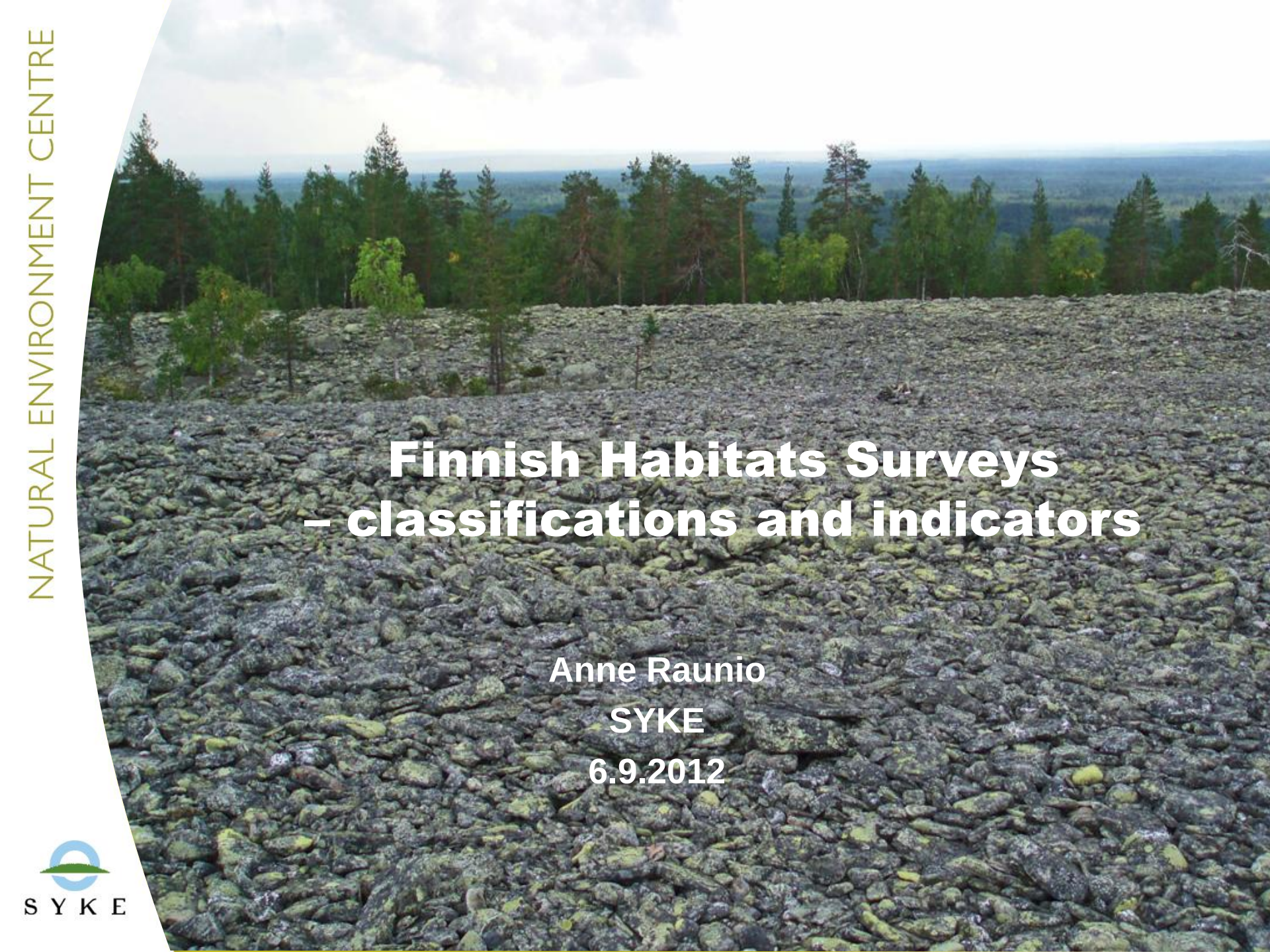

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Finnish Habitats Surveys – classifications and indicators

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Definition:

A habitat type means spatially definable land or aquatic area with characteristic environmental conditions (e.g. soil, climate, topography) and biota (composition of typical species and their abundances).

Contents:

- Needs of habitat data
- Habitat classification systems in Finland
- Existing habitat data
- Habitat indicators related to remote sensing and GIS

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Needs of habitat data

- International: Preparation of EU policies, implementation of Convention on Biological Diversity
  - Reports on conservation status of habitat types under Habitats Directive (every six years), Country Reports to CBD
- National: Legislation, decision-making on utilization of natural resources, nature conservation programmes etc.
  - Assessments of threatened habitat types
- Regional and local: Land use planning, environmental impact assessments, management and restoration plans
  - Identification of important habitat areas
- Types of data
  - How much? — Quantity data (area / number of occurrences)
  - What kind? — Quality data (habitat type specific structures and functions)
  - Where? — GIS data (location and outlining of habitat polygons)

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Habitat classification systems in Finland (1)

Classifications are usually hierarchic to third or fourth level:

1) Fell habitats 2) Mountain heaths 3) Oligotrophic mountain heaths 4) *Empetrum* mountain heaths

- Mires:
  - Highly developed classifications for both botanical and forestry purposes
  - Two classification scales: large-scale mire complexes (e.g. raised bogs) and small-scale mire site types (e.g. tall-sedge fens)
  - Mires include all habitat types on peatland (also wooded)

- Forests:
  - Forest site types based on plant communities; developed for forestry to represent fertility of sites
  - Some habitats important to biodiversity fit the system poorly (e.g. esker forests, alluvial forests)

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Habitat classification systems in Finland (2)

- Fell habitats:

  - Open alpine habitats above tree-line are special in fell area

  - Fell mires, rocks etc. can be classified according to corresponding habitat groups

  - Key elements for classification of open alpine habitats are altitude, depth and duration of snow cover and soil fertility

- Traditional rural biotopes:

  - Classification system was created in 1990s for nationwide inventory project

  - Key elements for classification are moisture, fertility and calcium content of soil as well as land use history

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Habitat classification systems in Finland (3)

- Coastal habitats of the Baltic Sea:

  - Heterogenous habitat group: detailed classification for some subgroups (e.g. dune habitats) only

  - E.g. succession series of forests on land uplift coast need further research for a detailed classification

- Rock outcrops and scree:

  - Classification based on abiotic features like rock type, steepness of slopes, exposure

  - Biological classification less developed; vegetation types often small-scale mosaic

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Habitat classification systems in Finland (4)

- Inland waters:

  - Lakes: both limnological and botanical classifications, but deficient vegetation data restricts use of the botanical classification

  - Typology of Water Framework Directive is coarse for biodiversity needs: key elements are e.g. size and depth of water bodies, humus content

  - Insufficient biological classification for streams and shores of water bodies

- Underwater habitats of the Baltic:

  - Development of classification began in 1990s when underwater habitat inventories were started

  - Development of classification is continued by HELCOM

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Comprehensive, hierarchical classifications covering all habitat groups

- **Nordic and European:**
  - Vegetation types of the Nordic Countries (Påhlsson [ed.] 1994, database www.norden.org): about 400 habitat types, mainly included in the following classifications
  - Palearctic Habitats, CORINE Biotopes, Natura 2000 natural habitat types, EUNIS habitats (database www.eunis.eea.eu)

- **Finnish:**
  - Toivonen & Leivo 1993: Vegetation type classification for vegetation mapping
  - Tuominen, Eeronheimo & Toivonen (eds.) 2001: General biotope classification for biotope mapping from aerial photographs
  - Raunio, Schulman & Kontula (eds.) 2008: Classification of habitat types and most common habitat complexes for assessment of threatened habitat types (381 habitat types at the lowest level on hierarchy)

Existing GIS data related to habitats (1)

- **Data on natural resources, land cover etc.**
  - Forestry: National Forest Inventory (GIS: Multi-source NFI), forestry planning data
    - biodiversity features: key biotopes, dead wood cubic volume
  - Water resources: state of surface waters, hydrology
    - biodiversity features: macrophytes, bottom fauna, fish fauna
  - Geological surveys: rock and soil types, geological formations, peat thickness
  - CORINE Land Cover (Finnish national data 25 m x 25 m): broad-leaved, coniferous and mixed forests on mineral soil, peat and rock; open mires etc. large scale habitats

± Nationwide data coverage → good backround data for biodiversity; more or less applicable for coarse scale habitat maps, area estimates and trend assessments when true biodiversity data is not available

Existing GIS data related to habitats (2)

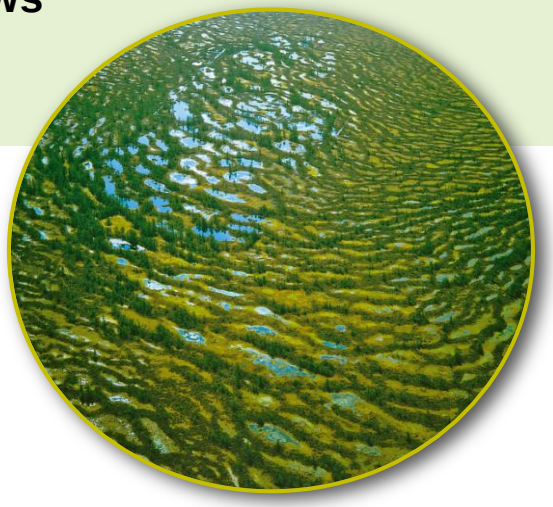
- **Habitat type data in terms of biodiversity**
  - Basic Data on Natural Habitat Types in Protected Areas (Metsähallitus): e.g. habitat types under Habitats Directive; small scale polygon data based on field inventories and/or aerial photographs
  - Nationwide data on significant habitat types (SYKE, Centres for Economic Development, Transport and the Environment, Geological Survey of Finland etc.):
    - Habitat types protected under Nature Conservation Act 29 §
    - Nationally valuable traditional rural biotopes
    - Nationally valuable rocky areas, moraine formations and aeolian sand and littoral deposits
    - Ditched and unditched peatlands, mire complexes, calcareous rock outcrops, underwater marine habitats (ongoing VELMU project)
    - Older data on nationally valuable old-growth forests, herb-rich forests, mires and eskers: general GIS data, but detailed attribute data not digital
  - Regional / local data (scattered, varying contents and quality): habitat data of municipalities, EIAs, research projects etc.

Habitat indicators related to remote sensing and GIS (1)

Features potential for remote sensing in **bold**

Examples of habitat types under the Habitats Directive

Habitat type	Habitat identification	State assessment	Challenges for remote sensing
Raised bogs (7110)	-**Structure of mire complex: morphology, topography** -**Mire surface micro-forms: hummocks and hollows**	**-Pressures: ditching, peat extraction** **-Gradual change (drying, overgrowth): tree and shrub coverage**	-Recognizing more detailed mire habitat types -Understanding mire hydro-logy based on mire surface topography gradients (airborne laser scanning)



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Habitat indicators related to remote sensing and GIS (2)

Habitat type	Habitat identification	State assessment	Challenges for remote sensing
Coastal dune types (2110, 2120, 2130, 2140, 2180, 2190, 2320) and Baltic sand beaches (1640)	**-Soil type and topography: sand, dune formations** **-Vegetation coverage and height: bare sand / moss-lichen / grass-herb / dwarf shrub / tree** → **dune succession series**	**-Eutrophication, overgrowth: trees, saplings, shrubs, reed** -Species of sunny and dry habitats: plants, insects	-Sand beaches often small-scale and narrow (edge pixels) -Distinguishing sand from gravel beaches

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Habitat indicators related to remote sensing and GIS (3)

Habitat type	Habitat identification	State assessment	Challenges for remote sensing in forests in general
Mountain birch forests (9040)	**-Tree canopy coverage** (min 10 %) -**Tree species** (mountain birch min 70 %) -**Tree canopy height** (min 2 m)	**-Condition of ground vegetation (lichens) on reindeer pastures (sparsely wooded)** **-Mountain birch forest area damaged by herbivorous moths**	-Features under tree canopy are often important: coarse woody debris, ground vegetation -Features representing forest naturalness: multi-layered canopy with natural gaps etc. -Recognizing important tree species like aspen and hardwood species **-Airborne laser scanning (ALS, LiDAR) is promising technology for forests and many other habitat groups**
Alluvial forests (91E0)	**-Location: along rivers and lakes, low topography** **-Tree species: mostly deciduous** **-Forest sites under flooding water**	**-Interval, duration and extent of floods** -Flood-influenced vegetation and plant species	


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Conclusions:
- Significant proportion of habitat features have potential for remote sensing
- Biodiversity is often small-scale and needs special applications
- Much call for established remote sensing methods for operational biodiversity mapping and monitoring
Thank you for your interest!
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