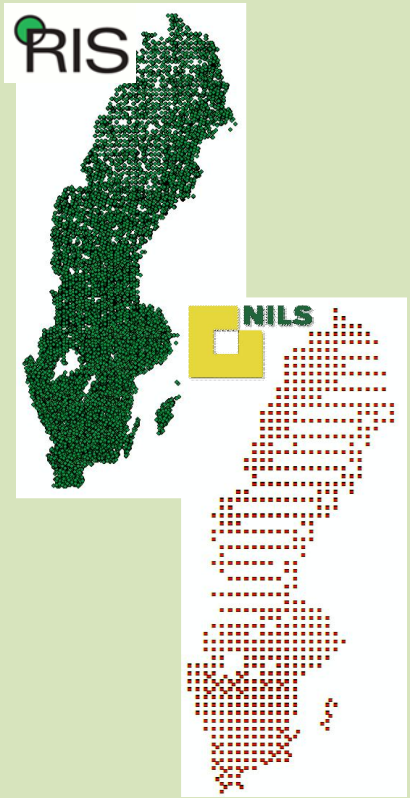
LIFE08 NAT/S/000264
MOTH - Demonstrating an integrated North-European system for monitoring terrestrial habitats

Åsa Hagner, SLU
Field manager

Sweden 41 000 000 ha
Coast 2 400 km (0.16%)

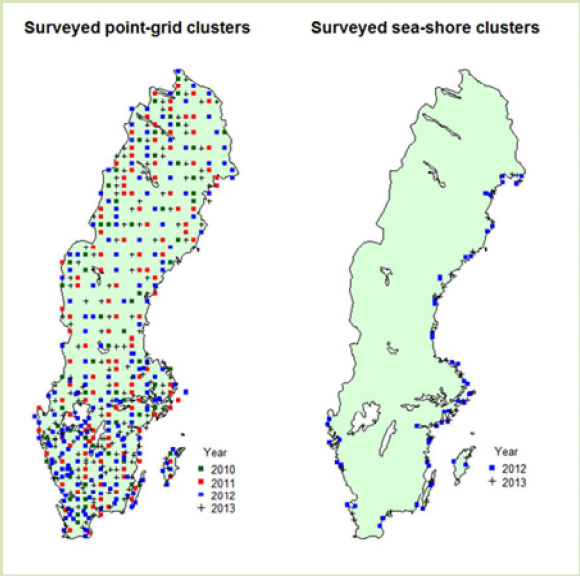
Life+ MOTH (2010-2014)



- Complementary
- Random sampling
- Two phase-design: interpretation + field visit

- Estimation of areal coverage, distribution and conservation status of terrestrial (less frequent) Natura 2000 habitats

- Combining results



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Monitoring Terrestrial Habitats (MOTH)
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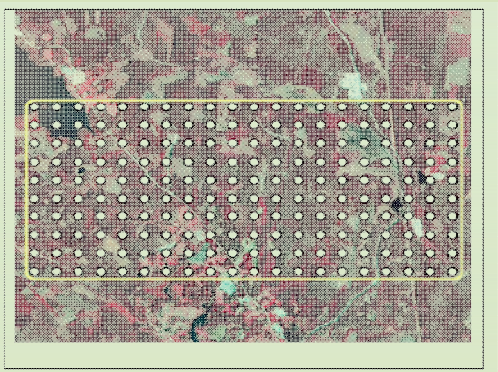
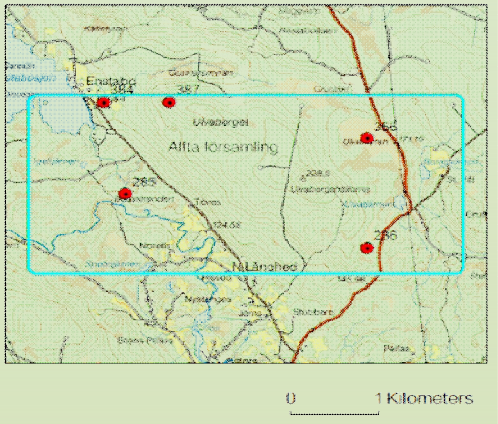
Two-phase sampling

MOTH General habitat inventory:

A cluster of 200 grid-points (5 x 2.1 km)

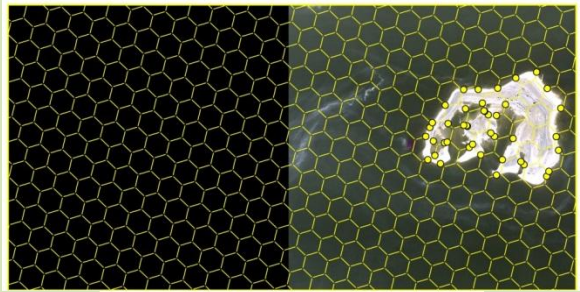


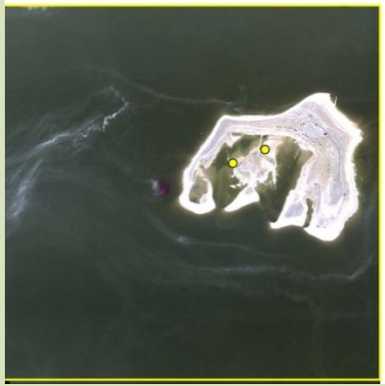


- First step: Aerial interpretation
  - Manual classification of each grid point/line-intercept using aerial infra-red images.
  - No help from ground data.
  - The aim is to divide the grid points/intercepts into broad habitat AI-classes
- Second step: Field survey
  - A proportion is randomly selected from each AI-class. The proportion differs between classes.
  - Selected plots are surveyed in the field. All plots all classified in the field and a number of status variables is measured.
- Analyses: Estimation of coverage and status .

MOTH Seashore inventory:

Line-intercepts, of approx. 300 lines (5 x 2,5 km)





Before:

- Images
- Manuals
- Equipment
- Protocols

- Databases
- Software

- Principles for phase-2 selection

- Employing field staff

During data collection:

<u>General habitat inventory</u>:

- Phase-1: approx. 230 working days by 6-7 interpreters (dec-apr)
- Phase-2: 10 field teams, 14-16 weeks incl. training

<u>Seashore inventory</u>:

- Phase-1: approx. 60 working days by 2-3 interpreters (may-june)
- Phase-2: 4 field teams, 5-6 weeks incl. training

<u>Support</u>:

- Throughout the surveys (phase-1, dec-june + phase-2, may-sept)

Afterwards:

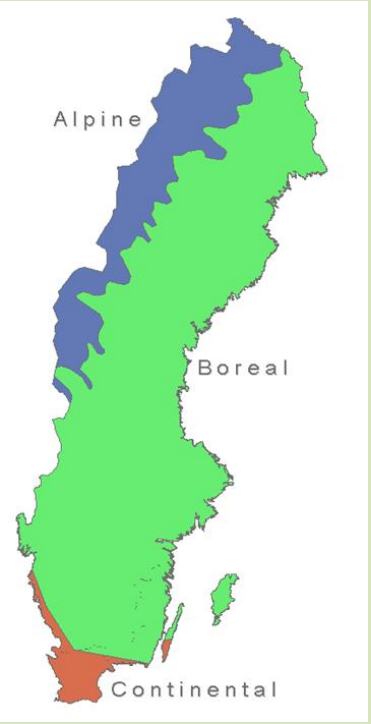
- Data-management
- Quality-control and assessment

- Analyses

- Reporting

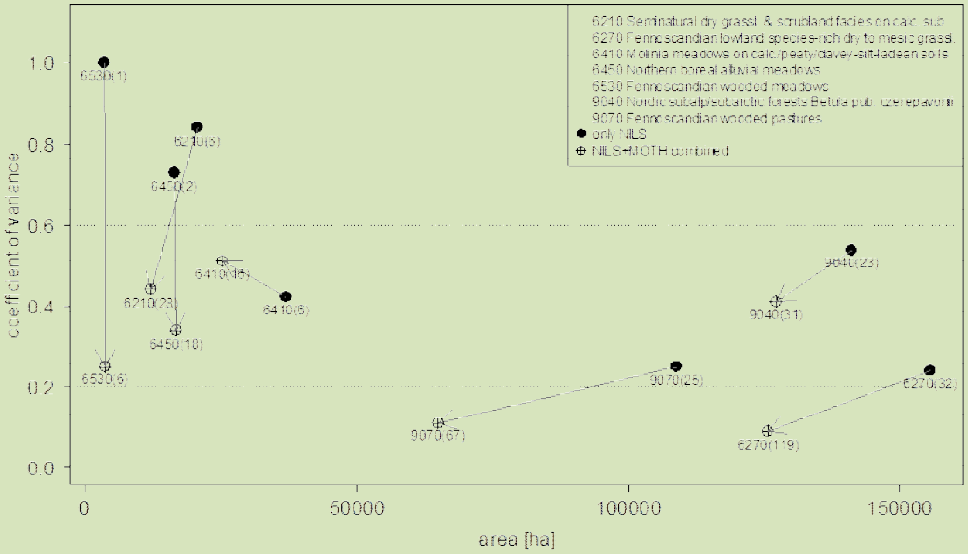
Life+ MOTH General habitat inventory: Combining results

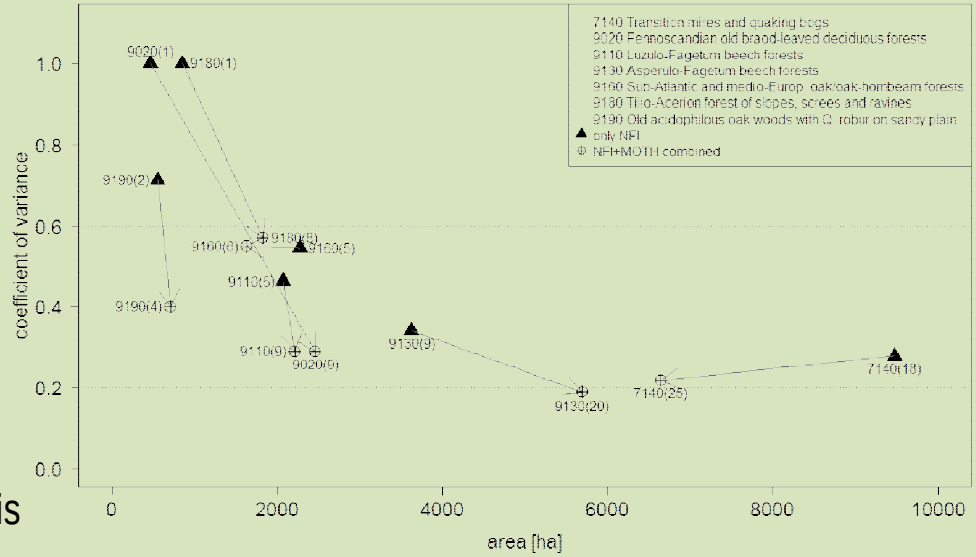
Coverage versus accuracy of the estimation



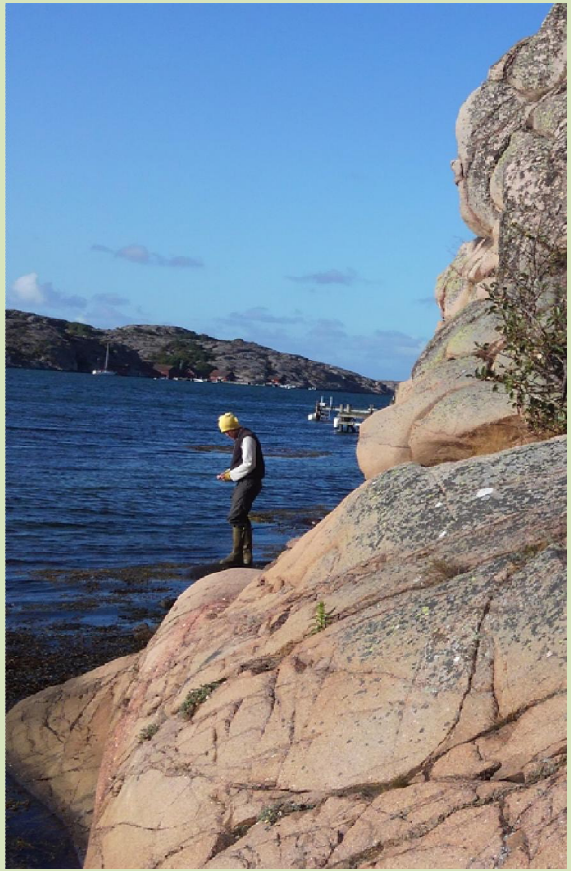
Boreal region:
Estimates based on NILS (2008-2012) versus combined estimates of NILS and MOTH (2010-2012)

Continental region:
Estimates based on NFI (2008-2012) versus combined estimates of NFI and MOTH (2010-2012)





Note: different scales on x-axis



Life+ MOTH Seashore inventory

Shore type (phase 1)	Total (km)	%	Exploited (km)	Exp. %
Rock	17 095	41,7%	1 109	6%
Boulder/gravel	11 018	26,9%	2 046	19%
Sand	3 313	8,1%	877	26%
Meadows/wetlands	6 191	15,1%	1 448	23%
Constructed*	3 357	8,2%	3 013	90%
Total Swedish seashore:	40 975 km		8 492 km	21%

*All constructed types are ”exploited”

Exploitation: according to distance to roads, houses, power-lines etc

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Life+ MOTH Seashore inventory:

Results based on 100 PSU, 6915 line-intercepts and 466 field transects:

Code		2012 data -> +2013 data
	Seashore area:	63 000 ha -> 64 000 ha
1230	Veg. seacliffs	33 000 ha -> 24 200 ha
1330	Saline meadows	1 300 ha -> 1 500 ha
1630	Baltic meadows	7 800 ha -> 9 900 ha
9030	Land upheaval forests	16 100 ha -> 17 100 ha
(1640)	Sandy beaches	2 900 ha -> 3 400 ha
(2100)	Dune habitats	2 000 ha -> 4 800 ha

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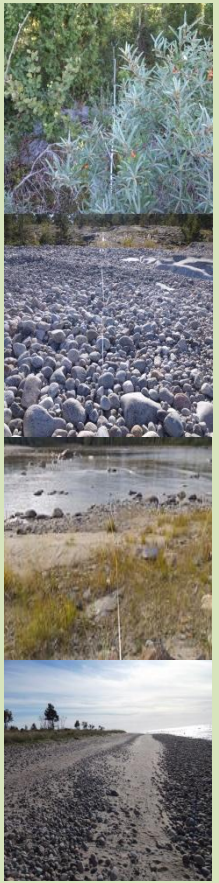
LIFE+ MOTH (2010-2014)

SLU, inst. för skoglig resurshushållning:
Hans Gardfjell, projektledare
Linda Ågren, ekonomi
Åsa Hagner, fältkoordinator
Helena Forsman, flygbildstolkning koord.
Sven Adler, analytiker
Henrik Hedenås, analytiker

SEPA, Naturvårdsverket:
Johan Abenius
Conny Jacobson



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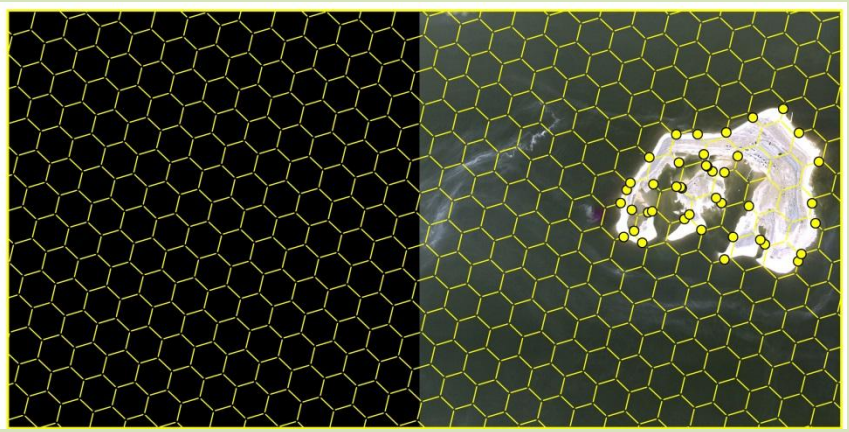
Life+ MOTH Seashore inventory



Selective lines:

- Approx. 300 lines per area
- Interpretation: Starting point Shore type, Coastal type, Habitat above the shore

Selection classes:

- Combination on interpretated classes
- random sampling

Transects :

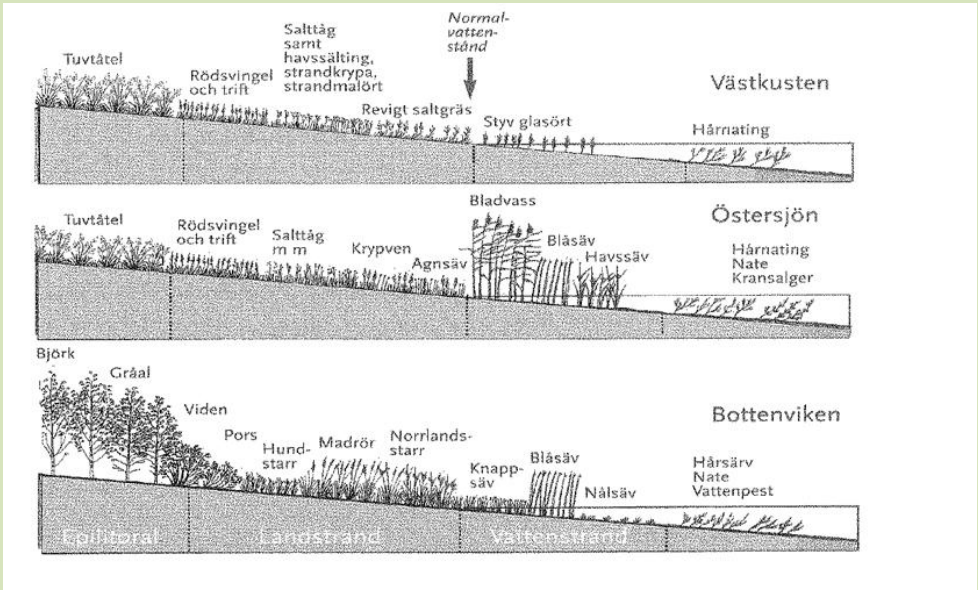
- 10m-wide in field

- From the mean seawater level throughout the supralitoral zone
- + connected N2k-habitat (if of interest)

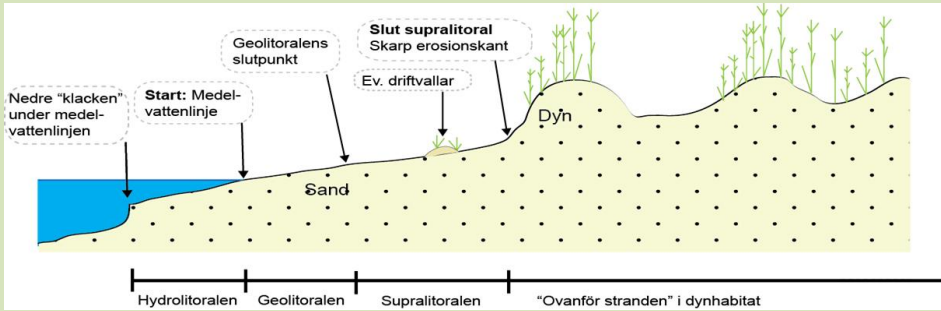
- Field sampling: detailed description, habitat classification, photos

Structures and species composition:

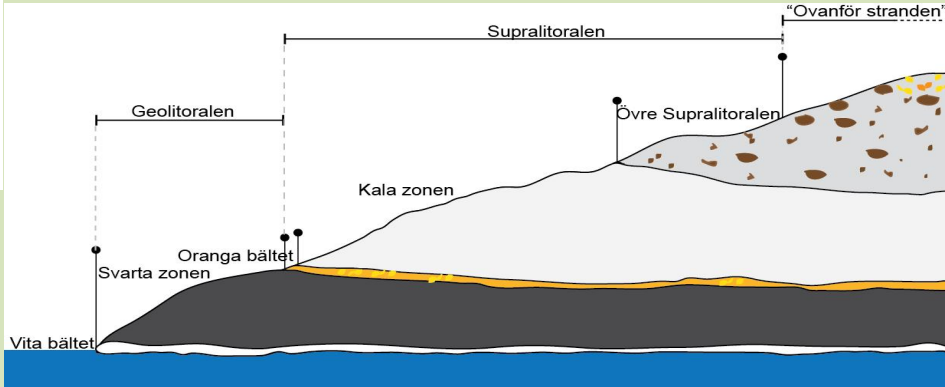
Seashore meadows:



Sandy shores:

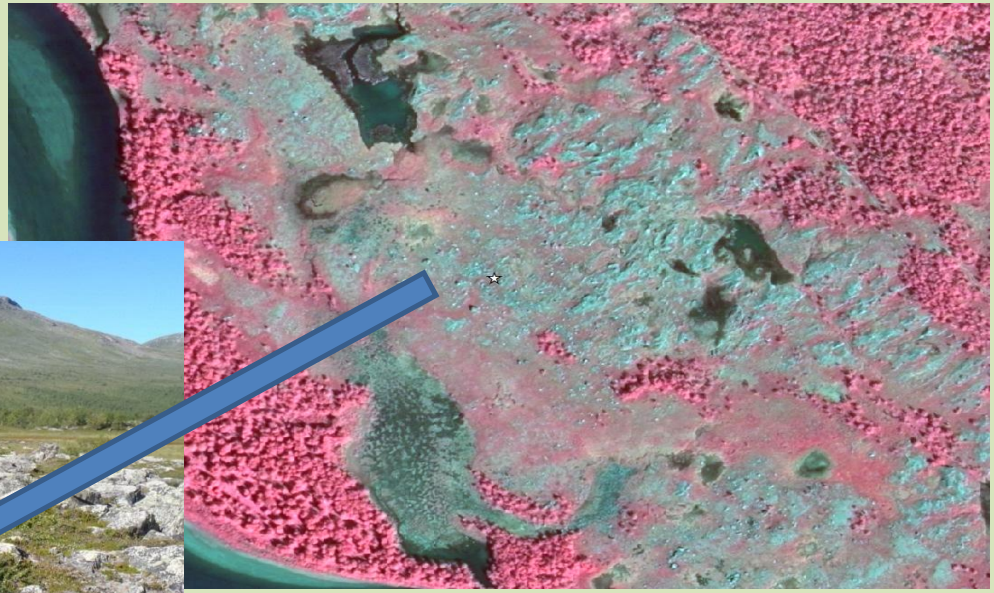


Rocky shores:



Archives of images

- Photos from each site



Life+ MOTH

- Complementary (to NFI and NILS)
- Random sampling
- Two phase-design: interpretation + field visit

- Combining data from MOTH with data from NFI and NILS
- Estimation of coverage, distribution and status of (less frequent) Natura 2000 habitats

General habitat inventory:

- 565 primary sampling units á 5 x 2,1 km: 110 814 interpreted grid-points, 5976 points selected for field survey

Seashore inventory:

- 250 primary sampling units á 5 x 2,5 km
- 5-year rotation
- 50 sampling units yearly
- 2012+2013 = 100 units: 6915 lines and 466 field transects:

Combined assessment from different sampling designs

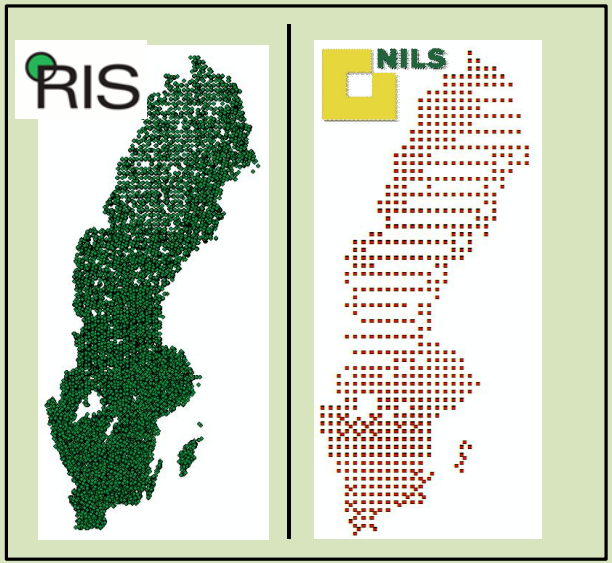
Data collection in known sites	Two-phase sampling	Random sampling
•The only(?) approach for rare habitats and species	•LIFE+ MOTH •Useful for habitats and with low areal coverage	•NFI, NILS •Useful for abundant habitats and species
•*Riparian mixed forest of Quercus robus (91F0, ~15 known sites in Sweden)* •*Redlisted species*	•*Many hard-wood forest habitats (9110, 9160 etc.)* •*Low abundant, but habitat specific species*	•*Coniferous old growth forests (taiga 9010), subalpine birch forests (9040)* •*Vaccinium myrtillus*
•*Most likely biased estimates* •*Efficient to detect a decline, but difficult to detect establishment*	•*Unbiased estimates* •*Complicated designs* •*Necessary to a priori define specific target habitats or species*	•*Unbiased estimates* •*Simple computations* •*General sampling program - can most likely be adapted to future requirements*

Rare Infrequent Common

MOTH Objectives

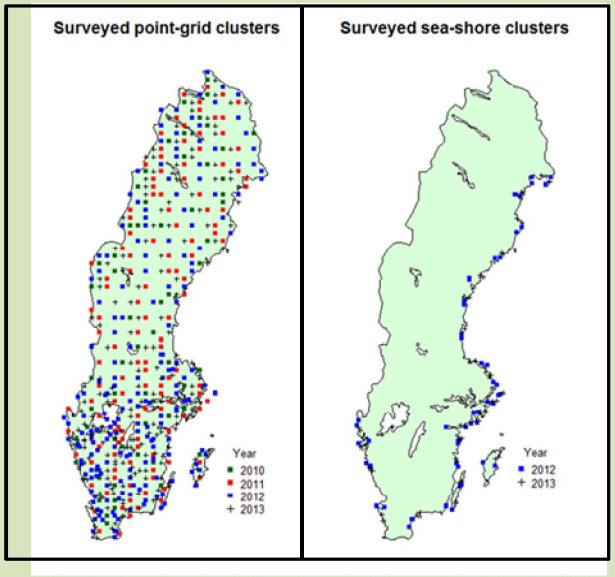
- Analyze NILS and NFI data
  - NILS - focus on alpine and grassland habitats
  - NFI - focus on forests and wetlands (mires)
- Collect and analyze data with two-phase methodology
- Develop methods for coastal habitats
- Combine MOTH data with NFI/NILS data
- Delivery of data to Species centre / Swedish EPA 2013

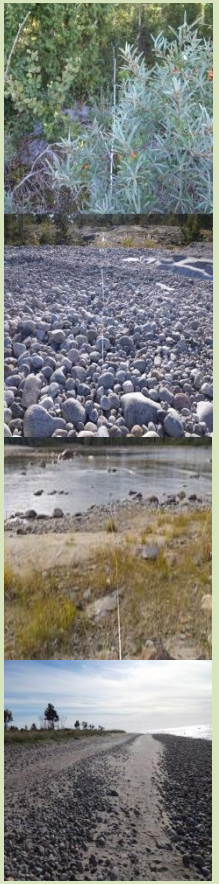
Ongoing Swedish monitoring programmes:



LIFE+ MOTH

(2010-2014)





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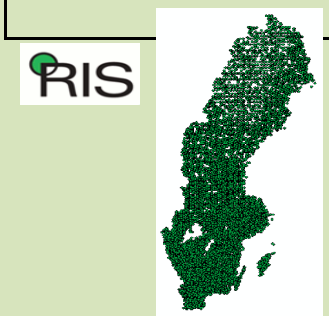
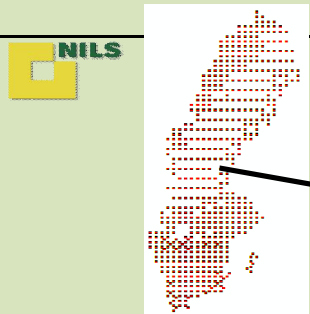
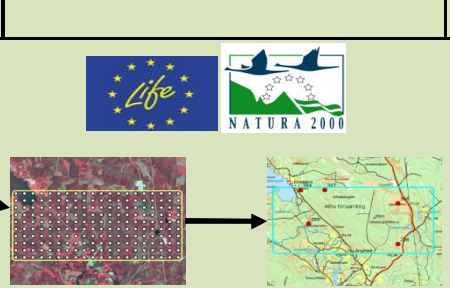
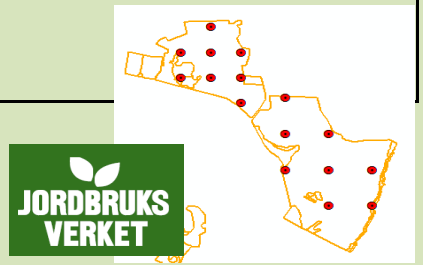
Sources of information for Natura 2000 habitats

NFI – National Forest Inventory	NILS – National inventory of landscapes in Sweden	MOTH – monitoring of terrestrial habitats	Ängs- och betemarks-uppföljning
Forests and wetlands	All terrestrial habitat types	Collecting data for less-frequent Natura 2000 habitats.	Grasslands and grassed shoreslines
Field inventoring, Random sample	Field inventoring, Random sample	Stratified sampling: Interpretation of infra-red digital aerial images combined with field inventoring	Field inventoring, Random sample from TUVA-database
39126 terrestrial plots (60% permanent) 5-year interval	6455 terrestrial permanent plots 5-year interval	Approx. 10000 field plots inventoried in cooperation with NILS. 5-year interval	2544 plots. Inventoried by NILS-personnel









Indicator species for wetlands:

Vetenskapligt namn	Svenskt namn	Söder	Norr
Bartsia alpina	Svarthö	1	1
Carex appropinquata	Tagelstarr	1	1
Carex capillaris	Hårstarr	1	1
Carex capitata	Huvudstarr		1
Carex flacca	**Slankstarr**	1	
Carex flava coll.	Knagglestarrgruppen	1	1/3
Cypripedium calceolus	Guckusko	1	1
Dactylorhiza incarnata coll.	Ängsnyckelgruppen	1	1
Eleocharis quinqueflora	**Tagelsäv**	1	1
Epipactis palustris	**Kärrknipprot**	1	
Equisetum scirpoides+variegatum	Tråd-/smalfräken	1	1
Eriophorum latifolium	**Gräsull**	1	1
Gymnadenia conopsea	Brudsporre	1	1
Listera ovata	Tvåblad	1	1
Ophrys insectifera	Flugblomster	1	1
Parnassia palustris	Slåtterblomma	1	
Primula farinosa	**Majviva**	1	1
Schoenus ferrugineus	**Axag**	1	1
Selaginella selaginoides	Dvärglummer	1	1/3
Tofieldia pusilla	Björnbrodd		1/3
Calliergon giganteum	Stor skedmossa	1	1
Campylium stellatum	**Guldspärrmossa**	1	1/3
Catoscopium nigritum	Svartknoppsmossa	1	1
Cinclidium stygium	Myruddmossa	1	1/3
Cratoneuron filicinum	Källtuffmossa	1	1
Leiocolea rutheana	Praktflikmossa	1	1
Meesia triquetra	Trekantig svanmossa		1
Meesia uliginosa	Svanmossa		1
Moerckia hibernica	Kärrmörkia	1	1
Paludella squarrosa	**Piprensarmossa**	1	1/3
Palustriella commutata+decipiens+falcata	**Tuffmossor**	1	1
Preissia quadrata	Kalklungmossa	1	1
Scorpidium cossonii	**Späd skorpionmossa**	1	1
Scorpidium scorpioides	Korvskorpionmossa	1	1/3
Tayloria lingulata	Kärrtrumpetmossa		1
Tomentypnum nitens	**Gyllenmossa**	1	1/3

Sum:
>3 points =
”rich” habitats

<3 points =
poor habitats

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