Monitoring coastal marine shores

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THUF Seashore inventory

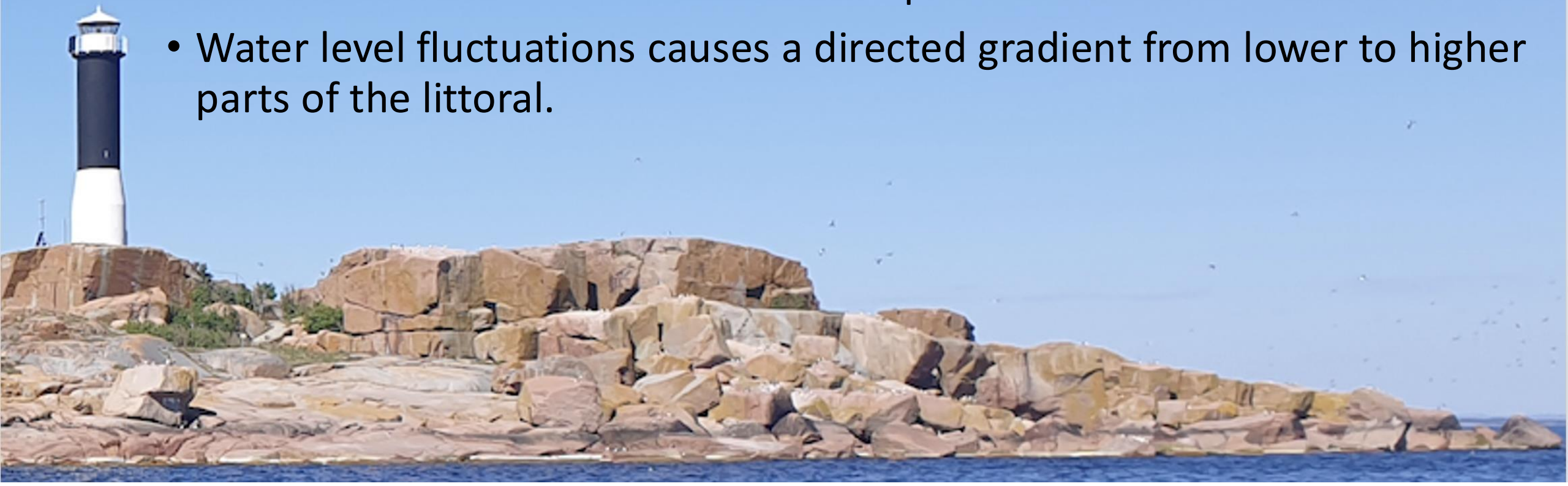
- Started 2012
- The inventory is financed by the Swedish EPA
- The primary goal of the inventory is to provide data on coastal habitats to the assessment of the European Habitats Directive
- Distribution, coverage, and condition
- Statistical precision
- Efficient trend analysis
- However, the inventory is designed to be a broad and general inventory of the coastal environment

Swedish marine coast

- Coast line 45 000 km
- Average width is 13 meters
- Area marine shores 60 000 hectares = 0.15% of total land area
- 10 coastal habitats
  plus 7 coastal dune habitats

Coastal habitats are different! There are some inherent traits connected to seashores that made it necessary to develop or adapt new sampling protocols.

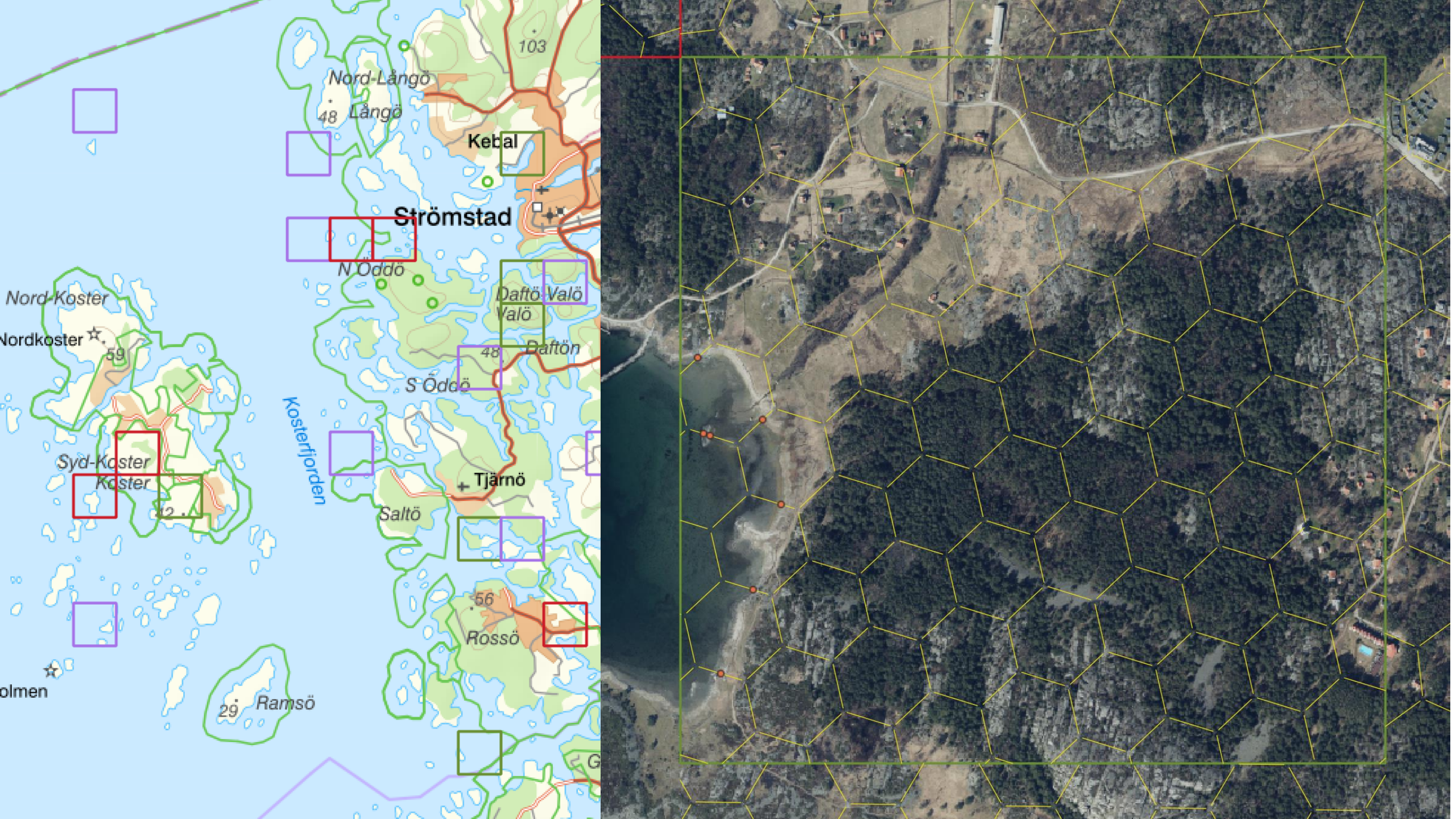
- Coastal habitats ’moves’. Erosion, relocation of sand and gravel, sedimentation, landupheaval processes, and exploitation moves the shore line and the coastal habitats in space.
- Water level fluctuations causes a directed gradient from lower to higher parts of the littoral.



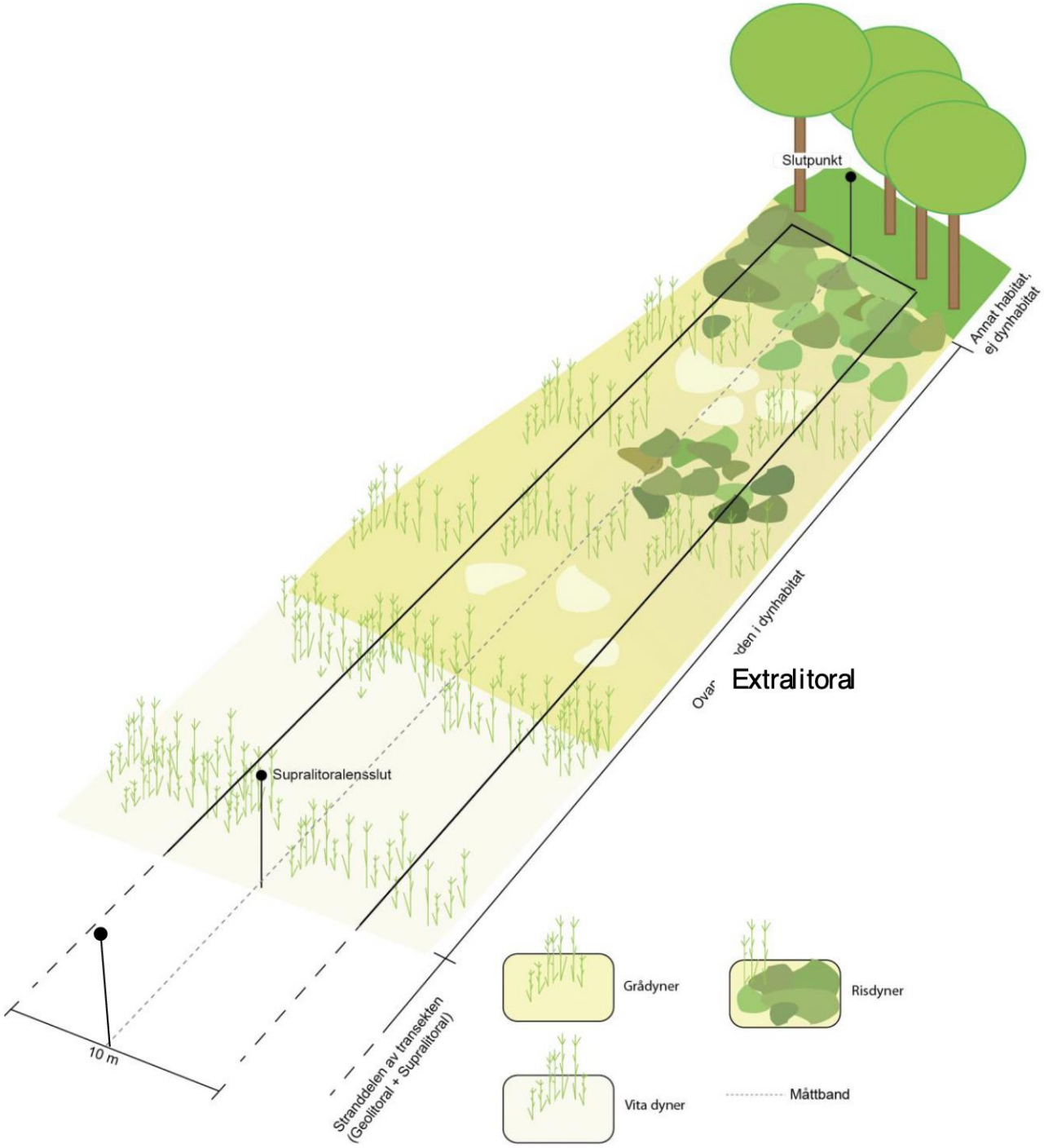
How to choose the best surveying method?

What options were available? We already knew that ’traditional’ random sampling designs (NILS, NFI) wasn’t efficient enough.

- Wall to wall survey using remote sensing
  - If it works, remote sensing can be adapted for one or a few variables. Land cover, land-use, and is some cases habitats. It gives no detailed information on biodiversity of species, and more detailed status variables
  - Aerial imagery (RGB, IR) are detailed, but needed manual interpretation. A survey and classification of the whole marine costal areas would be time cosnuming and costly
  - Satellite sensor resolution was at the project onset poor (Landsat 30 m pixels), but even with todays Sentinel 2 (10 m pixels) the resolution is low. Most coastal habitats are more narrow than a single pixel.
- Traditional permanent stations
  - Subjective choosen plots,
  - Common in marine and terrestrial monitoring
  - ’Suitable’ for trend analysis
  - No reliable information on total coverage and distribution
- Multi-stage sampling design
  - A combination of remote sensing in the first stage, with field sampling in the second
  - Line-intercept sampling in aerial images
  - Field sampling in 10 meter belts (transects)
  - Complex design with four sampling intensities, spatially balanced sampling of clusters, coordination of field transects


103
Nord-Långö
48
Långö
Kebal
Strömstad
N Öddö
Daftö Valö
Valö
Daftön
48
S Öddö
Nord-Koster
Nordkoster
59
Kosterfjorden
Syd-Koster
Koster
Tjärnö
Saltö
56
Rossö
olmen
29
Ramsö

- 10 meters wide transects (belt)
- Geolittoral och supralittoral
- Dunes, seacliffs, land upheaval forests, and fossile shingle shores that extends above the supralittoral are also surveyed
- Typical field variables
  - Habitats
  - Plant species, shrubs, trees
  - Land use
  - Substrate
  - Drift-lines
  - Litter
  - Photos



Koster (Swedish west coast)

- Transect located on an island
- Total transect length 84 meters (59 m geo littoral, 25 m supra littoral)
- Grazed salt meadow
- Sheep and geese grazing
- Traces of shrub removal noted

- Salt meadow, including patches of Salicornia mud
- 20 (mainly) vascular plants registered (from a list of 212). Three species were counted. Several grazing adapted species.
- One drift-line, mainly algae
- 1 dm fishing net

Coverage (2021-2024)

habitat	name	n_psu	n_transects	coverage_km2	CV
1220	Vegetated shingle (incl morain shores)	273	537	146	13%
1230	Sea cliffs	257	600	303	13%
1310	Salicornia mud	29	50	3	38%
1330	Atlantic salt meadows	71	135	30	30%
1630	Baltic coastal meadows	207	486	109	12%
1640	Sandy beaches (east coast only)	106	302	8	15%
2100	Dune habitats (coll.)	96	200	74	24%
9030	Land upheaval forests	96	203	141	16%
	Islets		392		
	Reed beds (at least 10 meters)		440		
	Transect without Annex I		260		

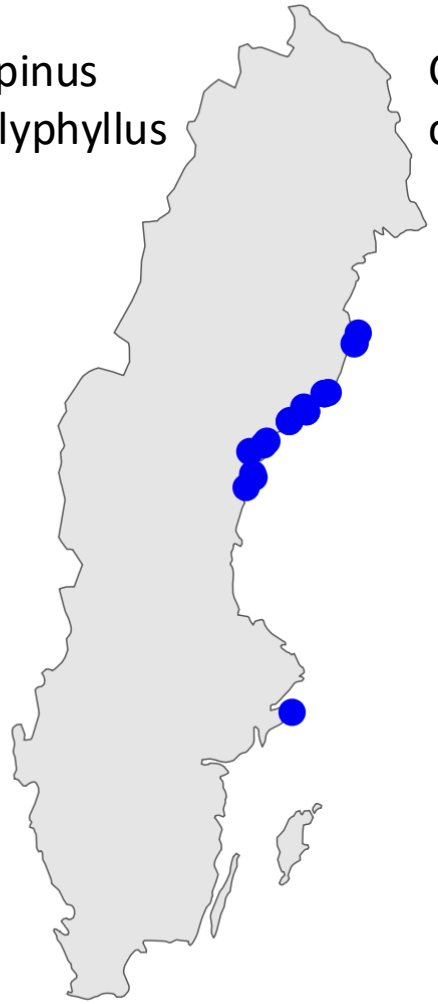
Condition

habitat	name	coverage high	coverage low	proportion low
1220	Vegetated shingle (incl morain shores)	100 (14%)	46 (27%)	32%
1230	Sea cliffs	264 (14%)	40 (21%)	13%
1310	Salicornia mud	2.5 (43%)	0.4 (59%)	13%
1330	Atlantic salt meadows	23 (35%)	7 (51%)	23%
1630	Baltic coastal meadows	66 (15%)	43 (19%)	40%
1640	Sandy beaches (east coast only)	6 (19%)	2 (18%)	23%
2100	Dune habitats (coll.)	43 (30%)	31 (40%)	42%
9030	Land upheaval forests	111 (18%)	29 (24%)	21%

Exploitation (buildings, roads, infra structure), negative land use, alien species, high shrub overgrowth

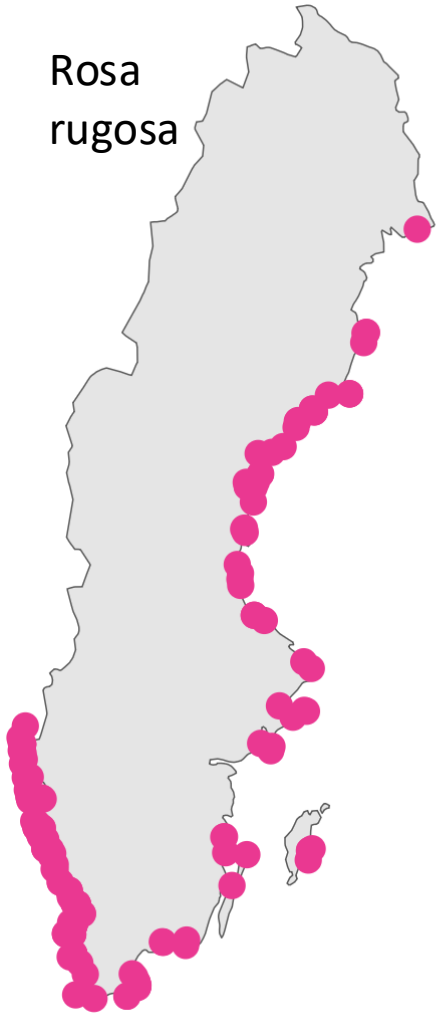
Alien species

Lupinus polyphyllus



Cotula coronopifolia

Rosa rugosa



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Aster tripolium

- Detailed information are collected for a subset of the species
- Individual count. Flowering and vegetative individuals (but not seedlings)
- 32,7 million individuals (2015-2019)
- Gives opportunity to follow trends in population size

Plastic bottles

- Litter and trash
- Number, length or size
- Count of plastic bottles

- 166 000 plastic bottles annually (2018-2020)
- On the Swedish shores in july-aug each year

Future

- Drone imagery
  - Detailed overview of vegetation and functional groups
  - Allows for change analysis if repeated
  - Calibration data for future models
- Satellite based time-series from known sites
  - Seashore transects
  - Other known sites
  - Modelling time series for vegetation cover, shrubs
- (Habitat recovery or degeneration in relation to sea level changes)