Swedish work with new monitoring solutions

- remote sensing
- DNA methods

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Swedish Agency for Marine and Water Management

Remote sensing
- infrastructure in Sweden

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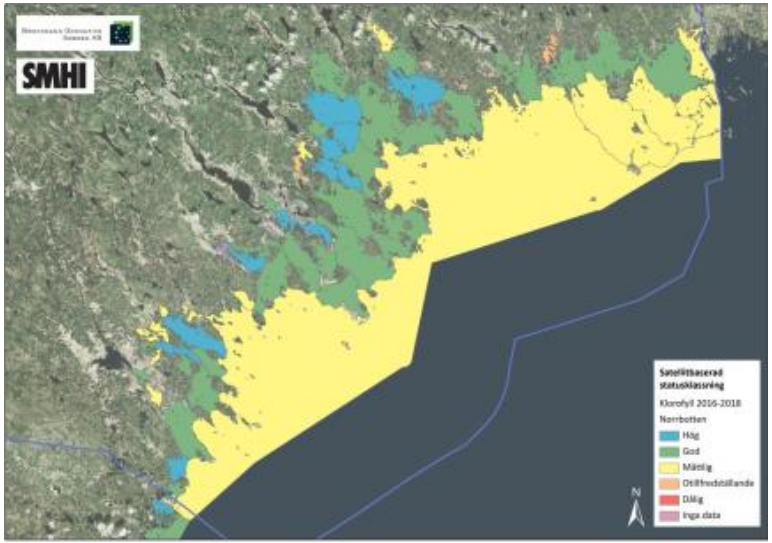
- Swedish National Space Agency (Rymdstyrelsen) - responsible for state financed national and international space activity in Sweden concerning science and development.
  - National authority interaction concerning Copernicus
- SMHI – monitoring of algal blooms (+ a lot of applications not concerning monitoring of water)
- Several private actors …
  - development, water quality, morphology



Monitoring of water quality using satellite

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- Research- and development focused on monitoring water quality using satellite have been performed for Swedish lakes and coastal water.
- Concentrations and trends in chlorophyll, secci depth, suspended material and humic substances (CDOM).

http://vattenkvalitet.se/statusklassificering/

https://www.havochvatten.se/hav/samordning--fakta/kartor--gis/karttjanster/karttjanster/satellitbaserad-statusklassning-av-sveriges-kustvattenforekomster.html

Baltic sea Algae Watch System

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Alger

SMHI utför året om regelbundna algprovtagningar från fartyg med efterföljande mikroskopanalyser vid ett antal fasta stationer för att se vilka arter som återfinns i Östersjön och Västerhavet. Satellitbilder används för att uppskatta den generella utbredningen av algblomningar sommartid.

Algblomningar från satellit

Arkivet innehåller kartor över ytansamlingar av alger detekterade från satellit. Produktionen har sedan startåret 2002 varierat över tid och utseendet på kartorna är därför inte homogent mellan åren. De dagliga kartorna ackompanjeras av en beskrivande text.

År

2018

Typ av bild

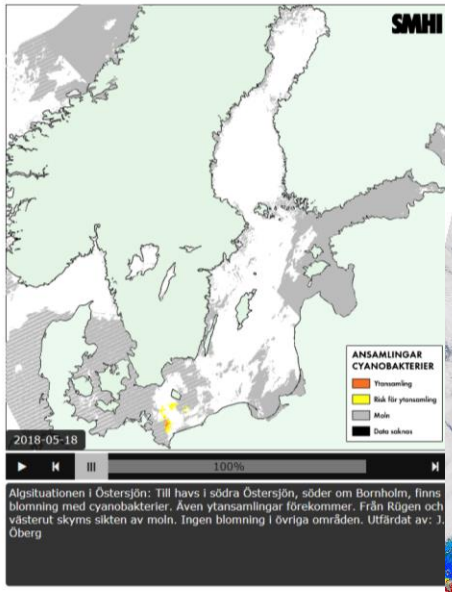
- Daglig översikt
- Veckosammanställning

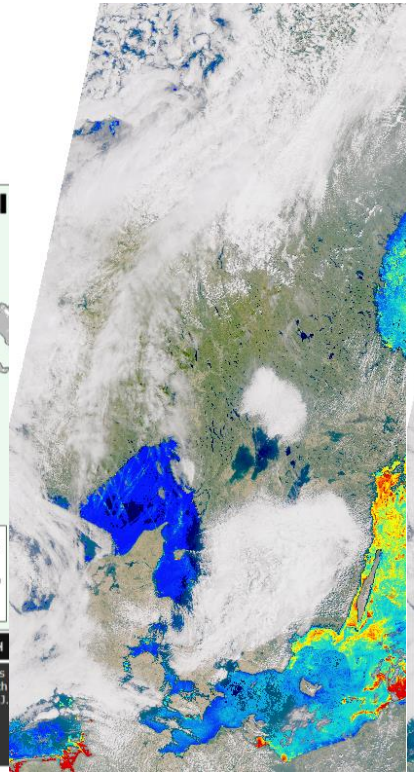
Språk/Language

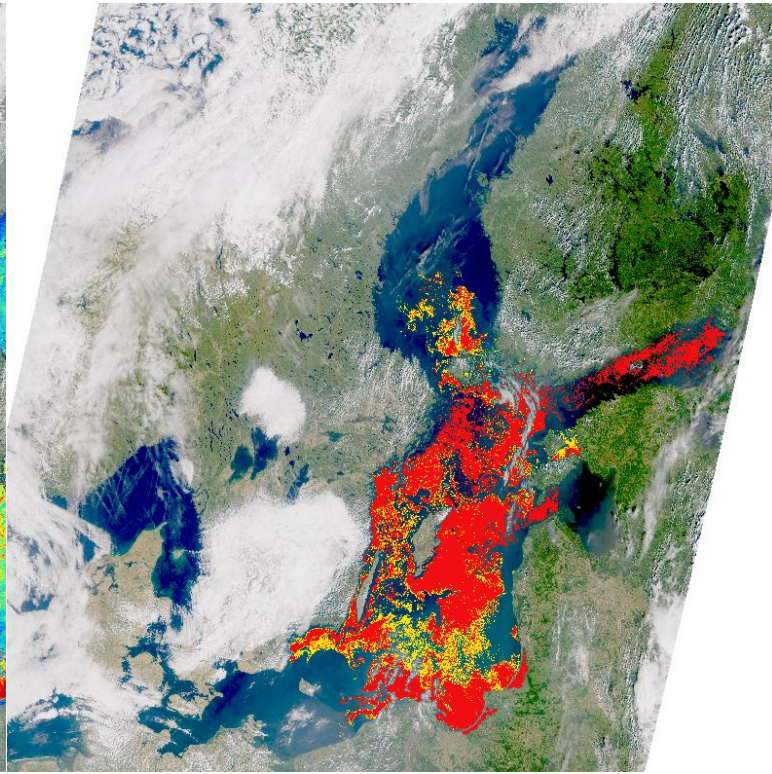
- Svenska
- English

Dagliga kartor (png) med tillhörande texter (json), alternativt veckosammanställningar (png) kan laddas ner för ett år i taget.

Ladda ned







Satellite image analysis to monitor vegetation in coastal waters (2014)

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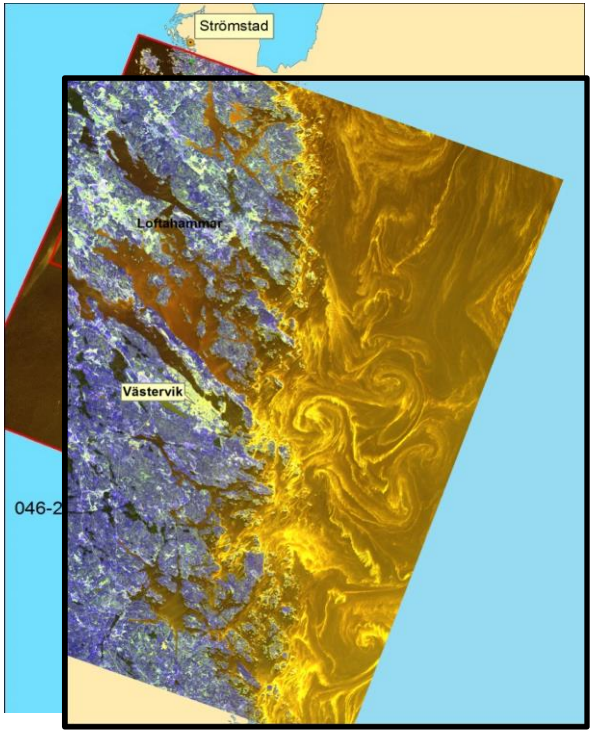
SPOT5-pictures from SACCESS

- 10 x10 meter (multispectral).
- 4 bandwiths (green-yellow, orange-red, NIR, SWIR)

Problems

- Clouds
- Blooms of cyanobacteria
- Filamentous algae covering the seabed



Unmanned aircraft systems help to map aquatic vegetation

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- Identification and cover of vegetation stands in rivers and lakes
- Frauke Ecke, SLU
- Conclusions: The tested UAS facilitates lake and river vegetation identification and mapping at the species level, as well as abundance estimates.

Mapping of physical impact in Swedish coastal waters

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- Project financed by SwAM performed by DHI och METRIA 2017-2018
- Satellite and geographic information system
- Surface covering mapping of exploitation and physical impact
- Harbours, piers, dredging, deposition of mud masses etc

Impact zones and accumulated impact

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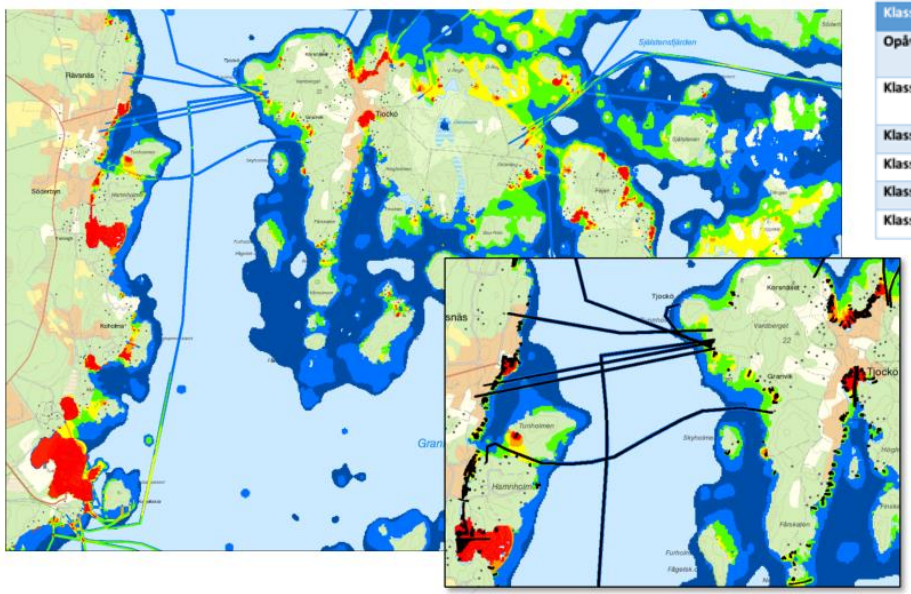
Accumulated impact on morphological status



Klass	Beskrivning	Färgkod
Opåverkat	Det finns inga tecken på någon fysisk påverkan på de hydromorfologiska processerna	
Klass 1	Fysiska påverkanstryck har trolig effekt på processerna men dessa effekter är försumbara	
Klass 2	Påverkan är troligen mätbar men påverkan på habitatnivå är troligen försumbar	
Klass 3	De förändrade processerna ger troligtvis en mätbar förändring på habitatnivå	
Klass 4	De förändrade processerna ger troligtvis en stor förändring på habitatnivå	
Klass 5	Områden med denna klasstillidelning har troligtvis helt onaturlig bottenmiljö	

- https://www.havochvatten.se/hav/fiske--fritid/miljopaverkan/fysisk-paverkan/kartlaggning-av-fysisk-paverkan-av-vattenmiljon.html

National land cover database

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Use data from Copernicus Sentinel 2 och national data (eg LIDAR)

Forest	Wetland	Arable land	Open land	Artificial areas	Water

NATUR VÅRDS VERKET – SWEDISH ENVIRONMENTAL PROTECTION AGENCY

MSB – Swedish Civil Contingencies Agency

SCB – Statistiska centralbyrån, Statistics Sweden

SKOGSSTYRELSEN – SWEDISH FOREST AGENCY

TRAFIKVERKET – SWEDISH TRANSPORT ADMINISTRATION

SLU

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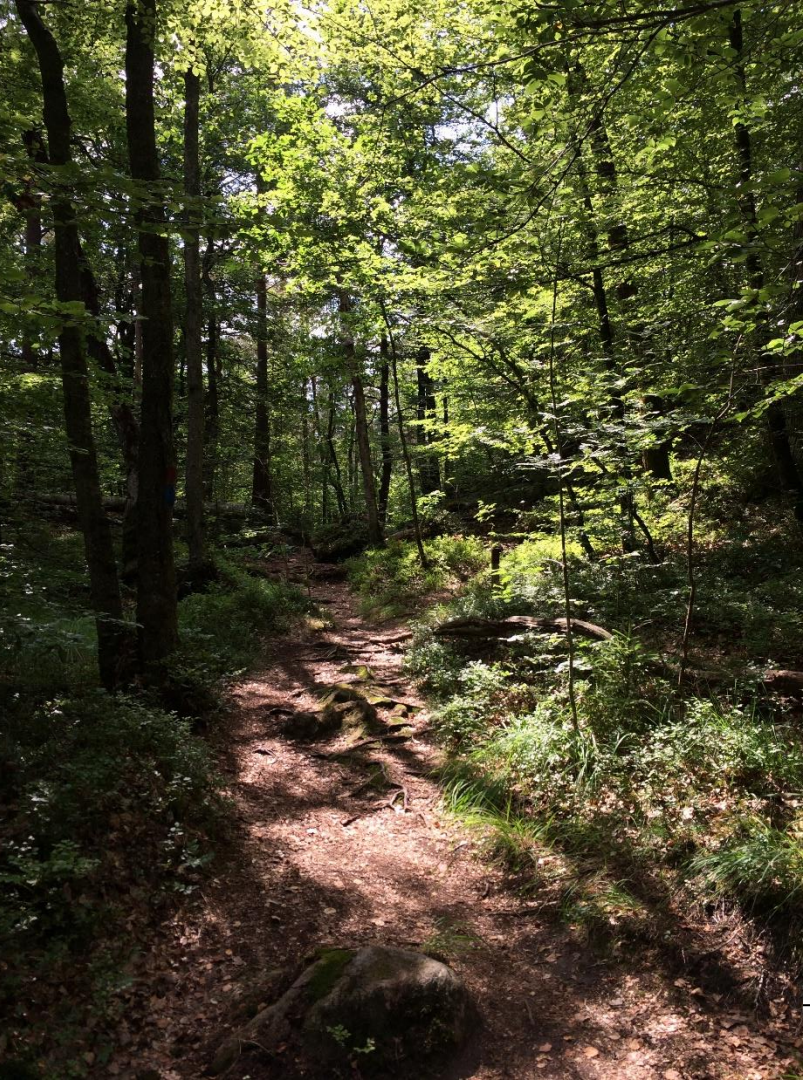
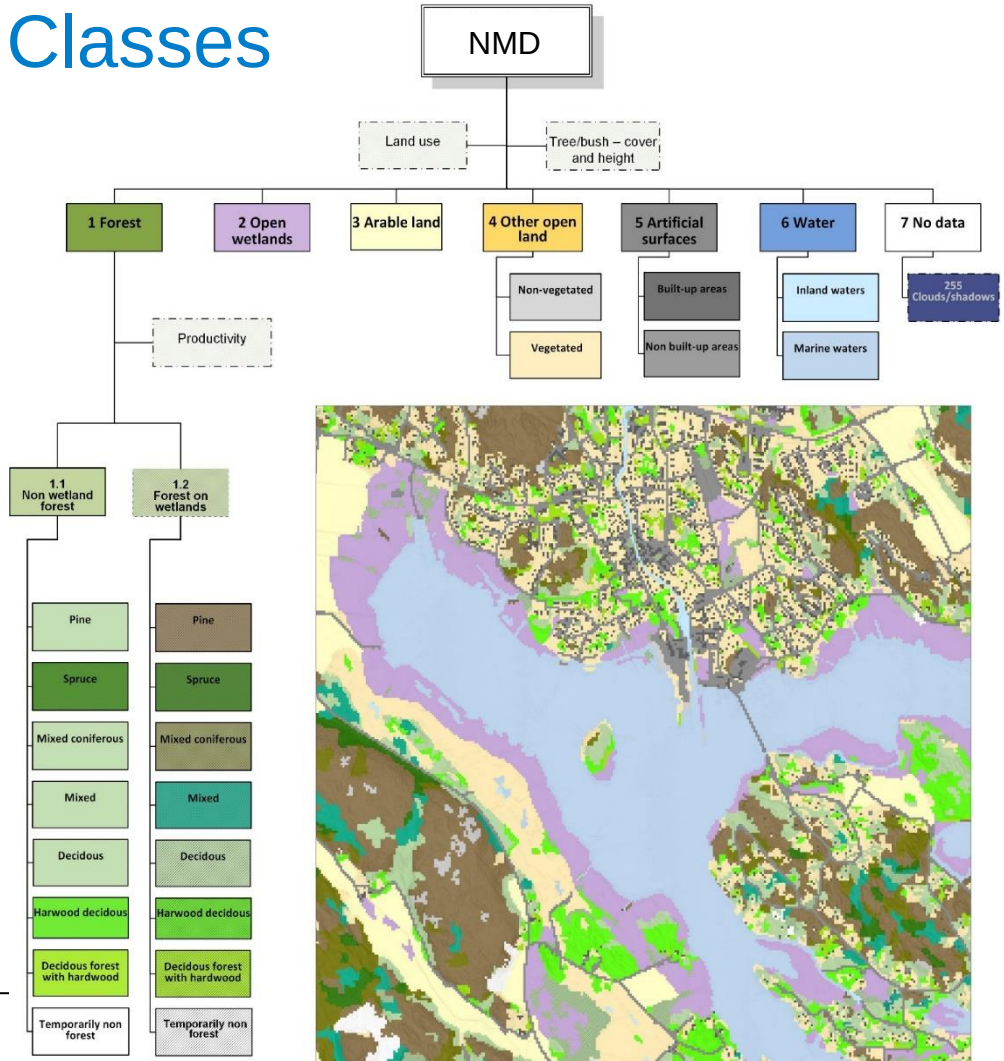
7 national agencies + 16 user organisations+ 1 company (Metria) + 1 university



Classes


NMD
Land use
Tree/bush – cover and height
1 Forest
2 Open wetlands
3 Arable land
4 Other open land
5 Artificial surfaces
6 Water
7 No data
Non-vegetated
Vegetated
Built-up areas
Non built-up areas
Inland waters
Marine waters
255 Clouds/shadows
Productivity
1.1 Non wetland forest
1.2 Forest on wetlands
Pine
Spruce
Mixed coniferous
Mixed
Decidous
Harwood decidous
Decidous forest with hardwood
Temporarily non forest
Pine
Spruce
Mixed coniferous
Mixed
Decidous
Harwood decidous
Decidous forest with hardwood
Temporarily non forest

Concept

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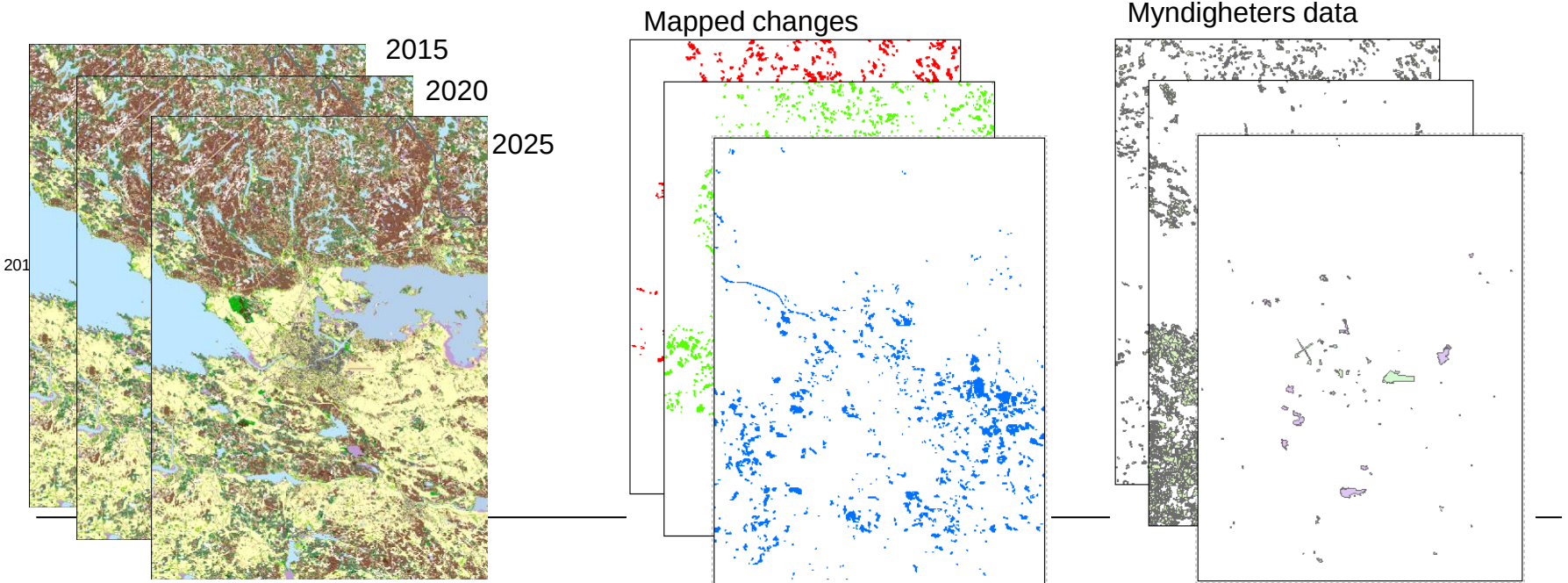
- Regular updating of data every x year
- Mapping of changes
- Updating of map with quality assured changes and data for management



DNA technique – infrastructure Sweden

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- SWEBOL (SLU/The Swedish Species Information Centre) – national coordinator, provide guidelines for documentation, sequencing, saving, reference library
- EDNA (SLU/SwAM/SEPA) - open forum where scientist and users can discuss how DNA methods can be used in monitoring and science
- Representatives from SLU is participating in DNAqua-Net, ScanDNAnet

Research call for DNA-methods, SEPA och SwAM, 8 projects, 3,5 MEUR, 2019-2021, 3 examples

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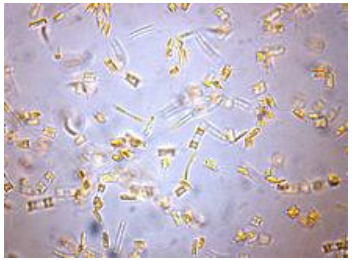

- DNA-barcoding of marine phytoplankton – focus on alien species and harmful algae
- Barcoding of limnic species to improve assessment of biodiversity (FRESHBAR) – diatoms and invertebrates
- Life-DNAquatic – Recommendations and guidelines for aquatic sampling for eDNA (where, when, how)
- http://www.naturvardsverket.se/Nyheter-och-pressmeddelanden/De-far-bidrag-till-forskning-om-DNA-metoder-inom-miljoovervakning/

Ongoing SLU project – bentic diatoms

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- Bentic diatoms is well functioning for status assessment
- Main aim of the project: Developing a method quantitative and qualitative analysis for monitoring in accordance with the requirements of the WFD – DNA-barcoding and ”next generation sequencing”.
- Sequences is collected in the reference library R-Syst (ONEMA)
- European cooperation in DNAqua-Net
- 2018: Focus on complementation of the diatom barcoding database with Swedish species.
- Project manager: Maria Kahlert https://www.slu.se/institutioner/vatten-miljo/forskning/alla-forskningsprojekt/dna-streckkodning/

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One more example!

SwAM is financing a 3-year project (2017-2019) concerning how genetic variation within species can be used in monitoring of aquatic environments

Pilot study of two species in two different aquatic environments:

- Brown trout (Öring) in small mountain lakes (Stockholm University)
- Fucus (Blåstång) in coastal waters (Gothenburg University)

Synthesize knowledge from these pilot studies and other available knowledge to develop criteria to identify e.g.:

A. Species och populations
B. Optimal methods

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Suggestion for cooperation

- New technique
  - Remote sensing : should be of good use for pressure analysis (morphology), in some cases also for status assessments (chlorophyll, macrophytes)
  - DNA – techniques : reference library
  - Intercalibration
- Grouping of waterbodies
- Design of monitoring programmes – Surveillance monitoring
- One step forward is to inform each other of ongoing projects – Easy way to do this? Mail list?

- challenges of adopting new methods, demands for national data registers, difficulties to meet the demands of WFD