

# Vegetation dynamics at the Nadym and Kharasavei sites in the West Siberia North

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Long-term vegetation monitoring is carried out since 1970 at the Nadym site in the West Siberia North.

The observation site is located in 30 km south from the Nadym town in the northern taiga. The annual geobotanical descriptions are carried out on fixed plots and transects in natural and disturbed conditions. Observations over vegetation dynamics were accompanied by soil descriptions, microclimatic observations, microrelief levelling and measurements of permafrost temperature and seasonal thaw depths.

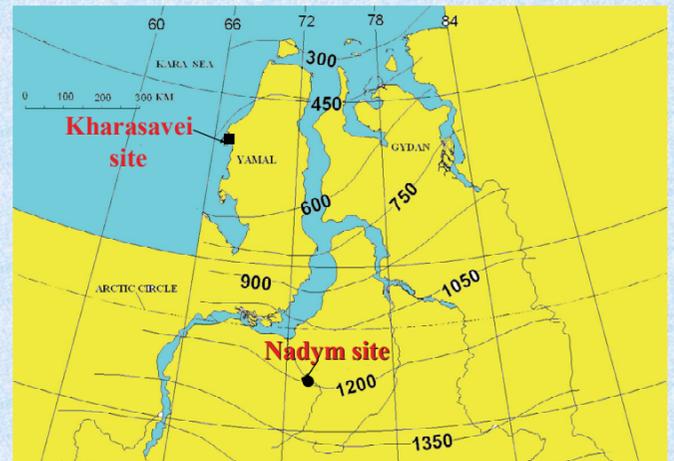
At the peatland with *Rubus chamaemorus* - *Ledum palustre*-*Sphagnum fuscum* - *Cladina stellaris* community in the first years after vegetation removal cotton grass-cloudberry groupings covering only 20 % of a surface have been formed. In 15 years on the disturbed peatland has been formed continuous cloudberry-cotton grass-*Polytrichum*-*Sphagnum* cover. This cover in 30 years as a result of the surface settlement, downturn of permafrost table up to 2-3 m, development of thermokarst and bogging was replaced by cotton grass-peat moss cover. The generated fragment of cotton grass-peat moss bog is kept and in 38 years after disturbance.

The carried out definitions of a plant biomass have shown, that as against boggy communities in tundra communities the biomass on the disturbed sites has increased in 2.5 times. In this tundra it is developed *Ledum palustre*-*Betula nana*-lichen-*Polytrichum* plant community, replaced through 30 years after disturbance developed here *Betula nana*-*Ledum palustre*-*Sphagnum*-lichen plant community. On disturbed hummocky tundra downturn of a permafrost table, rise in ground temperature, appearance of surface settlements and formation in them pools is marked; during the winter period snow capacity has increased. It has accompanied by sharp increase in vegetation structure of *Betula nana* participation, having average height 1 m, and also *Polytrichum* mosses. The big participation of these species has led to substantial increase of plant biomass. Appearance of *Betula tortuosa* and *Pinus sibirica* was observed too.

## Flat peatland before disturbance (A) and through 38 years after disturbance (B)



## Location of the Nadym and Kharasavei sites and the thawing index (DDT, °C·day)



The Nadym site is found on a flat boggy surface of the fluvial-lacustrine plain (third terrace) with altitude ranging from 25 to 30 m. The plain is composed of sandy deposits interbedded with clays, with an occasional covering of peat. Permafrost underlies the area sporadically. Patches of permafrost are closely associated with peatlands, tundras, mires, and frost mounds.

The Kharasavei site is located on the fluvial-marine plain, composed by clay and sands, with continues permafrost.

In Kharasavei region were established 6 (10 x 10 m) plots on which geobotanical descriptions and seasonal thaw depth measurements have been performed in 1978 and 2008.

For example, the first plot was established in the value with polygonal microrelief and prostrate dwarf shrub-sedge-moss-lichen cover. In 2008 number of species on plot has increased from 36 to 49 in the result of appearance new forbs and lichen species. The average height of most species has increased too. This is most likely in response to a rise in air temperature. The seasonal thaw depth increased from 70 to 90 cm for 30 years.

## Polygonal tundra



The other plot was established on the slightly sloping dry surface of the second marine terrace with prostrate dwarf shrub-sedge-lichen-moss cover. The number of plant species on the plot has a little decreased in 2008 as a result of loss of some lichens. It is probably connected with excessive pasture of deer's on these sites. Seasonal thaw depth increased from 65 to 84 cm.

## Dry patchy tundra



Comparison of species composition of plant communities for 1978 and 2008 is shown the increase of number species in the result of appearance new forbs and lichen species by air temperature rise. Trend of air temperature rising is 0,2 degrees per year. Only on dry sites with lichen cover disturbed by pasture of deer's this did not observe.

## Series of plant communities and permafrost conditions

Sedge-moss mire      Dwarf shrub-sedge-moss bog      Flat shrub-moss-lichen peatland      Palsa shrub-lichen peatland



## Active layer thickness

Permafrost absent

130 cm

58 cm

60 cm

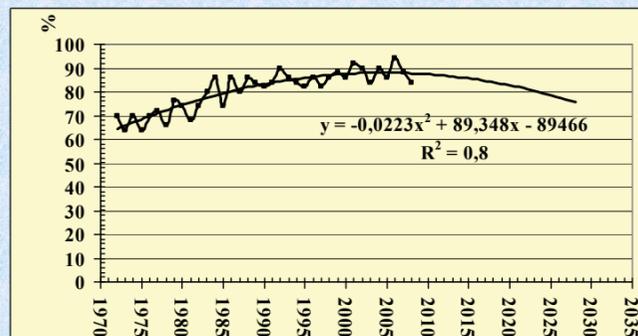
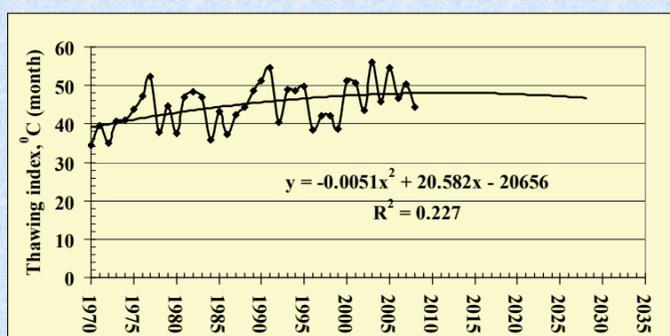
## Ground temperature at the depth 10 m

-0,1°C

-0,2°C

-0,6°C

## Thawing index and frequency of *Ledum palustre* on flat peatland for 1970-2030



**Conclusion:** The carried out monitoring has determined the impact of climatic changes on vegetation and permafrost of Nadym and Kharasavei area in West Siberia North. Last decades rise in air temperature is observed. On data of Nadym weather station for 1970-2008 the trend of increase of mean-annual temperature has made 0.04°C per a year, and the thawing index - 0.3 °C. The steady increase on the peatland in thaw depth (by 30 % for the 38-years period ) and ground temperature ( on 0.9-1.4 °C) is connected to rise in air temperature. The air and soil temperature increase is the likely cause for the appearance of tree species and rise in frequency of shrubs.