

OVERVIEW of VEGETATION, DYNAMICS, DISTURBANCE and RECOVERY STUDIES in the NADYM and YAMAI AREAS

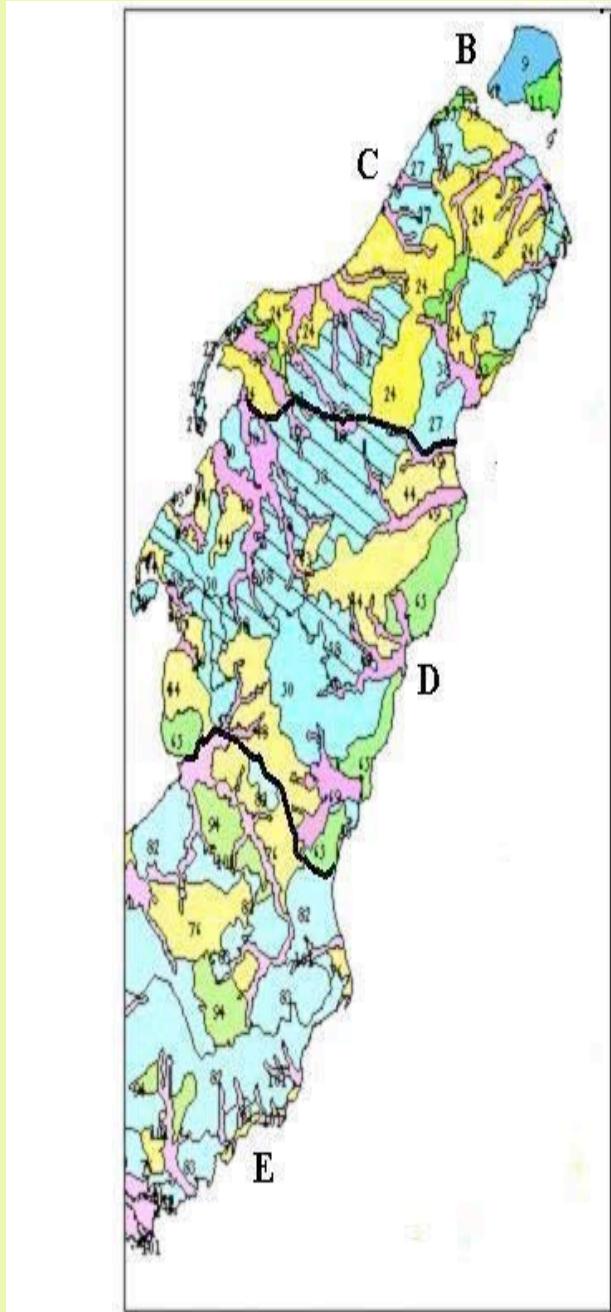
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YAMAL PLANT COMMUNITY MAP



9	15	24	27	32
33	35	38	43	44
50	58	65	69	76
78	82	83	94	101



Subzone boundaries

SUBZONE D

Marre-Sale grid



LEGEND OF PLANT COMMUNITY MAP

Map unit	Description	Communities
Zone B		
9	Moist acidic moss -sedge tundra	<i>Aulacomnium turgidum</i> - <i>Carex arctisibirica</i>
15	Wet acidic moss - sedge mire	<i>Calliergon sarmentosum</i> - <i>Carex stans</i> + <i>Eriophorum polystachion</i>
Zone C		
24	Dry acidic prostrate dwarf shrub-sedge -lichen tundra	<i>Salix nummularia</i> - <i>Carex arctisibirica</i> - <i>Alectoria ochroleuca</i>
		<i>Cetraria cucullata</i> - <i>Hierochloe alpina</i>
27	Moist acidic sedge -moss tundra	<i>Carex arctisibirica</i> - <i>Aulacomnium turgidum</i>
32	Moist nonacidic and acidic prostrate dwarf shrub -sedge -moss tundra	<i>Dryas subincisa</i> + <i>Salix polaris</i> - <i>Carex arctisibirica</i> - <i>Dicranum elongatum</i>
33	Wet acidic sedge -grass -moss mire	<i>Carex stans</i> - <i>Calliergon sarmentosum</i> + <i>Drepanocladus exannulatus</i>
		<i>Carex stans</i> + <i>Eriophorum polystachion</i> - <i>Calliergon sarmentosum</i> + <i>Sphagnum squarrosum</i>
35	Wet saline grass - sedge meadows	<i>Puccinellia phryganoides</i> - <i>Carex subspathacea</i>
38	Riparian acidic sedge -moss bogs and willow -forb shrublands	<i>Carex stans</i> + <i>Eriophorum polystachion</i> - <i>Calliergon sarmentosum</i>
		<i>Salix glauca</i> - <i>Pedicularis sudetica</i>
Zone D		
43	Dry acidic dwarf shrub -lichen tundra	<i>Salix nummularia</i> + <i>Dryas subincisa</i> - <i>Cetraria cucullata</i>
44	Dry acidic dwarf shrub -moss -lichen tundra	<i>Ledum decumbens</i> - <i>Vaccinium minus</i> - <i>Cetraria cucullata</i> + <i>Racomitrium lanuginosum</i>
50	Moist acidic dwarf shrub -sedge-moss tundra	<i>Betula nana</i> - <i>Carex arctisibirica</i> - <i>Dicranum congestum</i> + <i>Aulacomnium turgidum</i>
58	Moist nonacidic prostrate dwarf shrub -low shrub -forb-moss tundra	<i>Dryas punctata</i> - <i>Saxifraga nelsoniana</i> - <i>Dicranum congestum</i>
65	Wet acidic sedge-dwarf shrub-moss mire	<i>Salix glauca</i> + <i>Salix lanata</i> - <i>Petasites frigidus</i> - <i>Aulacomnium palustre</i>
69	Riparian acidic sedge-moss mire and low shrub-sedge-moss tundra	<i>Carex aquatilis</i> - <i>Drepanocladus exannulatus</i> + <i>D. fluitans</i>
Zone E		
76	Dry acidic dwarf shrub -sedge -lichen -moss tundra	<i>Ledum decumbens</i> - <i>Vaccinium vitis -idaea</i> + <i>Empetrum subholarticum</i> - <i>Cladina mitis</i>
78	Dry nonacidic low shrub -prostrate dwarf shrub -forb-lichen -moss tundra	<i>Dryas subincisa</i> + <i>Diapensia lapponica</i> - <i>Pedicularis sudetica</i> - <i>Alectoria ochroleuca</i> + <i>Racomitrium lanuginosum</i>
82	Moist acidic dwarf shrub -sedge -moss -lichen tundra	<i>Salix glauca</i> + <i>S. lanata</i> - <i>Petasites frigidus</i> - <i>Aulacomnium palustre</i>
83	Moist acidic dwarf shrub -low shrub -forb-moss -lichen tundra	<i>Betula nana</i> + <i>Salix pulchra</i> - <i>Aulacomnium turgidum</i> + <i>Dicranum elongatum</i> + <i>Cladina stellaris</i>
94	Wet acidic low shrub -dwarf shrub -sedge-forb-moss-lichen mire	<i>Salix lapponum</i> - <i>Betula nana</i> - <i>Carex aquatilis</i> - <i>Calliergon stramineum</i> + <i>Sphagnum lindbergii</i>
		<i>Ledum palustre</i> + <i>Eriophorum vaginatum</i> - <i>Rubus chamaemorus</i> - <i>Sphagnum fuscum</i> + <i>Cladina stellaris</i>

Polygonal bog on Yamal





Ledum palustre

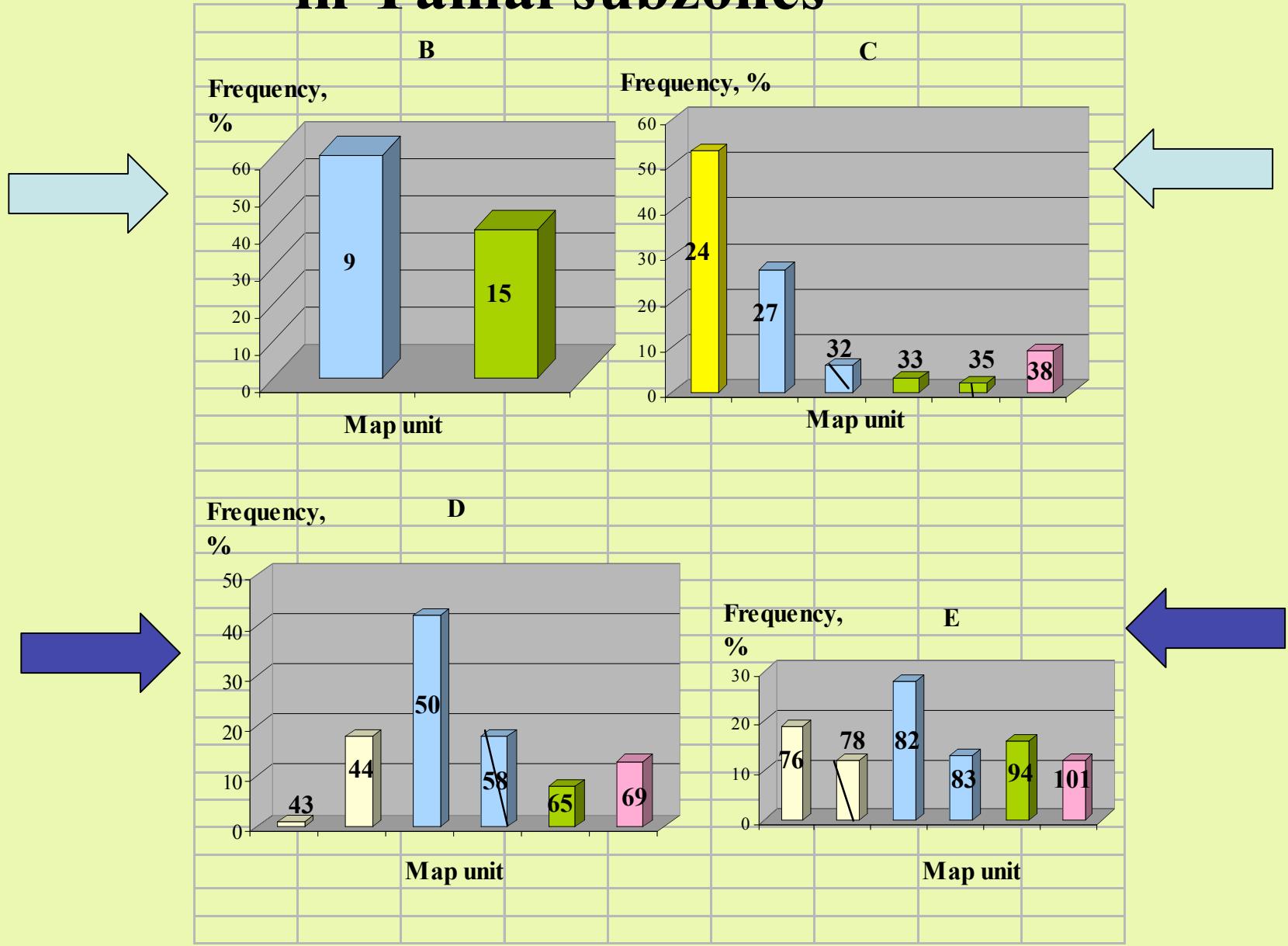


Cladina stellaris

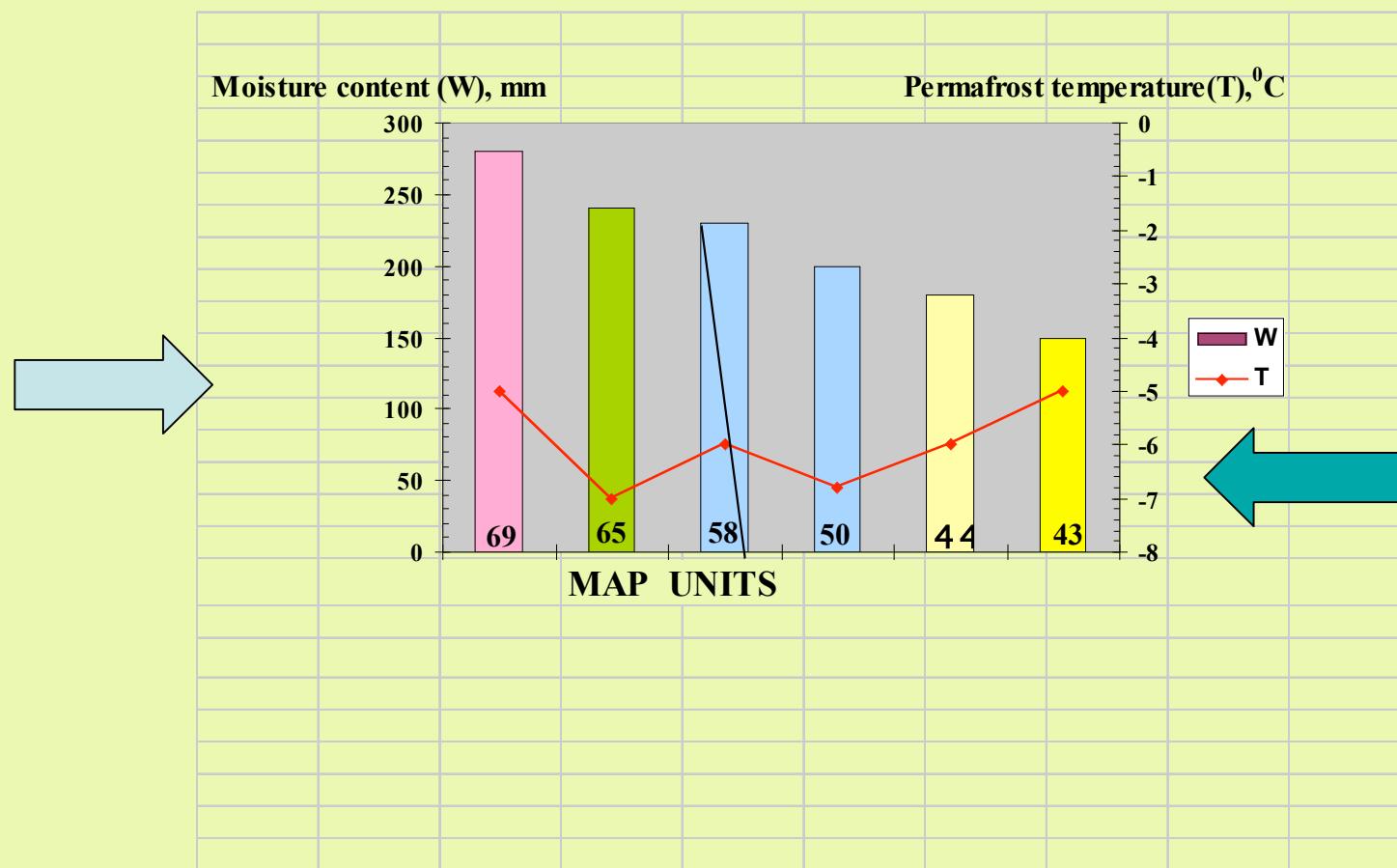


Cetraria nivalis

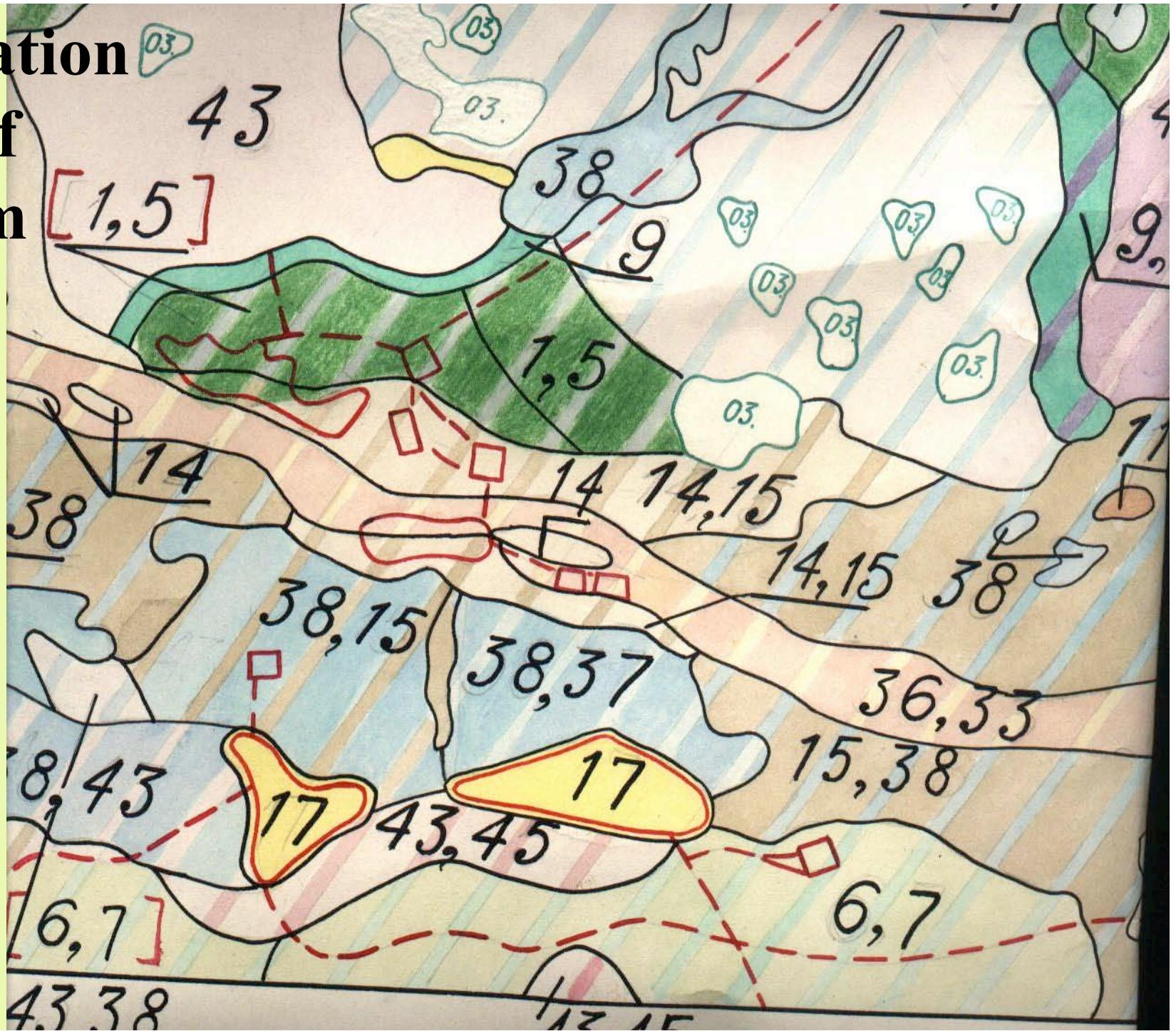
Frequency of plant communities in Yamal subzones



Interactions between plant communities and soil moisture and permafrost temperature.



Vegetation map of Nadym region



LEGEND OF NADYM VEGETATION MAP



Plant communities

Forest: 1 - birch -larch and birch -pine shrub -lichen sparse forests on dry gentle sandy sites; 5 - larch sedge -shrub -moss open woodland with hummocky microrelief on slightly drained sites; 6 - spruce -larch shrub -lichen -green moss forests on dry sites of plains, composed by clay; 7 - spruce -larch shrub -moss sparse forests and open woodland on slightly drained sites, composed by clay with hummocky microrelief and small active layer thickness; 9 - spruce -birch -larch shrub -sedge -moss forest s on flood plains; 10 - spruce -larch sedge -shrub -peat moss open wood on flat boggy flood plains with hummocks; 11 - sands, deprived the vegetation cover on disturbed sites; 14 - cedar -birch forb-shrub forests on flood plains ; 15 - cedar -birch grass -shrub -moss forests on flood plains ; 17 - settlements on early forestry sites.

Meadows: 33 - forb - grass; 36 - spits and beaches with fragments of meadow vegetation.

Mires: 37 - sedge -moss mires; 38 - shrub -sedge -peat moss hummocky bogs with lenses of frozen g rounds.

Peatlands: 43 - flat cloudberry -shrub lichen -moss and moss -lichen peatlands with sedge -moss pools; 45 - peatlands with sedge -shrub -moss -lichen cover on palsa and sedge -peat moss - on pools between palsa.

Red lines - linear and area disturbances.

Flat peatland before disturbance



Flat peatland in 30 years after disturbance



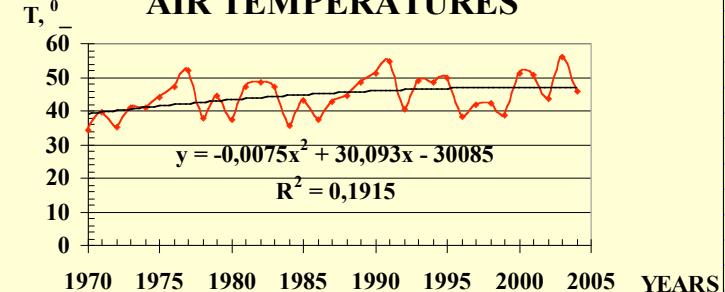


Flat peatland

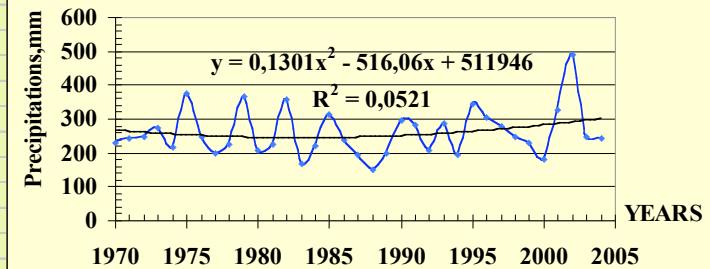


Ledum palustre

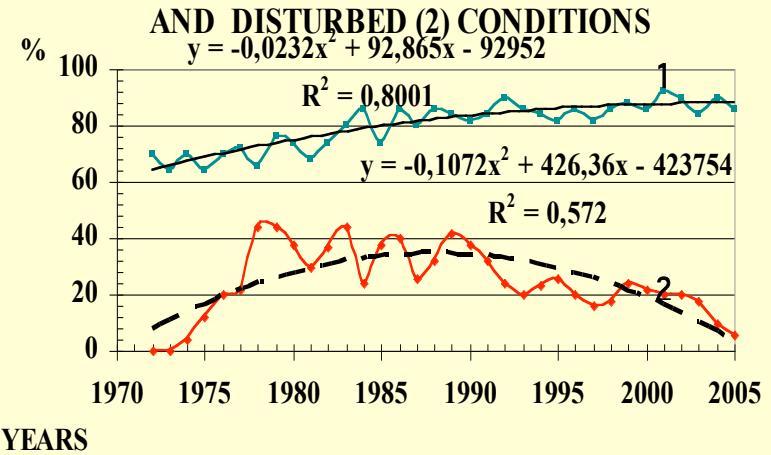
THAWING INDEX ($^{\circ}\text{C.month}$) OF AIR TEMPERATURES



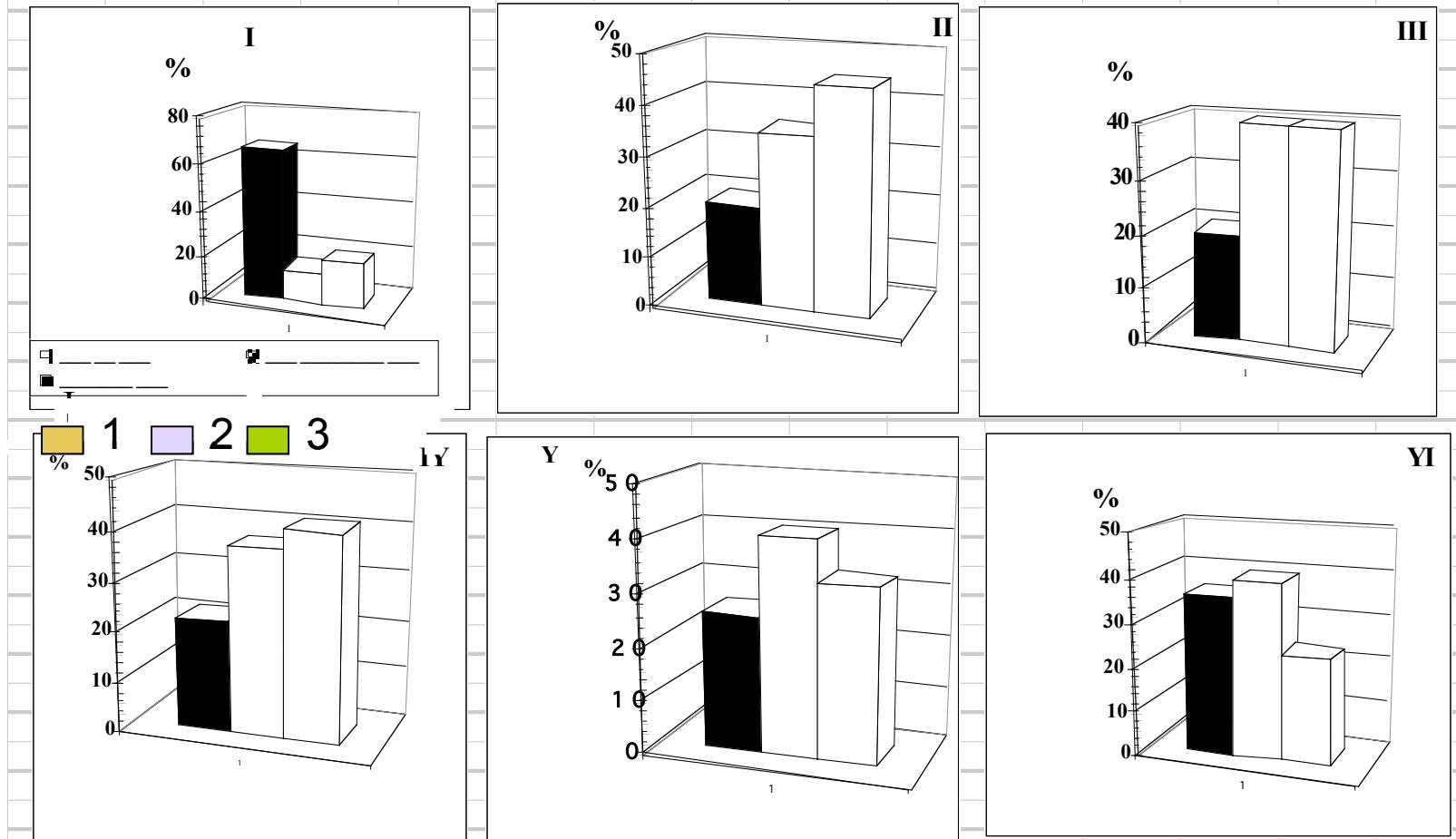
SUMMER PRECIPITATION



FREQUENCY OF LEDUM IN NATURAL (1) AND DISTURBED (2) CONDITIONS

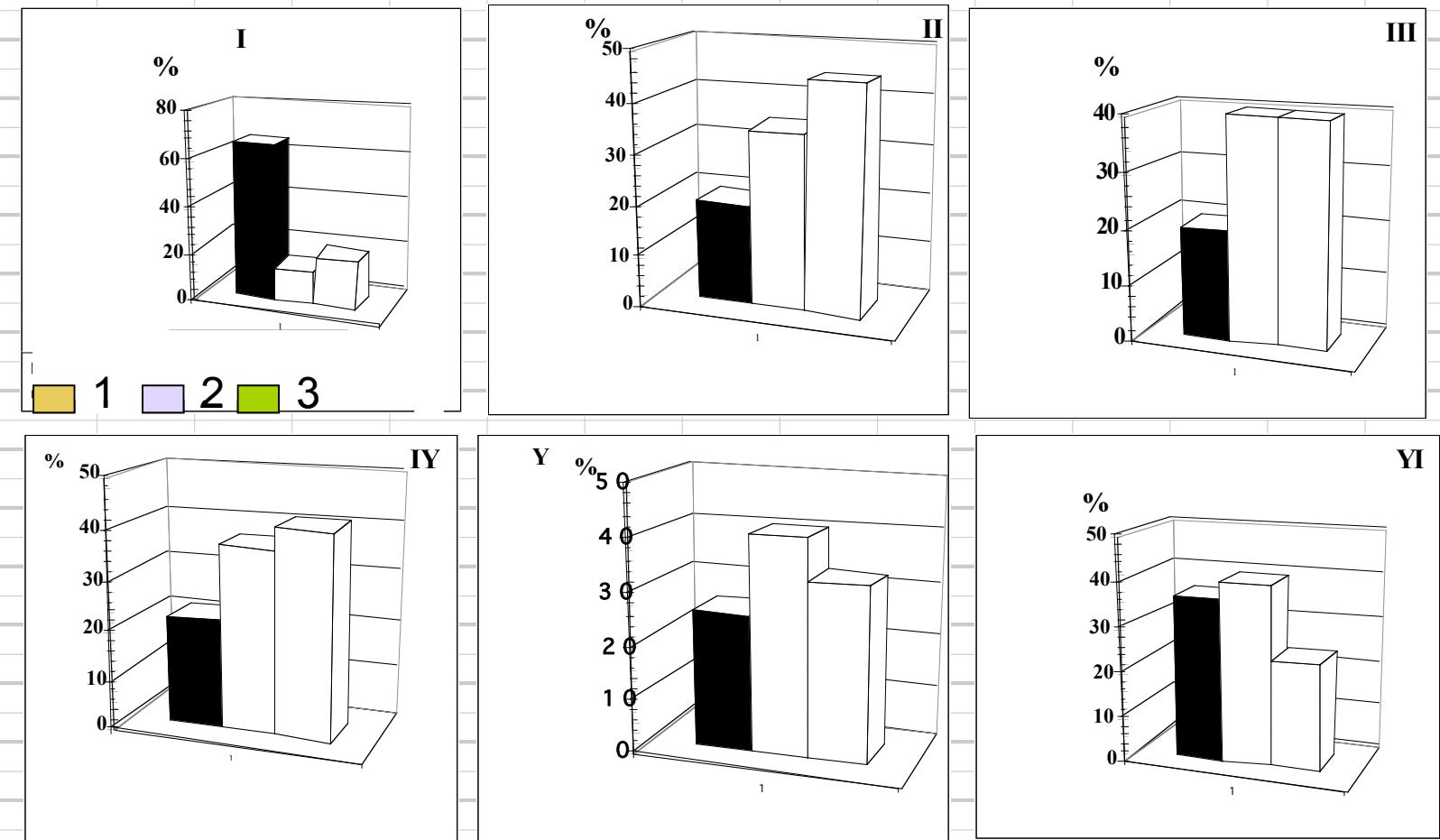


Frequency of plant growth forms within flat peatland in subzone D.



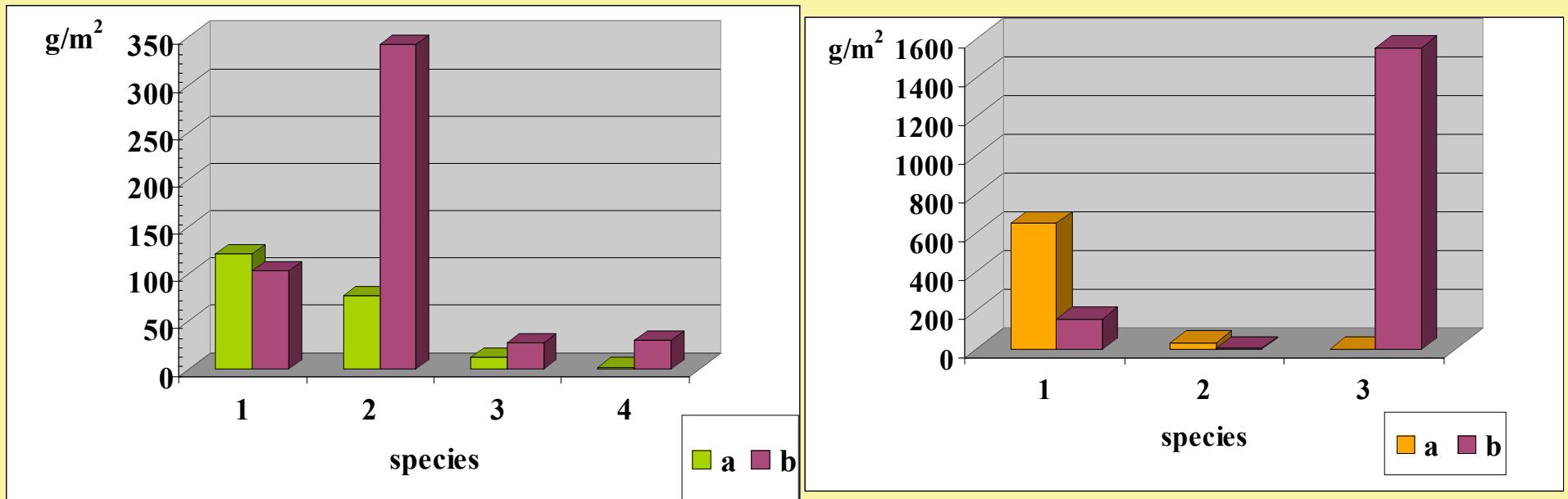
I – not disturbed, II – in the year of disturbance, III – 3 years after disturbance, IY – 6 years after disturbance, Y – 8 years after disturbance, YI – 18 years after disturbance. 1 - Chamaephytes, 2 – hemicryptophytes, 3 – cryptophytes.

Frequency of plant growth forms within flat peatland in typical tundra (subzone D)



**I – not disturbed, II – in the year of disturbance, III – 3 years after disturbance,
IY – 6 years after disturbance, Y – 8 years after disturbance, YI – 18 years
after disturbance.** 1 - Chamaephytes, 2 – hemicryptophytes, 3 – cryptophytes.

Aboveground plant biomass of hummocky tundra in natural (a) and disturbed (b) conditions (Nadym site)



Vascular plants

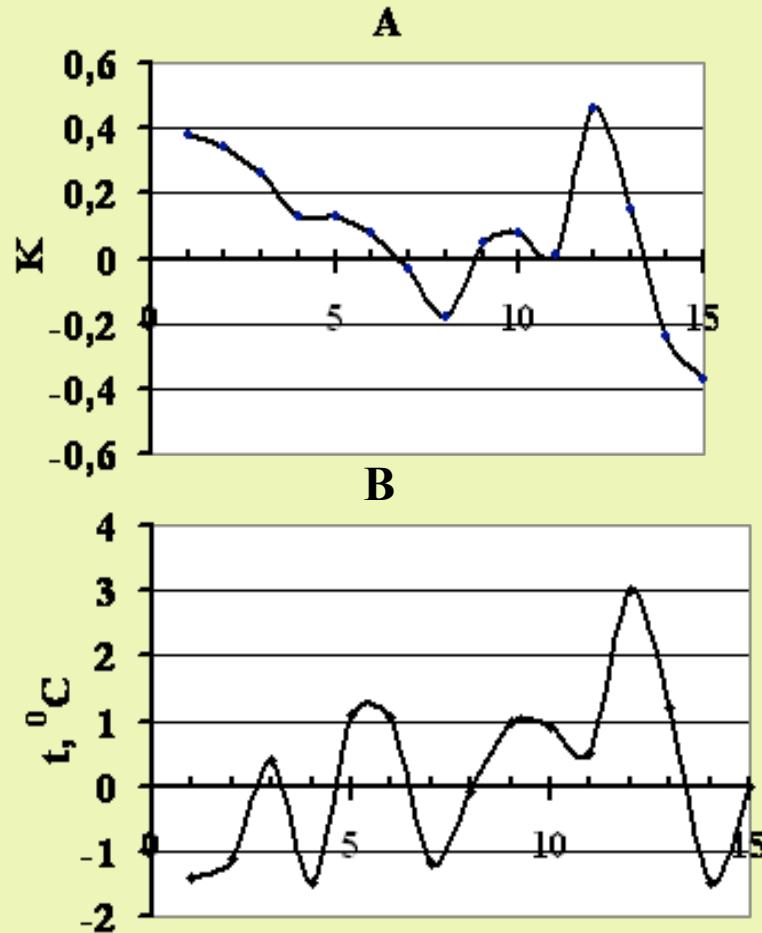
1- *Ledum palustre*, 2 – *Betula nana*, 3 -*Vaccinium vitis-idaea*,
4 – *Carex globularis*

Lichens and mosses

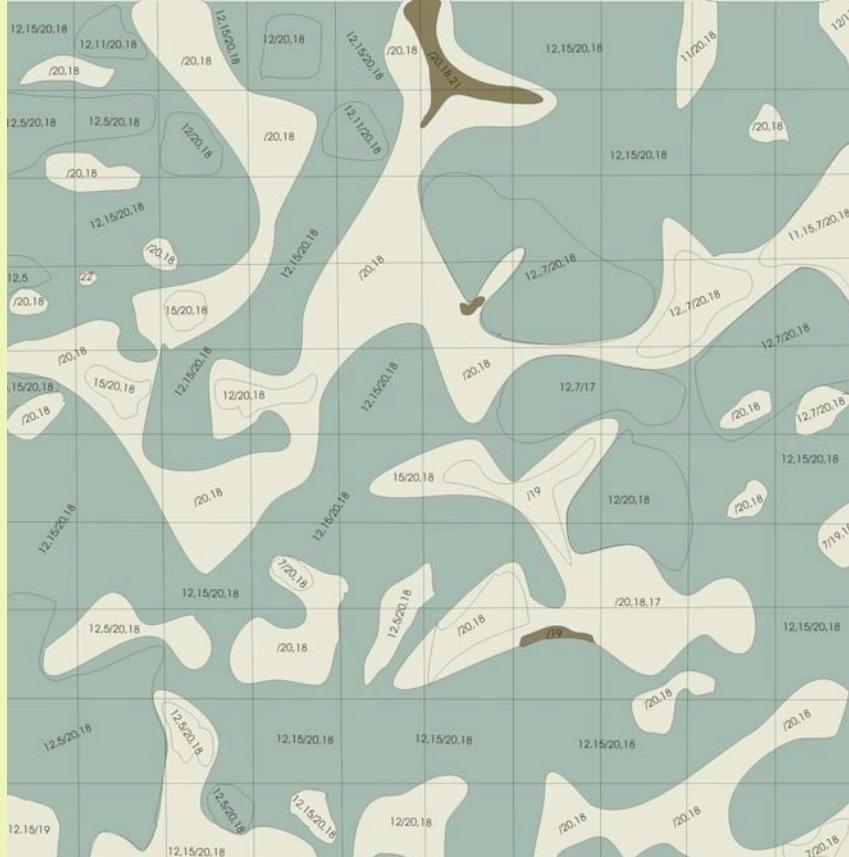
1 – *Cladina*, 2 – *Sphagnum*,
3 - *Polytrichum*

Autocorrelation coefficient (A) for *Polytrichum commune* and air temperature (B)

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Vegetation horizontal structure of frost mound A in natural (A) and disturbed (B) conditions B



Microrelief:

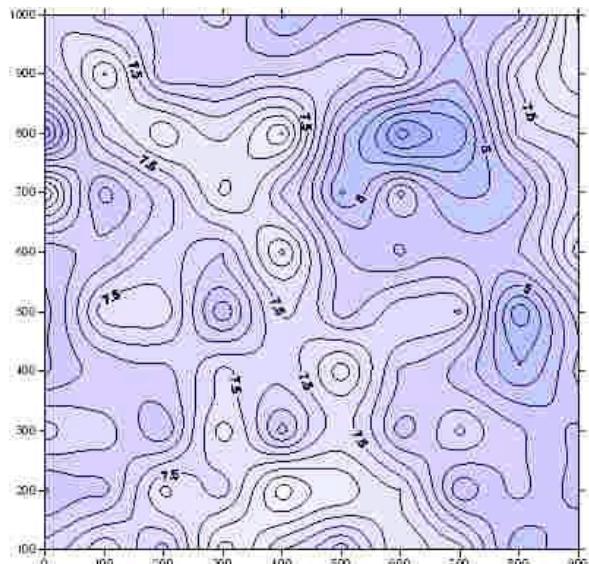
- Flat surface
 - dishes
 - hummocks

• **Microrelief:**

- hummocks
 - peat hummocks
 - sandy surface
 - tussocks
 - water

Soil temperature ($^{\circ}\text{C}$) at the depth 20 cm

A

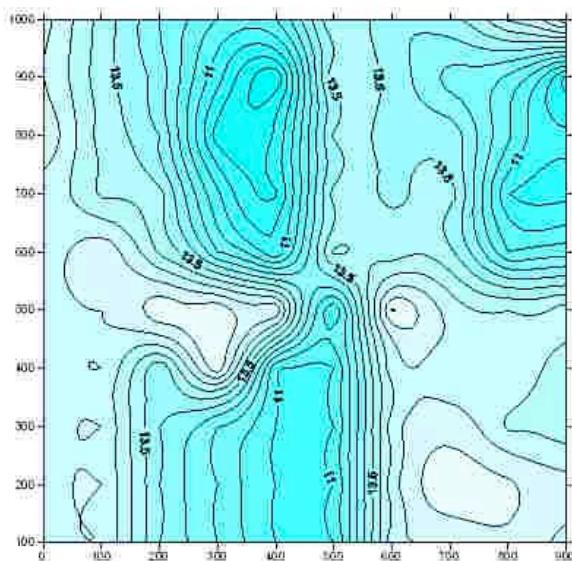


A

Frost mound before disturbance



B

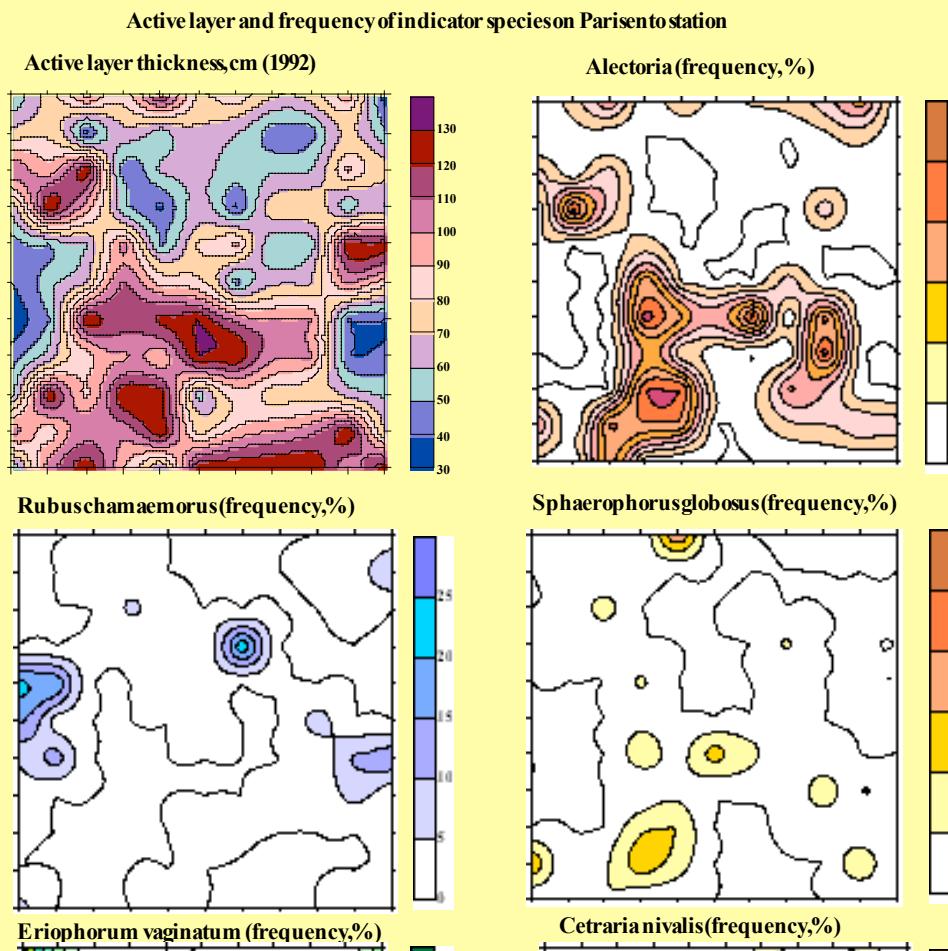


B

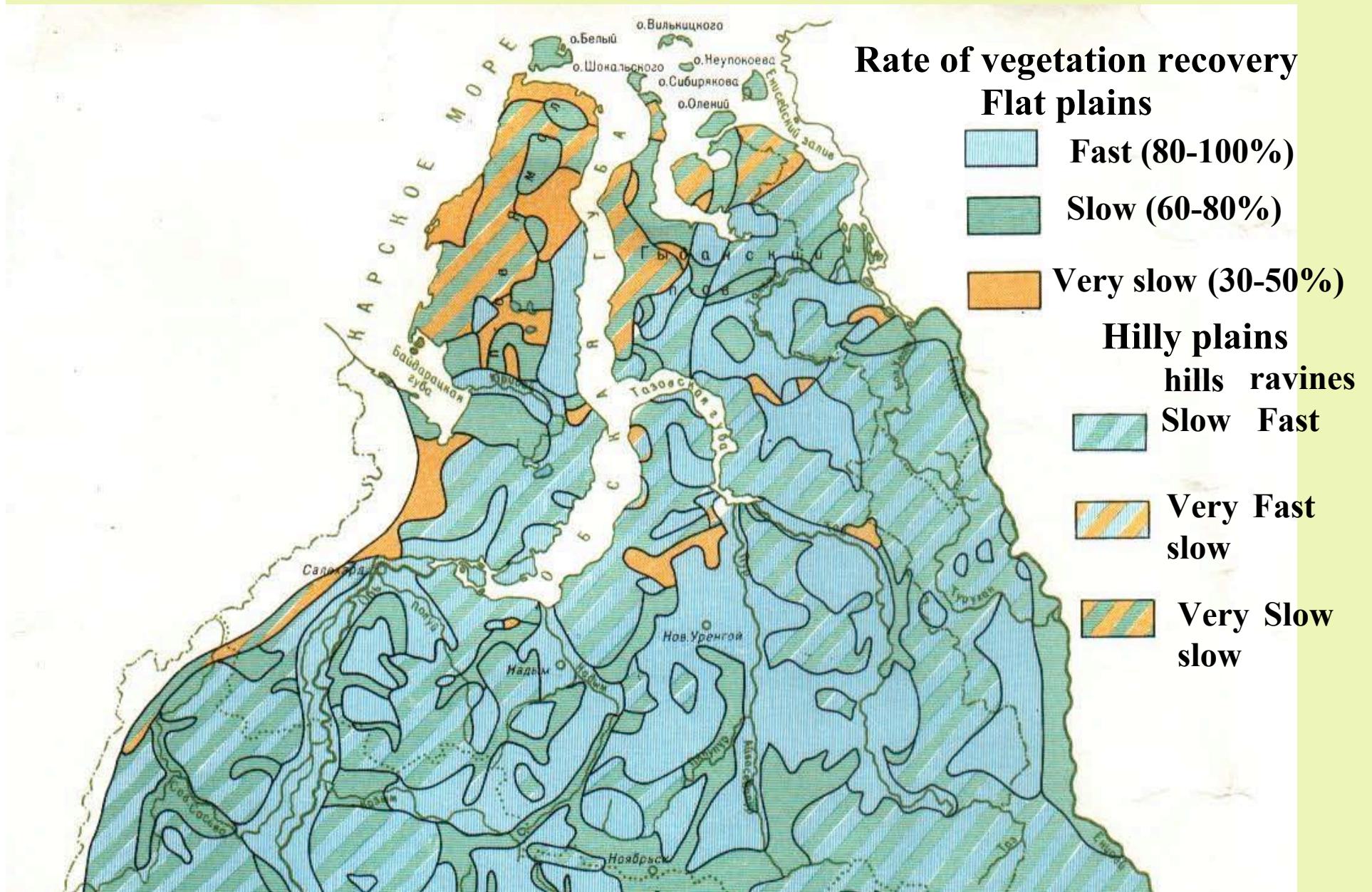
Frost mound after disturbance



Active -layer and frequency of indicator species in subzone D.



Rate of vegetation recovery after disturbance



SUMMARY

Vegetation of West Siberia North finds out essential floristic and physiognomy differences caused by geological and climatic features of this region. Only mire and halophyte plant communities in different subzones find out significant similarity.

The analysis of the compiled vegetation maps has allowed studding spatial structure of vegetation at different levels of research - from regional up to local.

Repeated mapping has enabled to investigate vegetation dynamics under impact of anthropogenic factor.

The ecological factors determining development of plant communities are revealed on materials of long-term stationary observations , and also revealed the parameters describing changes of vegetation as a result of climatic changes and anthropogenic impact (species structure, coverage, frequency, biomass).

The water and thermal regime of soil are the main environmental factors in development of West Siberia plant communities.

Studying interactions of different ecosystem components has allowed revealing geobotanical indicators of seasonal thaw depths.



Спасибо за внимание!

THANK YOU