The methodology for the assessment of ecosystem sensitivity in Arctic coastal habitats

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The Study Objective

Wetlands International coastal initiative since 2009

Overall : The prevention of long-term damage to Arctic wetlands through better understanding of the ecosystem functions and species biology

Practical objective: To develop methodology for assessment of coastal wetlands sensitivity for conservation needs based on:

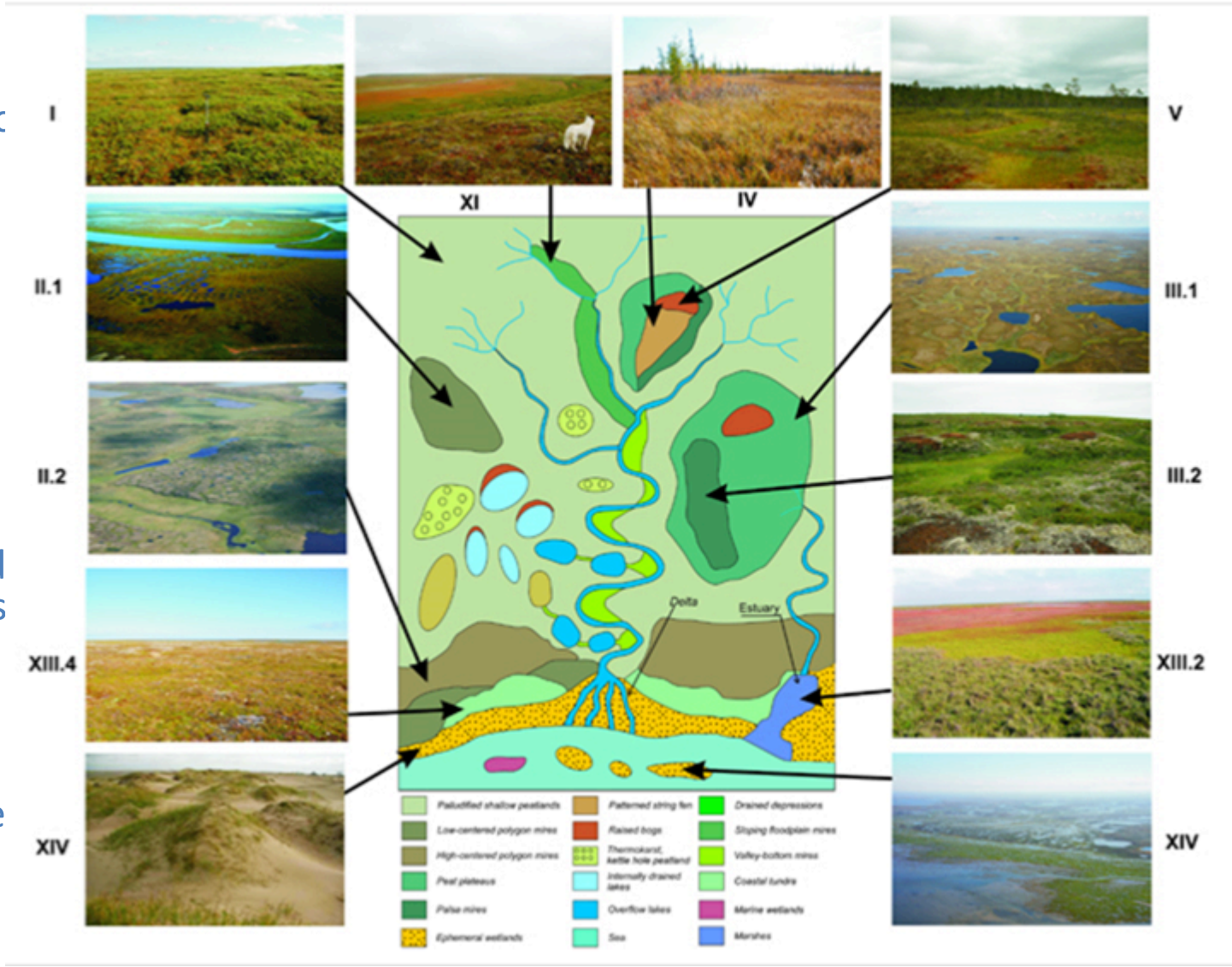
- the knowledge of species biology and population biology
- the understanding of ecosystem functions and processes
- structural-functional connection/indication

The quality criteria

- operational with minimum scope of field data
- based on the modern and wide range published scientific knowledge
- Replicable regionally and circumpolar

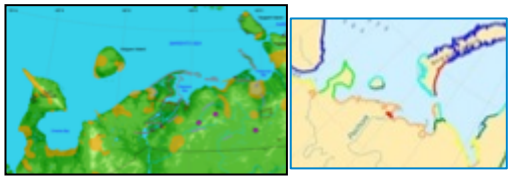
Work scope

- Pan-Arctic & generic applicability
- CAFF Arctic region
- Coastal zone: the ecotone between terrestrial and marine ecosystem
- Coastal wetlands in Arctic include: estuaries, deltas, tidal ephemeral and permanent marshes coastal marshes, swamps and bogs, rocky shores, coral reefs and other ecosystems that are in the range of influence of the marine waters.



Sensitivity & vulnerability at operational level

Regional: Valuable & vulnerable sites



Arctic Coastal Wetland classification

Basic coastal map

Existing & new mapping data:

- remote sensing
- maps with other classifications
- vegetation maps

Value

- Species number
- Critical bird species
- Endemic species
- Ecosystem services

Stability

- Soil structure
- Position/slope
- Productivity
- Dynamics / erosion

Sensitivity

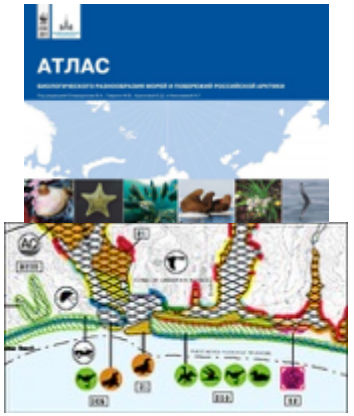
Vulnerability to oil spills:
- e.g. E.S.I.
- substrate

Generic Vulnerability

Vulnerability to oil spills:
-Sensitive species locations (colonies, spawning sites,...)

Site specific Vulnerability

Sensitivity & Vulnerability Map



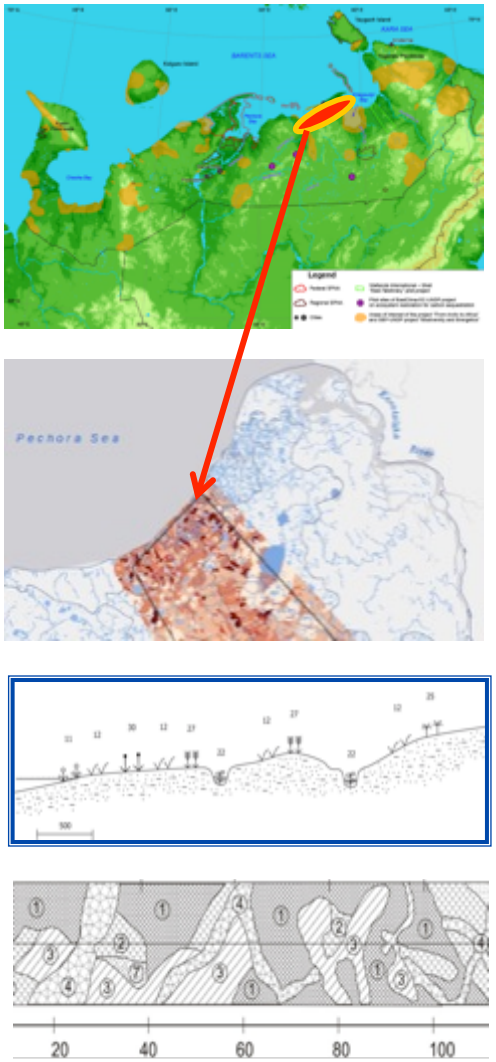
Two levels: Regional & Operational

Regional scales:

- scales 1: 1 000 000 - 1:8 000 000
- Vulnerable landscape types
- Protected sites, endemic flora/fauna, critical habitats (CH project), endangered species, vulnerable species with aggregations

Operational scale:

- Scales 1:50 000 – 1:10 000
- Ecosystem based assessment
- Population/species based assessment

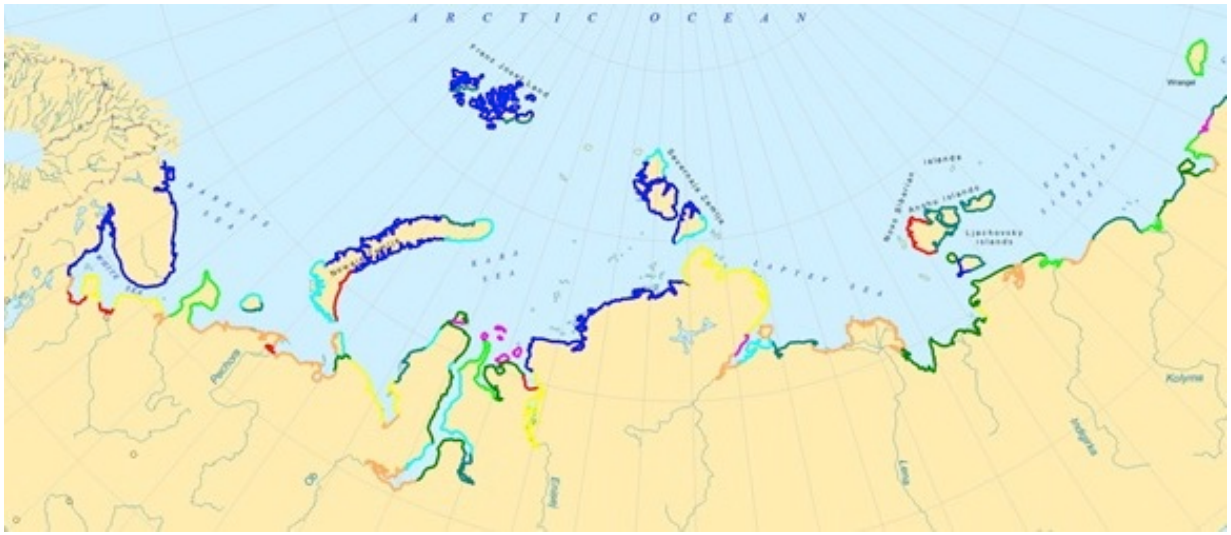


Arctic coastal wetland classification

Draft classification with 9 morphological shore types

9 main morphological shore types: circumpolar

- Ingressive (with narrow bays) coasts
- Muddy coasts
- Termoabrasion coasts
- Denudation coasts
- Bay coasts
- Abrasion coasts
- Accumulative coasts
- Lagoon coasts
- Level-headed with hoe



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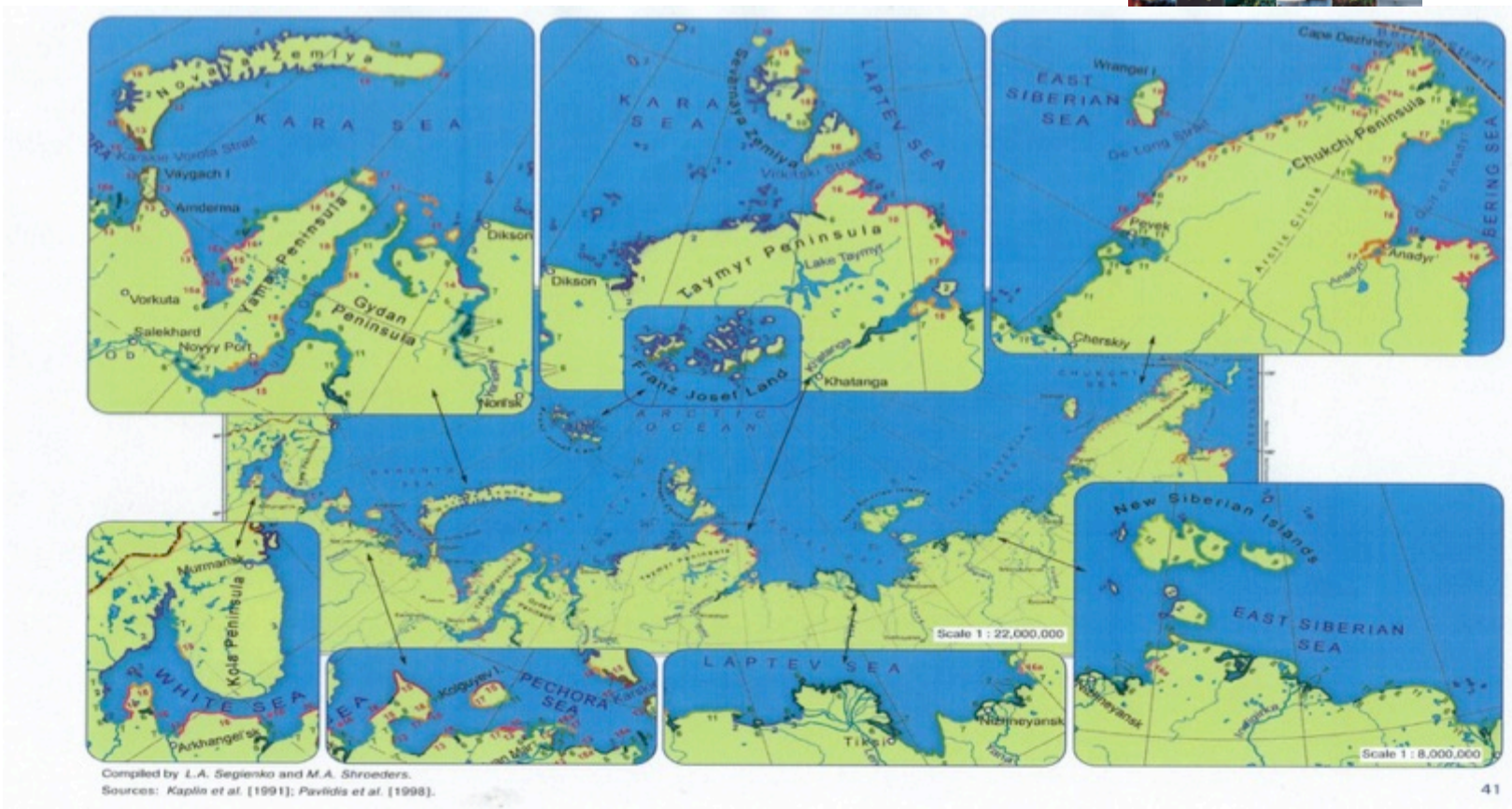
Arctic coastal wetland classification

Draft classification with 19 morphological shore types

19 main morphological shore types: Regional scale



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Arctic coastal wetland classification

Draft ecotope classification 27 classes

27 wetland classes: operational scale

Substrate	Situation	Salt marshes	Brackish marshes	Freshwater marshes	Coastal tundra	Cliffs & benches
Mud	**Low**	1	-	-	26	27
	Middle	5	-	20		
	High	-	-	23		
Mud + clay	**Low**	2	12	-		
	Middle	6	15	-		
	High	9	18	24		
Sand	**Low**	3	13	-		
	Middle	7	16	21		
	High	10	19	25		
Pebble + shingle	**Low**	4	14	-		
	Middle	8	17	22		
	High	11	-	-		

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Arctic coastal wetland classification

Draft ecotope classification 27 classes

27 wetland classes:

- Ecotope based
- Non-hierarchical classification
- Units indicative by vegetation
- Mapping unit size up to 10^2 m
- The class is the unit of the sensitivity assessment

Salt marshes
1 Low salt marshes on mud substrate
2 Low salt marshes on clayey-muddy substrate
3 Low salt marshes on sand substrate (open community on sand shores)
4 Low salt marshes on pebble-shingle substrate (open community on pebbles shores)
5 Middle salt marshes on mud substrate
6 Middle salt marshes on clayey-muddy substrate
7 Middle salt marshes on sand substrate (community on sand shores)
8 Middle salt marshes on pebble-shingle substrate (community on pebbles shores)
9 High salt marshes on clayey-muddy substrate
10 High salt marshes on sand substrate
11 High salt marshes on pebble-shingle substrate (community on pebbles shores)
Brackish marshes
12 Low brackish marshes on clayey-muddy substrate
13 Low brackish marshes on sand substrate
14 Low brackish marshes on pebble-shingle substrate (open community on pebbles shores)
15 Middle brackish marshes on clayey-muddy substrate
16 Middle brackish marshes on sand substrate
17 Middle brackish marshes on pebble-shingle substrate (open community on pebbles shores)
18 High brackish marshes on clayey-muddy substrate
19 High brackish marshes on sand substrate
Freshwater marshes
20 Middle freshwater marshes on mud substrate
21 Middle freshwater marshes on sand substrate
22 Middle freshwater marshes on pebble-shingle substrate
23 High freshwater marshes on mud substrate
24 High freshwater marshes on clayey-muddy substrate
25 High freshwater marshes on sand substrate
Other
26 Coastal tundra
27 Communities on cliffs and benches

Sensitivity, Value, Vulnerability

Definitions

- **Value:** inherent indicator of an ecosystem of habitat based on e.g. number of species, endangered species, endemics, vegetation types
- **Stability:** natural feature of an ecosystem reflecting its capacity to stay unchanged under the pressure of an impact or stress (resistance), and the capacity to return to the initial status after impact is over (resilience)
- **Sensitivity:** combination of the value and the stability of an ecosystem, and is a measure of how sensitive it will be to induced changes [*Or: the degree to which features respond to stresses, which are deviations of environmental conditions beyond the expected range]*

The concept of ecosystem sensitivity

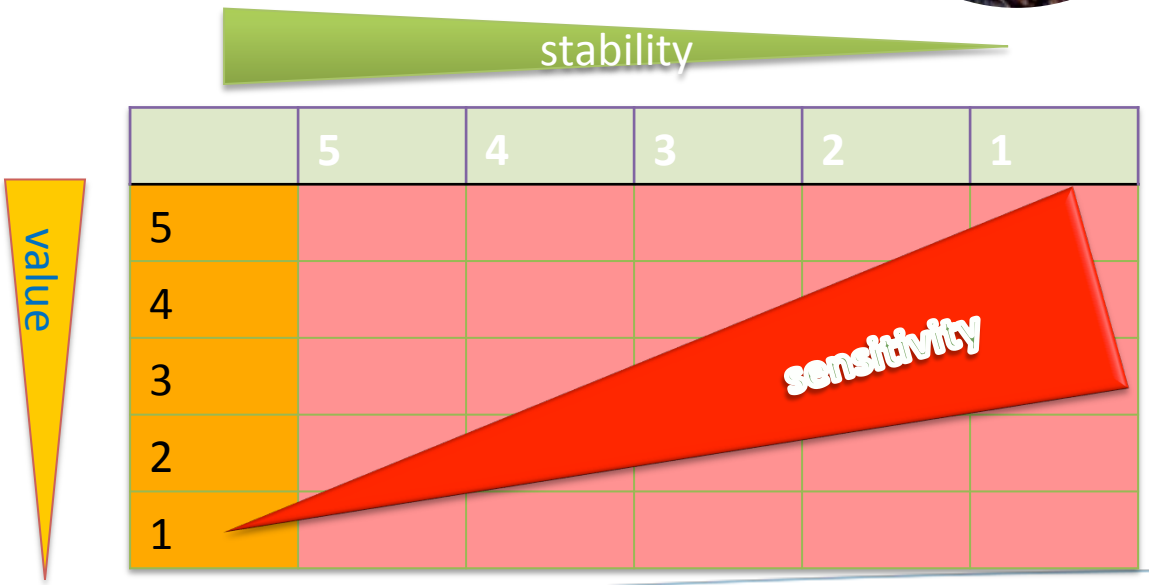
The assessed unit – the ecotope type

stability

- resilience
- resistance

natural functions value

- matter balance
- hydrology
- biodiversity



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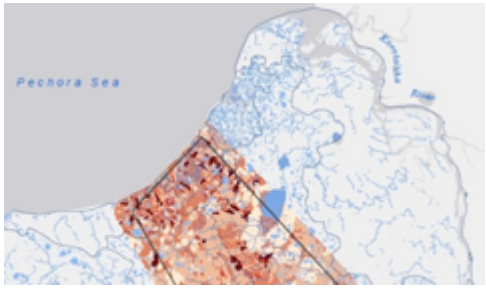
Natural value and stability



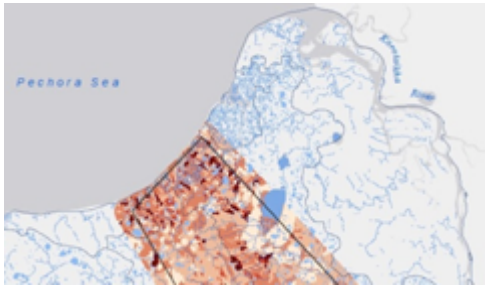
Method of assessment

Measurable parameter in the field:

Geomorfology, soil features, permafrost, hydrological features, vegetation structure

value	stability
Carbon storage	Organic layer depth
Water storage	Permafrost depth
Water discharge	Soil texture
Ecosystem diversity	Position on the slope
	Ecosystem turnover (paleo)

Natural value and stability



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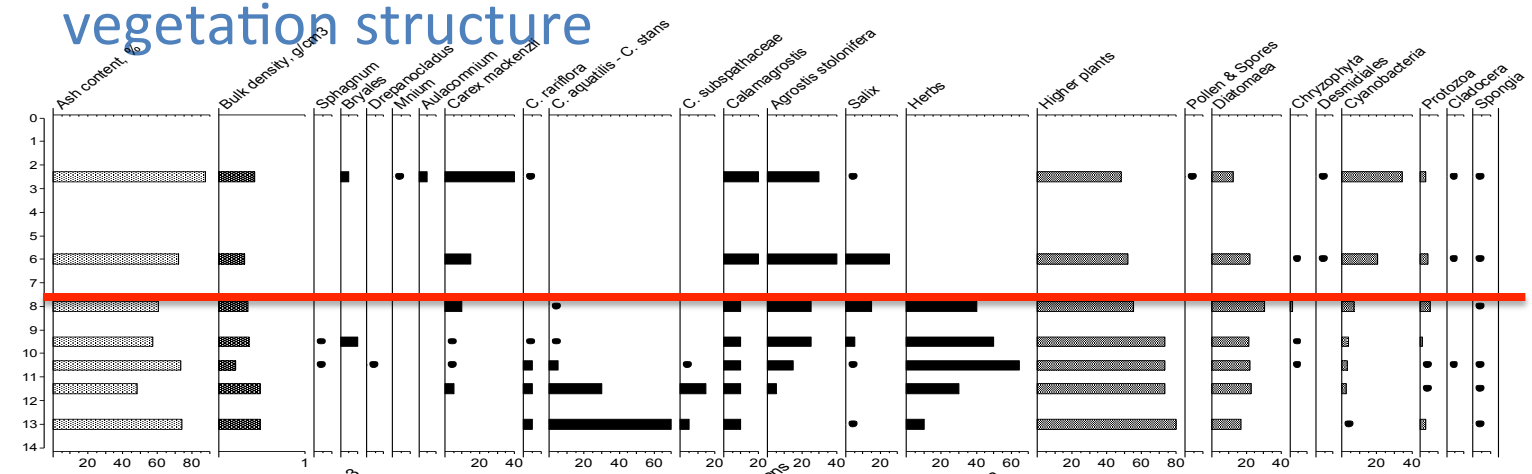

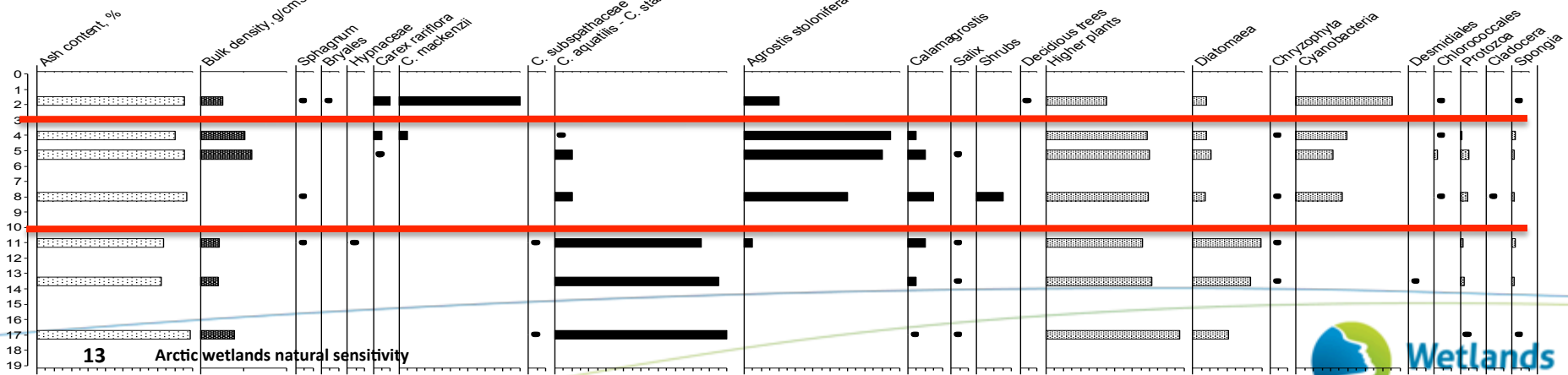

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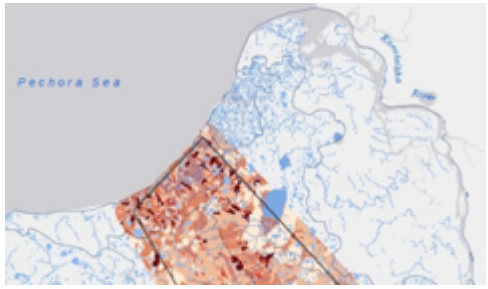
Natural value and stability



Method of assessment

Measurable parameter in the field:

list of plant species with abundance characteristic (cover or number per sq.); list of potential animal species

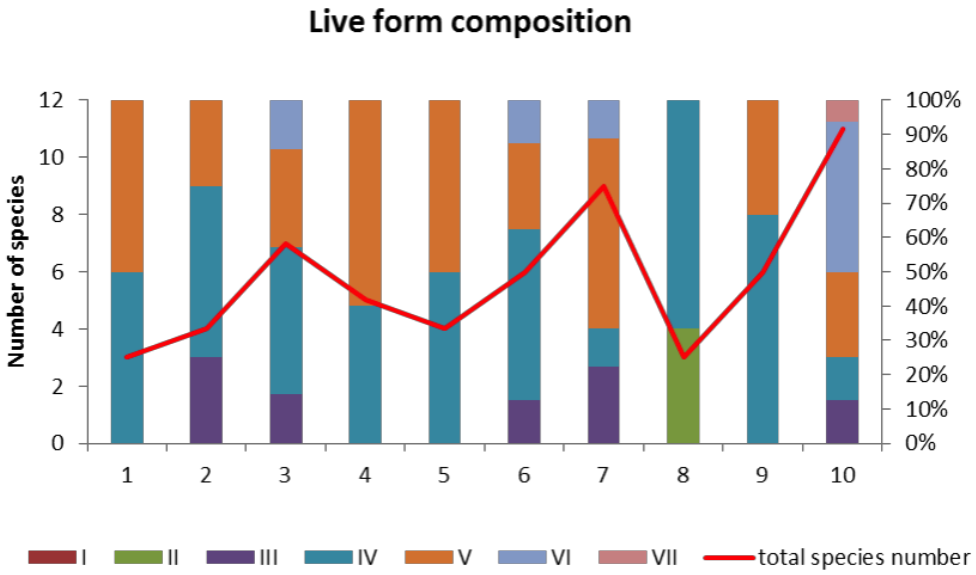
value	stability
Number/ratio of rare species	Ratio of living forms
Number/ratio of provisional species	Plant density, productivity (biblio)
Uniqueness of ecosystems/for species	The ratio of C-S-R/K-r species
Species diversity	
The taxonomic group ratio	
The biogeographic group ratio	

Natural value and stability

Method of assessment

Measurable parameter in the field:

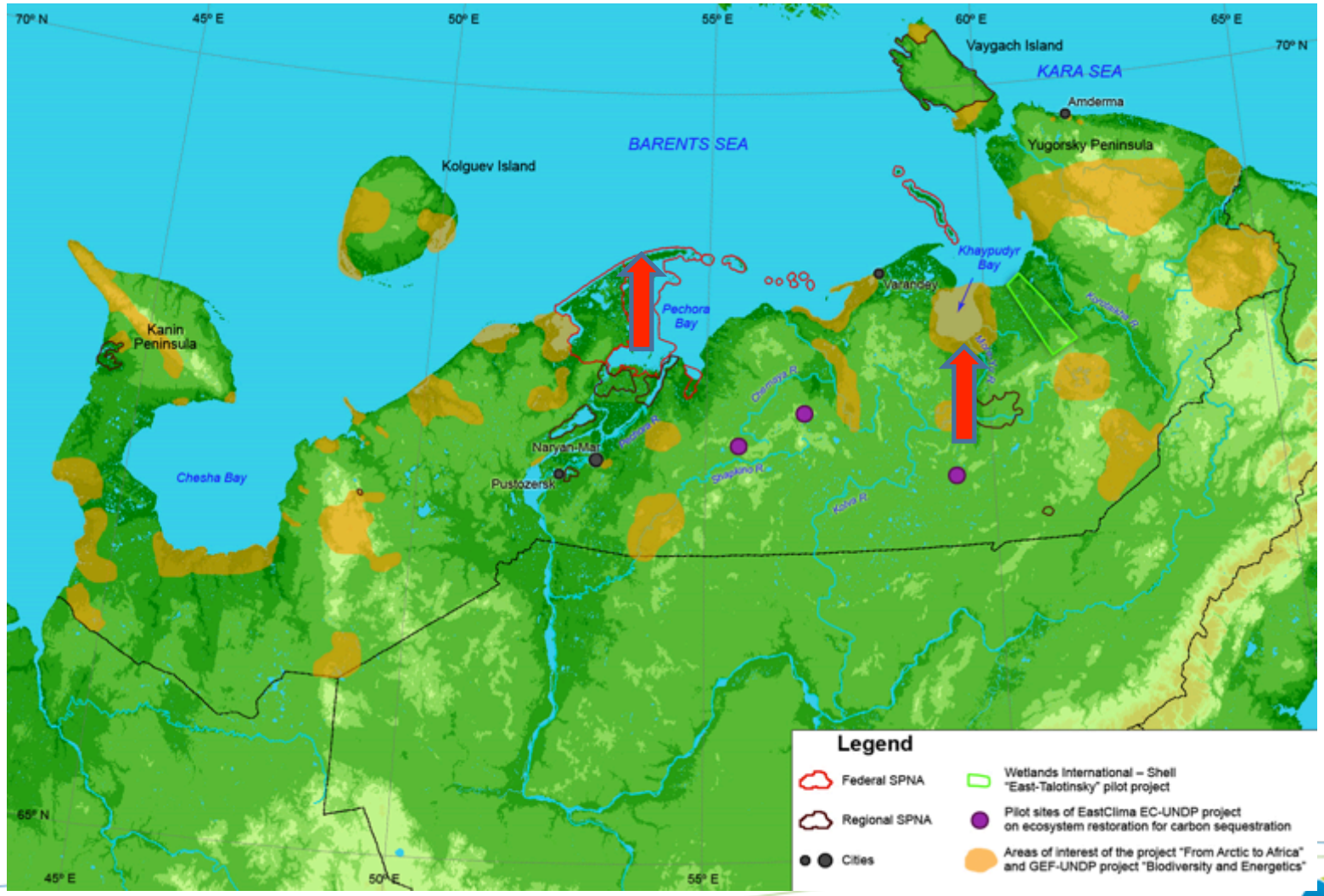
list of plant species with abundance characteristic (cover or number per sq.) – example with living forms



Living forms		Rank for stability
Herbaceous floating monocarpic	**I**	1
Herbaceous annual monocarpic	**II**	2
Cane root perennial herbaceous perennial polycarpic	**III**	3
Long rhizomatous herbaceous perennial polycarpic	**IV**	5
Tussock herbaceous perennial polycarpic	**V**	4
Brush root herbaceous perennial polycarpic	**VI**	4
Shrubs and dwarf shrubs	**VII**	5

Plans for study

We locate pilot where we have data



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- UNDP Komi
- Shell

Questions?

"We safeguard and restore wetlands for people and nature"

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