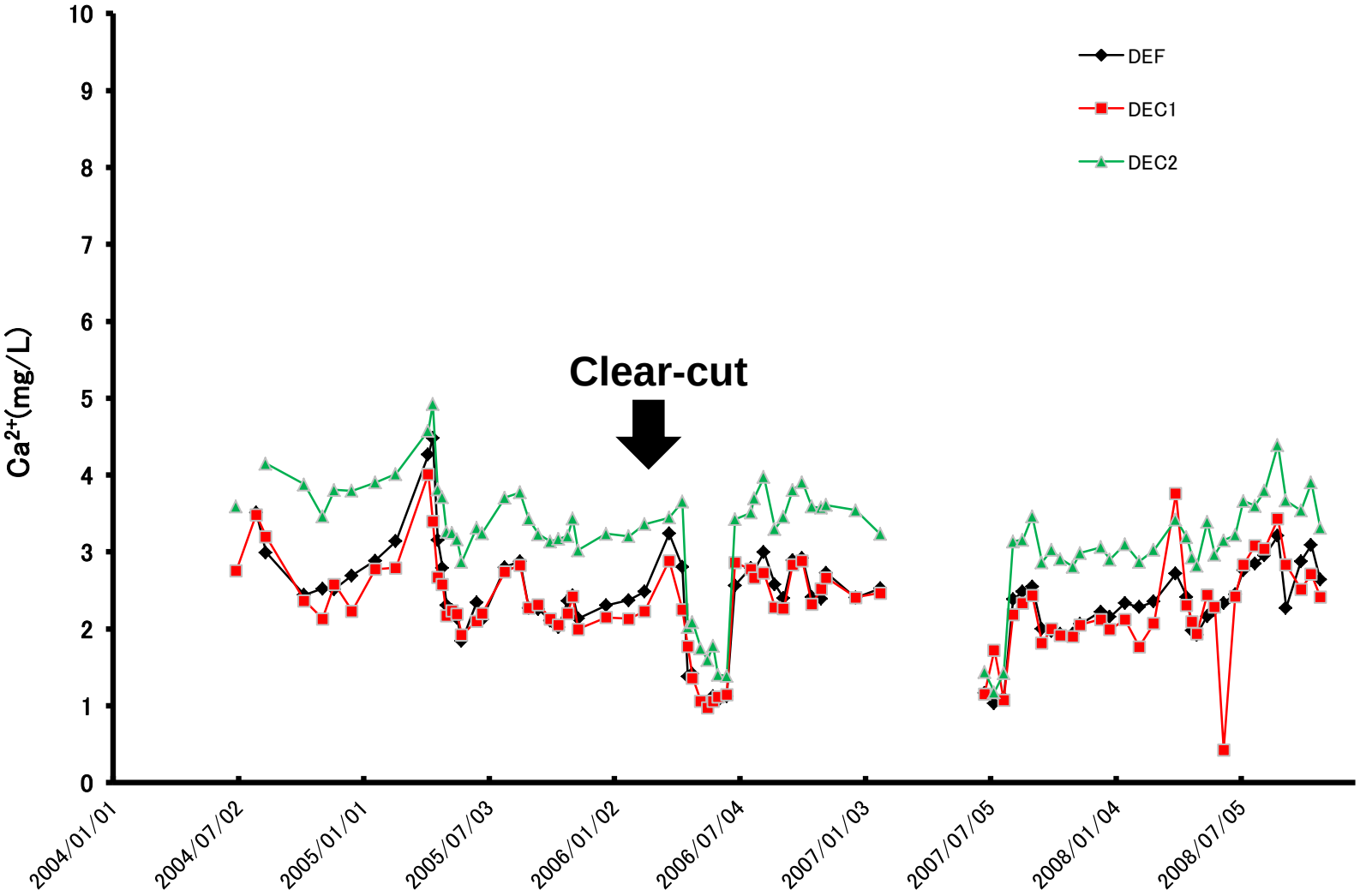
The long term change of water temperature in the research site

(DEF: forest site DEC1,DEC2: clear-cut site)



The long term change of nitrate ion in the research site

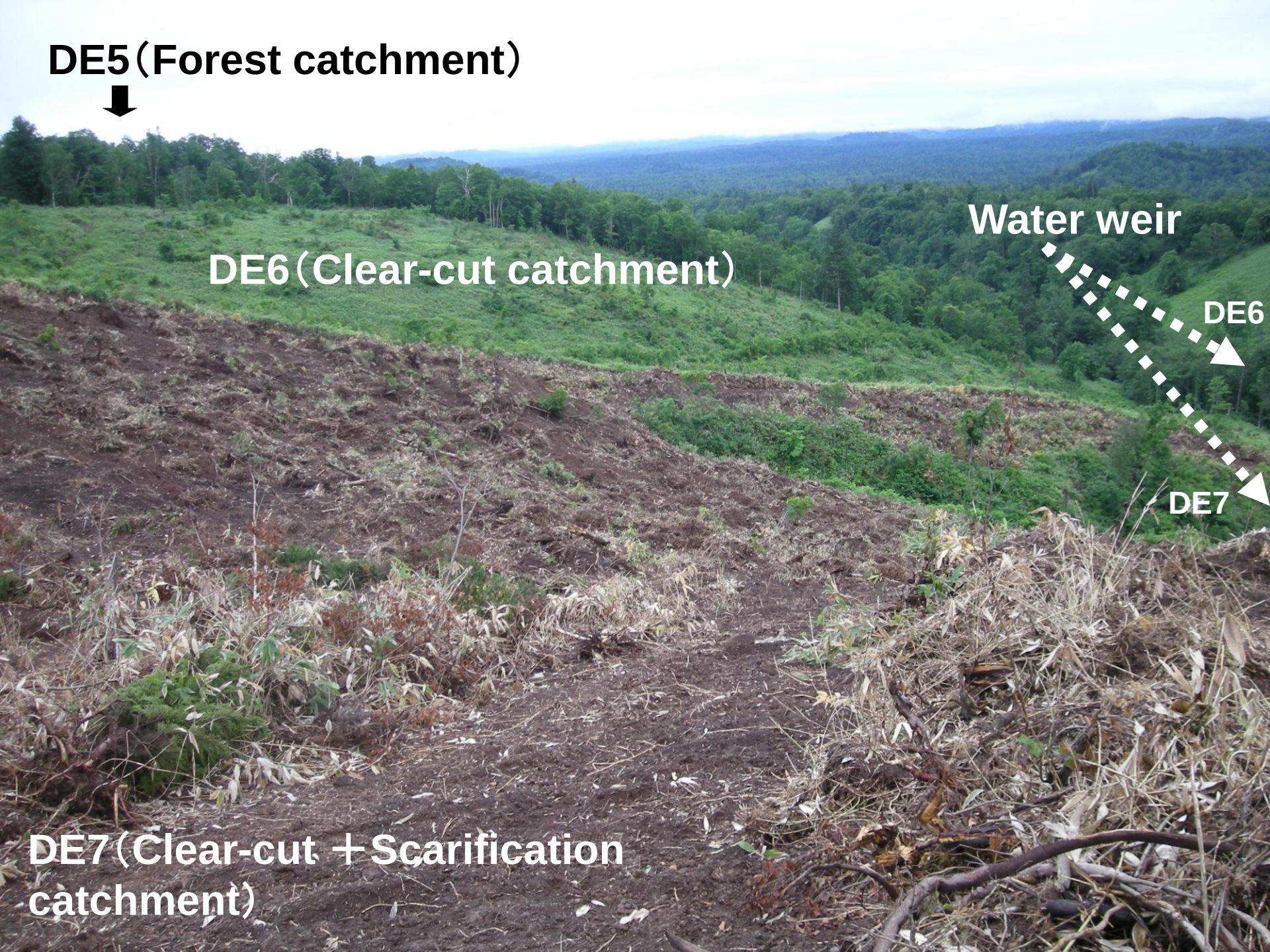
(DEF: forest site DEC1,DEC2: clear-cut site)

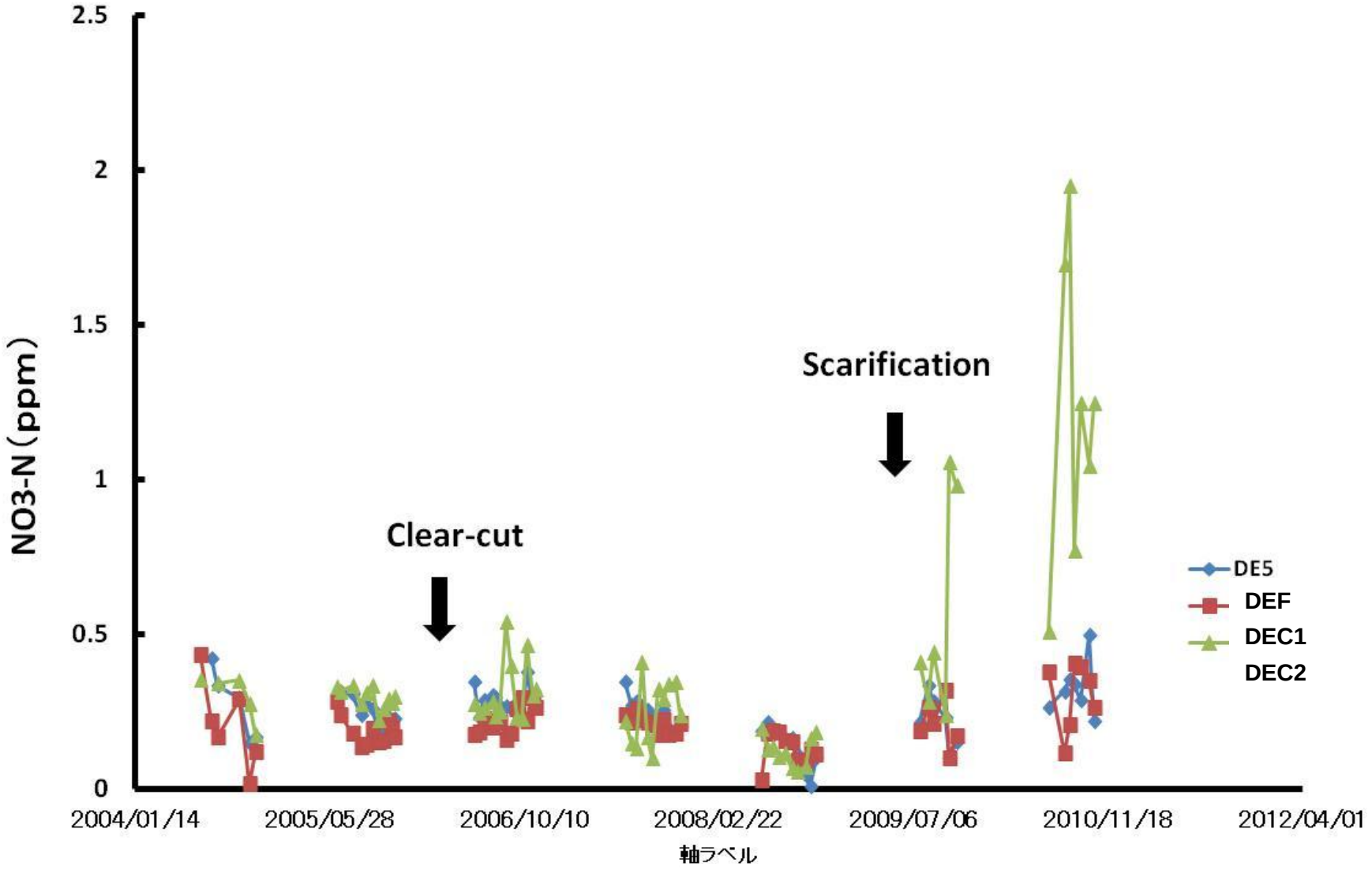


The long term change of calcium ion in the research site

(DEF: forest site DEC1,DEC2: clear-cut site)

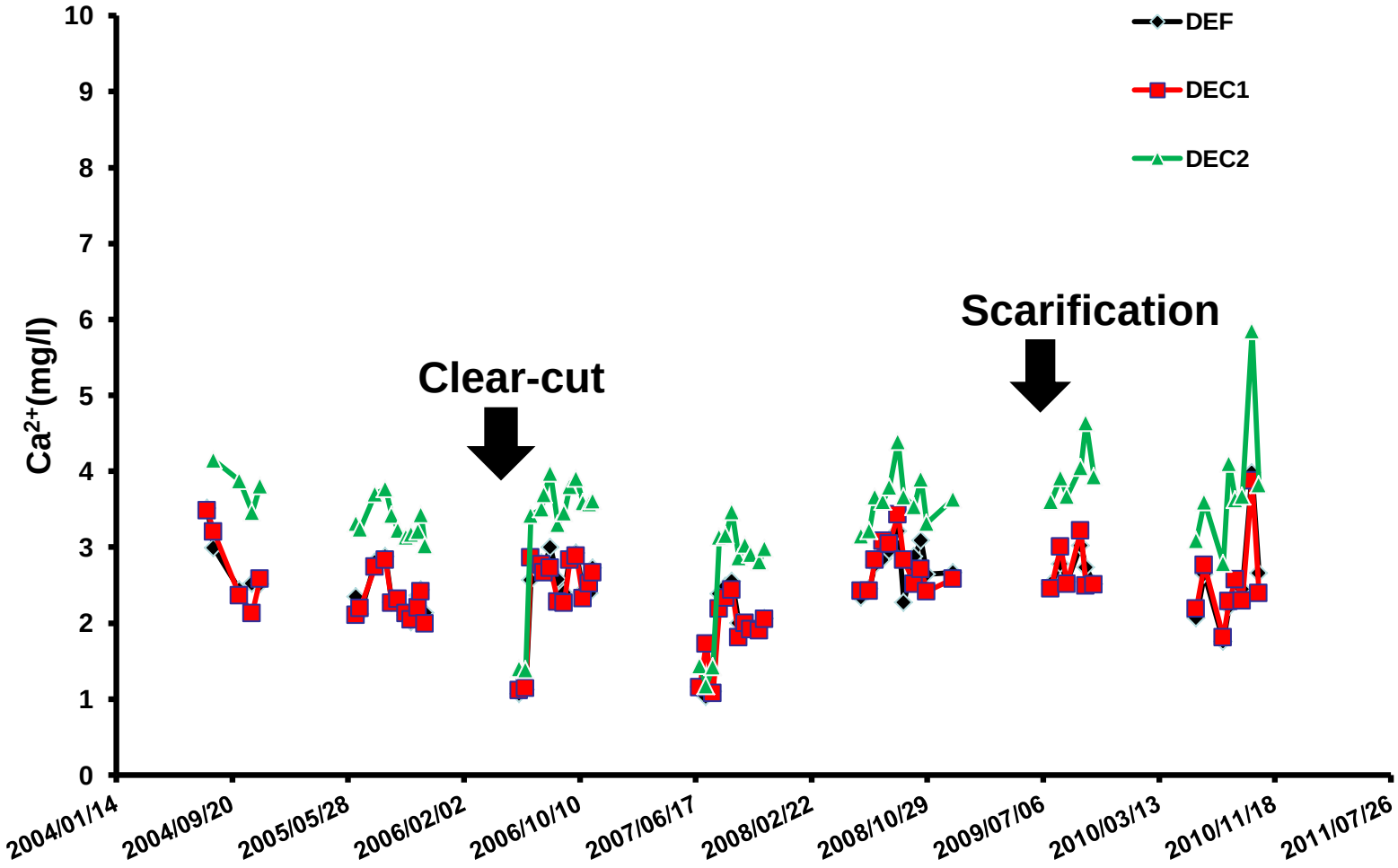
The scarification of forest floor in one of clear-cut site


DE5（Forest catchment）
Water weir
DE6（Clear-cut catchment）
DE6
DE7
DE7（Clear-cut ＋Scarification catchment）



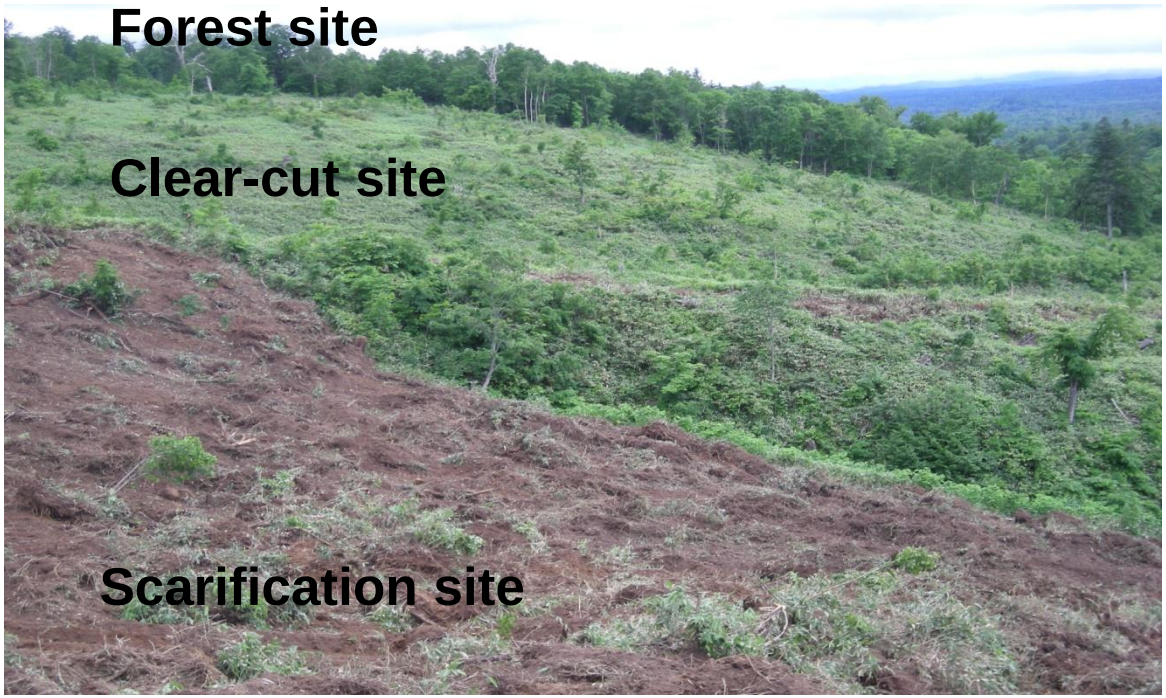
The concentration of nitrate increased after scarification.

(DEF: forest site　　DEC1,DEC2: clear-cut site)



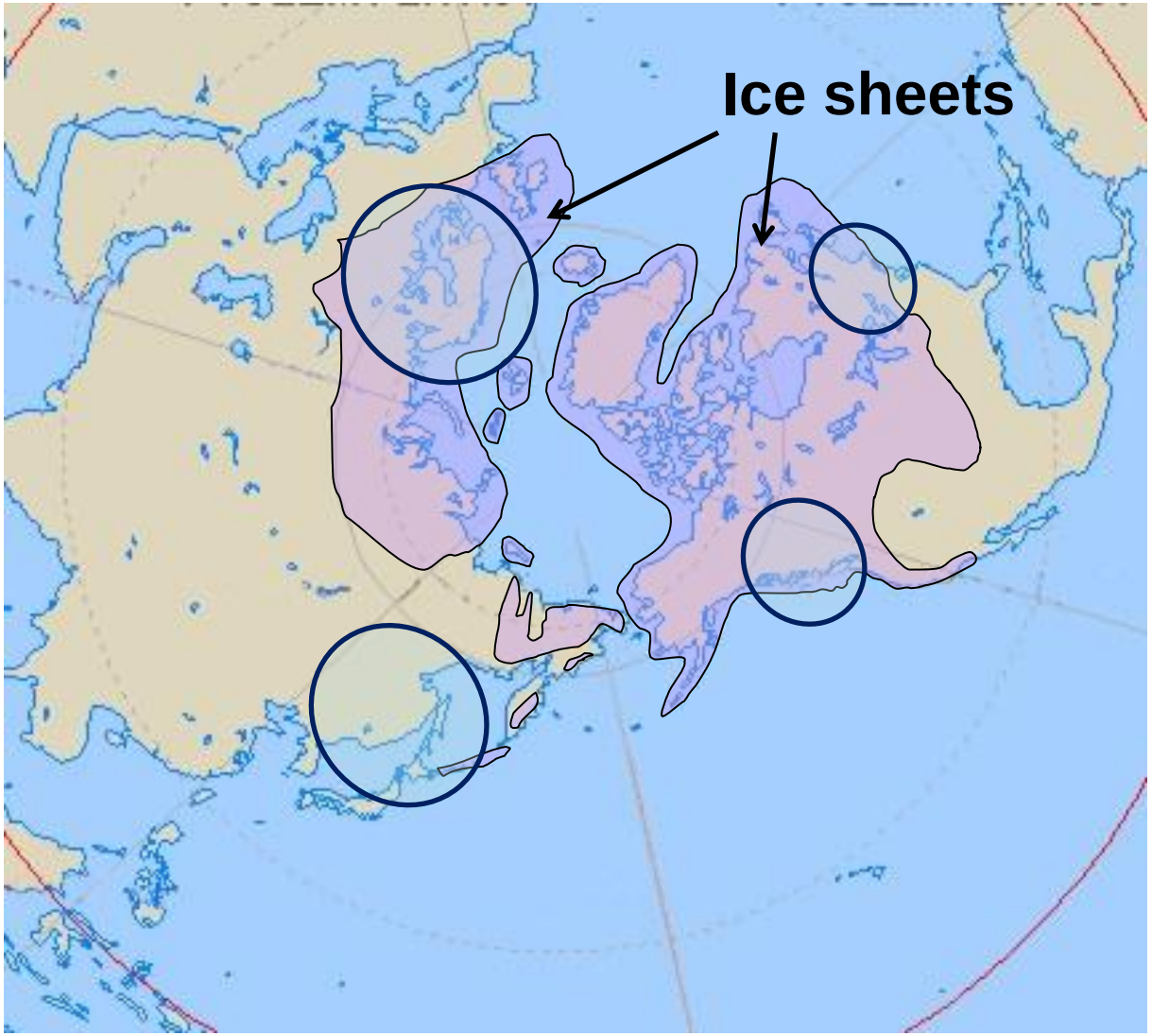
The concentration of Ca^{2+} increased after scarification.

(DEF: forest site DEC1,DEC2: clear-cut site)



The reason of our results, which is different from those reported in USA and northern Europe, is due to the presence of thick sasa community and the thick soil and weathering crust with high permeability in the research site.

Soil profile and weathering crust (ca. 2m thick)



The forests of northern America and Europe have been established on the thin soil layers with poor buffer capacity (glacial till) left after the regression of ice sheets in the last ice age.

The distribution of ice sheets in the last ice age

Although the climate and the forest type are relatively the same, the response of forest watersheds against artificial disturbance strongly depends on the condition of soil and forest floor.

The comparative joint research between Finland and Hokkaido will contribute to appropriate evaluation of the forest functions in the North.