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Baseline Assessment for all pilots

An initial activity of WP2 is a description and baseline assessment of each study pilot that will be used as the baseline to assess progress during the project and can aid in the future cooperation between the study pilots. The assessment also serves to establish the status of mainstreaming of NbS into the pilots. The assessment survey is divided up into three parts: 1) Description of the pilots, 2) Questions concerning how the enablers are currently addressed in the pilots, and 3) Brief questions about the MANABAS framework (inspired by ISBAM).

Part 1: Pilot description

Our aim is to mainstream nature-based solutions on the different coasts of northwest Europe. Therefore we need a description of the coastal system. This is divided into two sections: A) description of the coastal (natural) system of the pilot, and B) description of the governance system.

Name of pilot: Malmö-Falsterbo

Location of pilot:

WGS84

55°29'34.3"N 12°57'40.0"E

WGS84 DDM

55°29.572'N 12°57.667'E

WGS84 decimal (lat, lon)

55.49286, 12.961121

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Pilot aims/objective:



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- Investigate different strategies to protect protected areas for nature in a changing climate. Strategy 1 includes allowing shoreline to retreat and investigate the possibilities to change land-use behind existing sea meadows by changing fields to meadows and find methods to mimic the requirements needed to change land use. Strategy 2 includes strengthening and adapting existing natural biotopes.
- Find strategies to introduce NbS in existing nature reserves and Natura 2000 by implementing climate adaptation measures in existing plans for maintenance of protected areas (management plans)
- Investigate which measures are most suitable in the pilot area according to site specific aspects
- Guidance to gain municipalities to implement NbS in master plans and in protected areas with municipal responsibility
- Cost-benefit analysis of different strategies and methods
- Capacity building by showing concrete and creative solutions in existing legal systems and show where existing laws are incomplete

Which nature-based solutions will you be working with in MANABAS?

- Change land use from fields to meadows in areas behind existing grazed meadows to mimic the requirements needed to replace existing sea meadows which will stand under water when sea level rise
- Reenforce and adapt existing natural structures:
 1. Beach nourishment
 2. Strengthening of existing dunes and establishment of new dunes by different methods
 3. Planting eelgrass and gain favorable conditions for spontaneous establishment of eelgrass adjacent to existing eelgrass meadows

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A. Description of the coastal system

Please briefly describe those areas that are relevant for your pilot:

1. The landscape including geology, morphology, and biology.

The Pilot is located in the most southern part of Sweden just south of Malmö, the third biggest city in Sweden (about 350 000 inhabitants). The Pilot area extends from south of the bridge between Malmö and Copenhagen to the southwest part of Sweden including Falsterbo Peninsula. The Pilot area consist of several protected areas of different size, different natural and cultural values and different status of regulations. The Pilot is located in lowland (ground level < 3 m).

The seabed surface south of Malmö is dominated by a layer (0,1 – 2 m) of moveable sand. The sea bottom is very shallow and flat with a water depth of only 2 meters at a distance of 3,5- 4 km from the shoreline. The beach plane contains of a two meters thick layer of clay moraine and closest to the shoreline the more clay is covered by marsh peat.

The seabed surface around the Peninsula of Falsterbo is dominated by moveable sand except the south- east part Kämpingebukten where the sand fraction is coarser and less moveable. Falsterbo is low-lying and built up of unconsolidated sand. The peninsula has not yet reached its equilibrium shape and is still growing. The former island of Måklappen is now totally integrated with the peninsula. The beaches are dominated by sand and gravel. the sand is partly re-deposited by the wind that forms dunes, mainly int the south part of the peninsula.

Most of the area is part of the Natura 2000 network. The area contains of SCI under the EU Habitats Directive and SPA special protection areas under the EU birds Directive, which are overlapping. There are also many nature reserves mostly overlapping the areas of Natura 2000.

The distance from the Öresound bridge to the Peninsula of Falsterbo is a coherent area of three nature reserves, containing grazed beach meadows, important for birds. The nature reserve Vellinge ängar is one of the foremost sea beach meadows in the county with long continuity. The Peninsula of Falsterbo contains of seven nature reserves

The waves and currents are constantly reshaping the beaches around the Falsterbo peninsula. Lagoons and sand banks form and then disappear. The shallow waters, with their sand banks and green fields of eelgrass, create the conditions for a rich biodiversity. The eelgrass provides shelter for cod, flatfish, eel and lumpfish, and this is Sweden's most important reproductive environment for tur-

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bot. There has been a successful project to protect breeding waders from predation by mammals, which has benefited the waders such as Pied Avocet, Oystercatcher and Redshank.

2. The hydrodynamic forcing from tide, water level, wind and waves. If possible, include some statistical values

The pilot is minor affected by tides, only few centimeters. Water level varies a lot during a year from about + 1 meter over MSL at winter storms and about – 0,2 meter below MSL which coincides with high water level in the north part of Öresund.

Highest observed water level is 1,46 meter for Klagshamn (north part of pilot) and 1,54 meter for Skanör (south part of pilot). Historical sea water levels during Backafloeden in 1872 was estimated to 2,4 meter and Julstormen in 1902 was estimated to 2,06 meter. High water levels in this area are not associated with the highest wind speed. The process for high water level is complicated and dependent on high background levels in the Baltic Sea followed by strong westerly winds which subsides and ends with northerly wind. Hence, extreme waves and water levels are unlikely to occur concurrently.

The wind climate is dominated by westerly and southwesterly winds (mean wind 6,8 m/s for Falsterbo). Wind speeds can be more than 30 m/s, for example 31,1 m/s at the storm event Otto in February 2023.

The pilot can be considered a low energy coast, where the waves break far from the shore.

3. Which current NBS solutions are already present it can be a non-engineered original landscape)

The south part of the Peninsula of Falsterbo consists of a dune system. The dunes serve as natural protection for Falsterbo and is integrated in the planned coastal defense of Falsterbo.

Dredging is sometimes necessary in the channel of Slusan at the Peninsula of Falsterbo. Dredged sand from the channel is placed on the closest beach and on the east part of Kämpingebukten.

In the sandLIFE project invasive plants (japanese rose) were removed at the peninsula of Falsterbo to gain native locally adapted dune vegetation.

4. Describe how study pilot is monitored.



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Data of Sea water level is monitored continuously in the north part of the pilot since 1929 and in the south part since 1992.

Groundwater level at Peninsula of Falsterbo is monitored by the Municipality of Vellinge.

Monitoring of different species in protected areas take place regularly. Falsterbo Bird Station has monitored the bird migration since the 1950s. Monitoring invasive alien species also take place regularly. Area of Foteviken a reference area for research and some of the data are available in LIFE Baltcoast. The municipality of Vellinge is coordinating a research project including nature -based prototypes of dikes. In the project nature values and erosion resistance will be evaluated in different vegetation types on the dikes.

5. Describe the sediment dynamics: Macro or micro sediment budget, conceptually or detailed volumetric monitoring. Include any dredging

The very flat terrain makes the area from Malmö to Falsterbo to a low-energy coast where the waves break offshore and no significant erosion takes place. Instead, there is a certain accumulation of sand, which is supported by a wave current model that shows a weak sediment transport both north and south. (Geological Survey of Sweden 2021)

Longshore sediment transport was estimated by University Lund (2021). Figure 2 show results from Peninsula of Falsterbo.

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Figure 2. The results for the longshore sediment transport estimates around the Falsterbo peninsula. The green arrows indicate the modeled direction and magnitude of the net transport. The red dots indicate the wave model grid nodes where the wave information was extracted for the longshore sediment transport estimates. The colored background represents the bathymetry scaled from green (shallow) to red (deep).

6. Long term trends. These could be chronic erosion, long-term subsidence or trends in mean sea level.

Change of shoreline was investigated for period the 1940-2010 by Swedish geological Survey. For most of the shoreline between Malmö and the Peninsula of Falsterbo no change is registered.

The shoreline north of at the harbor of Skanör at the Peninsula of Falsterbo have eroded more than 60 meter. At the rest of the west side and in the south of the Peninsula accumulation of more than 60 meter has taken place.

The uplift of this part of Sweden is less than 1 mm /year. SMHI have estimated local sea level rise at different time scale and different climate scenarios for each municipality in Sweden.



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See example below:

Estimated future mean sea level at scenario RCP 8.5 in meter (height system RH 2000)

Municipality	RCP 8.5: 2050	RCP 8.5: 2100	RCP 8.5: 2150
Malmö	0,29-0,50 m	0,67-1,21 m	0,94-2,01 m
Vellinge	0,32-0,52 m	0,70-1,24 m	0,97-2,05 m

7. Describe the current coastal protection being used in the study pilot.

The municipality of Vellinge got a permit for an embankment consisting of soil and walls in the protected area in 2022. The coastal defense will protect the urban area Skanör – Falsterbo from storm floods until about year 2065 and are under construction now. The defense expressed in the existing management plan for protecting buildings and infrastructure on Falsterbonäset by Municipality of Vellinge can be input for a case study suggesting other alternatives. Some of the stretches presented in the plan did not get a permit. Evaluating pros and cons of different strategies to protect both nature and infrastructure from rising sea level is important.

Municipality of Malmö is also planning for embankments in protected areas in the north part of the pilot in Bunkeflostrand.

8. Describe the current risk of flooding and erosion.

Flooding will be the most important threat to buildings and infrastructure. Many existing buildings can already be flooded at storm events. For example, more than 2000 buildings for housing are situated at a ground level below 2 meters. Big parts of the beach meadows will stand under water when sea level rise.

Risk of erosion is a minor problem in the area. Sensitivity of erosion is classified by Geological Survey of Sweden (SGU) and is based on an index. Index

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contains analysis of soils on beach and sea, ground slope, observed erosion and explosion of winds and waves. Figure 3 show that most of the coastline have no or little sensitive for erosion. Certain stretches show moderate sensitivity for erosion an only the north parth of the Peninsula of Falsterbo have high sensitive for erosion.

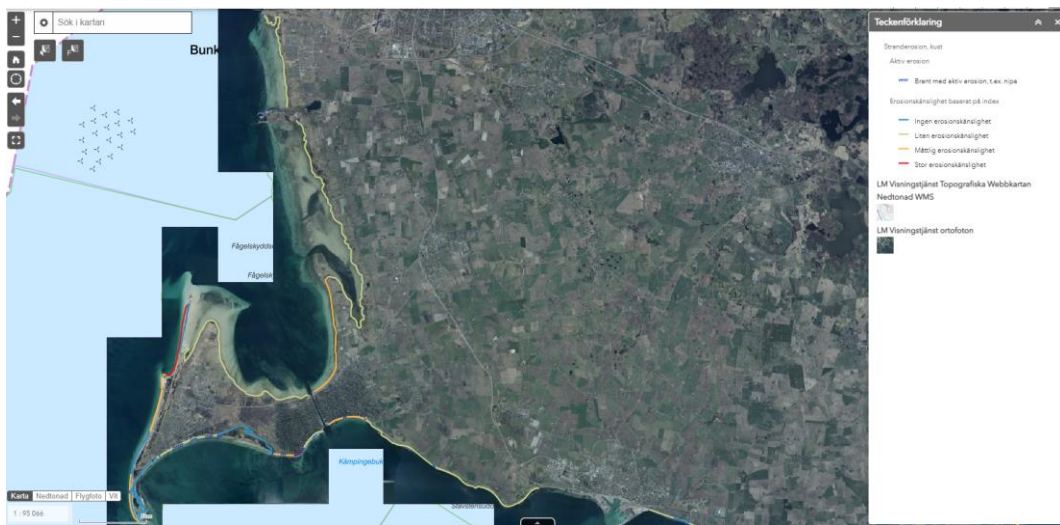


Figure 3 Sensitivity for erosion based on index. Blue = no sensitivity for erosion, green= little sensitivity for erosion, Orange= moderate sensitivity for erosion, red= High sensitivity for erosion

9. Which human activities impact your coastal system?

The harbor of Skanör probably affect erosion north of the harbor.

The nature reserve Ljungskogen was once planted to stop the sand from eroding. Today, sand dunes with sea lyme grass and sand sedge lie interspersed among the trees. The idea is that the pine forest will be replaced by oak trees at some point.

A low dike affects part of the beach meadows. In MANABAS we will investigate possibilities to restore the hydrology by allowing an increased inflow of salty seawater.

10. Describe important culture and historical aspects in the study pilot

The income-generating herring fishing during the 13th-15th centuries and the associated Scanian markets meant that the towns Skanör and Falsterbo developed into important trading cities with international exchange of goods.

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Pasture land use have dominated since the middle ages. Dikes consisting of eelgrass and peat used to separate fields from pasture land are preserved in the area. These dikes could also protect buildings from high water events. More than half of the Falsterbo Peninsula was open heathland 150 years ago. The original oak forest was cut down in the Middle Ages to provide fuel and timber. Today, only Skanörs Ljung Nature Reserve remains as a reminder of how humans have shaped the landscape on the peninsula.

The coastal waters contain shipwrecks that are proof of the lively traffic that has moved through the area since the middle ages.

Falsterbo Peninsula is attractive from a recreational point of view. The transformation of the area into a recreational environment gained momentum about 1900. An important prerequisite for early tourism was the construction of the railway between Falsterbo and Malmö. The fact that the land was very sandy should have benefited tourism by being attractive for bathing and outdoor recreation but not particularly beneficial for agriculture. During the beginning of the 20th century, hotels, dance halls and boarding houses sprung up.

Today a big part of the Peninsula of Falsterbo consist of buildings for housing.

B. Description of the governance context

Please briefly describe those areas that are relevant for your pilot:

11. Who are the landowners of the land?

The landowners represent a diverse group from the Swedish state, municipalities, farmers, companies and all other kind of property owners.

12. What are the main land uses in the pilot area (ie agriculture, nature reserve, infrastructure),

Most of the area consist of nature reserve and Natura 2000. Most of the nature reserves are grazed. A small portion of the area consists of fields. There are also urban areas with at total population of about 38 000 inhabitants concentrated to Bunkeflostrand/ Klagshamn in the north (Municipality of Malmö) and Höllviken/Ljunghusen, Skanör/ Falsterbo in the south (Municipality of Vellinge).

13. What are the current laws and regulations that govern the use of nature-based solutions in the pilot (i.e Natura 2000, planning)?



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The nature reserves overlapping areas of Natura 2000 are strictly regulated according to the Swedish Environmental Code. However, the county administrative board, can change part of the regulations if it gains the purpose of the natural values. The environmental objectives according to the water framework directive are also implemented in the Environmental Code. Permits and other errands regulated by the Environmental Code have to take account to the Environmental court. To note is also, that it's normally easier to get a permit according to the Environmental Code for "soft" measures compared to traditional flood defense measures.

The municipalities have monopoly to plan all activities in their own territory and according to the Planning and Building Act new buildings are not allowed in areas with risk of flooding or erosion. The County administrative board can stop municipal detailed development plans in areas with risk of flooding and erosion. For existing buildings, landowners are responsible to protect their own property, and no national or regional authority or municipality is responsible by law for coastal protection. This fact implies that Sweden has no national flood prevention strategy when it comes to coastal flooding and neither a national coastal management plan.

14. What is the current status of using nature-based solutions in your pilot area (ie to what extent are they mainstreamed into existing policy?)

The south part of the Falsterbonäset (Coastal defense Skanör – Falsterbo) consist of a sand dune. The municipality will not construct a coastal defense in this area, just strengthening the dune if needed.

15. What are the current goal conflicts (ie protecting cultural vs natural areas, or protecting private land vs municipal-owned land, or agricultural uses vs nature preservation?) How are these dealt with?

Limited space due to coastal squeeze give rise to goal conflicts.

According to Swedish law the property owners are responsible for defending their homes from erosion and flooding ten years after a detailed development plan is decided. The system, where individuals are responsible for existing buildings, can result in a situation where some buildings will be protected, and some buildings will be left and will finally fall into the sea. A big variation of coastal defends will be implemented. Most of the coastal defends will affect nature and surrounding properties negative.

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On the other hand, protected areas have strong regulations which can be a limit for Municipalities and individuals to implement more appropriate nature-based solutions affecting protected areas.

One example of a goal conflict between nature conservation and protecting buildings for housing and infrastructure is the coastal defense Skanör – Falsterbo. Such coastal defenses will be tried in court, CAB was one of the interests who appealed against the permit for some of the distance due to risk for impact on habitat of Natura 2000. The legal processes will continue for a while. An outer embankment, suggested by the municipality, will affect protected areas much more than the inner embankment and is hardly feasible according to existing legislation.

16. How are the stakeholders identified and involved

Our organization have a long tradition to cooperate with municipalities, landowners and NGOs in spatial planning and nature conservation. The stakeholders therefore already were identified. In April 2023 we arranged a dialogue and information meeting with a field visit for the stakeholders in the pilot. Municipalities, landowners and NGOs participated. These meetings will be arranged once a year.

17. Briefly describe the socio-economic development in the area.

It is an area with very good socio - economic conditions. Parts of the urban areas Bunkeflostrand/ Klagshamn, Höllviken/Ljunghusen, Skanör/ Falsterbo can be flooded at high water occasions.

18. What do you experience as the main barriers to mainstreaming NbS in .your pilot?

- No possibilities for the Swedish state to gain control over private land for future needs for protected areas
- No budget for climate adaptation measures in protected areas
- NBS usually need more space compared to grey solutions
- Municipalities responsible for all spatial planning but lack mandate to implement measures which gain individual landowners
- Uncertainties in climate scenarios and which time perspective is relevant for spatial planning and measures
- Difficulties to protect sandy beaches because it can be difficult to use nature-based measures such as beach nourishment. One reason for that is limited resources of sand which can be excavated. Local resources of sand



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are not available because situated in habitats in protected areas. Excavation of sand is prohibited in the area.

C. Implementation scheme

Please describe your timeline for implementing NbS during MANABAS and beyond (i.e. starting point, estimated finalization, monitoring period)

- inventory of plans of maintenance for the protected areas January-September 2023
- Inventory of existing parameters used for monitoring January-november 2023
- GIS analyses to find out how different habitat in the protected areas will be affected at different levels of sea level rise. May 2023-December 2023
- investigate possibilities to change land-use behind existing sea meadows by changing fields to meadows January 2024- March 2025
- investigate possibilities how to strengthen beaches, sanddunes and eelgrass meadows September 2023 – December 2025
- implementing climate adaptation measures in existing plans for maintenance of protected areas (management plans) October 2023-December 2025
- Produce a guideline for implementing climate adaptation measures in plans for maintenance. October 2025- June 2026
- Cost-benefit analysis of different strategies and methods October 2026- March 2027
- Produce guidelines for municipalities to implement NbS. January 2027-May 2027.

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Part 2: Enabler Assessment

Please consider the barriers identified in Part 1B (question #18). The enablers below are meant to be ways to overcome these barriers. However, these enablers are not set in stone and will be further developed, augmented and /or changed during the MANABAS Coast project. There may be other enablers that are more important in certain pilots or for mainstreaming NBS. We will explore these during our project. In this assessment we want to get an initial idea of how these proposed enablers by EcoShape play out in your pilot and for mainstreaming NBS on a large scale.



Enabler 1: Technology and system knowledge

- Which types of technology or systems knowledge are important in your pilot? (i.e. Sediment cell, salt marsh protection, salt marsh dynamics, sand nourishment, enhanced dune development)
salt marsh protection, salt marsh dynamics, sand nourishment, enhanced dune development, changing land use from fields to grazed meadows.
- Are there any knowledge and technology gaps in your pilot that need to be addressed? Please briefly describe.
Detailed site specific knowledge is needed.

Enabler 2: Multistakeholder approach



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- Who are the main stakeholders in your pilot?
Municipalities, landowners, NGO:s
- How will you engage your stakeholders in the project?
One yearly dialogue meeting for all stakeholders. The first dialogue and information meeting with a field visit was arranged in April 2023.

Enabler 3: Management, monitoring, and maintenance

- What routines does your pilot have in place for management, monitoring and maintenance of the NbS?

We will start to identify areas of different biotopes (Natura) in the pilot and follow the development for different parameters.

We have started inventory of monitoring parameters for which other authorities are responsible. We will start routines to compile these data.

- How do you measure the success of your pilot? Do you have any indicators for successful mainstreaming of NbS?

We have just started to identify such indicators and have the following suggestions:

Changed area of different biotopes due to sea level rise

Number of implemented changes in management plans relative to needed changes registered in the inventory of nature reserves.

Enabler 4: Institutional embedding

- How do current institutional arrangements already facilitate mainstreaming of NbS? Please describe and mention the key institutions

The Swedish Environmental Protection Agency have published a guidance for NbS <https://www.naturvardsverket.se/publikationer/7000/naturbaserade-losningar/>

Another authority, Swedish Civil Contingencies Agency can distribute grants to municipalities to protect against natural disasters. The wording "The measures must have the conditions to fulfill the purpose of the support in a lasting way", can be an obstacle to implementation.



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- How committed is your organization to mainstreaming NbS within MAN-ABAS Coast and after the project ends?

CAB is responsible to coordinate the work with climate adaptation in the region of Skåne. The intention is to develop existing plans for maintenance of nature reserves, including effects of climate change (especially sea level rise). A Guideline for implementing climate change adaptation in existing plans for protected areas can be used by other counties and municipalities. We also look forward to learn from other Pilots.

Enabler 5: Business Case

- Do you face problems with funding in your pilot? Please briefly describe, including the general sources of funding.

Maintenance of protected areas is financed by budget decided by the Swedish government. The national budget for nature conservation has diminished the last years. There is no national budget for climate adaptation measures in protected areas.

- How will your pilot and/or continued mainstreaming be funded after the MANABAS Coast project?

The activity in MANABAS, implementing climate adaptation measures in existing plans for maintenance of protected areas (management plans) will help to fund measures from the regular national budget.

Enabler 6: Capacity building

- What types of capacity building would your pilot need in order to facilitate mainstreaming of NbS?



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Enabler ranking

To what extent are the above enablers important for mainstreaming NbS in your region? Please rank (1 is least important, 10 is most important)

Enabler 1: Technology and system knowledge

1 2 3 4 5 6 7 8 9 10

Enabler 2: Multistakeholder approach

1 2 3 4 5 6 7 8 9 10

Enabler 3: Management, monitoring and maintenance

1 2 3 4 5 6 7 8 9 10

Enabler 4: Institutional Capacity

1 2 3 4 5 6 7 8 9 10

Enabler 5: Business case

1 2 3 4 5 6 7 8 9 10

Enabler 6: Capacity Building

1 2 3 4 5 6 7 8 9 10

Suggestion for additional enablers

Are there any aspects of mainstreaming enablers from your pilot that you can already suggest? If so please briefly state these:



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Part 3 MANABAS mainstreaming framework (inspired by earlier work e.g. ISBAM)

Within MANABAS Coast we are working on a framework that helps in mainstreaming NBS. To develop this framework, we need information on the pilots as well as the ambitions and goals of the different organization involved. We build on work already done in the past such as the ISBAM approach, which was developed in the Interreg BwN project (see also the brochure in the appendix for a further explanation or online). Just as the enablers, the MANABAS mainstreaming framework is still a work in progress.

As a starting point for the MANABAS framework, 3 leading principles from ISBAM are evaluated. We would like to know if these principles can also be applied across the entire northwest Europe coasts and how they can be improved. .

Three leading principles have been identified that are deemed important to enable mainstreaming of NBS:

MANABAS Coast principle 1: "Act at a landscape (system) scale, including both the natural and socio-economic system/context"

- Do you identify with this principle?
yes
- Is this principle applied (to a certain degree) within your pilot? And within your organization? If yes, how?
Yes. The County Administration Board is the representative of the national government in Skåne and ensures that government policy and goals are implemented in the county. The CAB has the responsibility to coordinate the regional adaptation climate actions. The need for actions have to be reported in the regional action plan for climate actions
- In managing your assets, how are the system-wide effects and benefits taken into account?



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- On a scale from 1 (room for improvement) to 10 (superb), do you think your organization adheres to this principle? Why?

1 2 3 4 5 6 7 8 9 10

MANABAS Coast principle 2: “Integrate management of multiple assets and functions within the landscape system context”

- Do you identify with this principle?

Yes

- Are relevant organisations/institutions efficiently cooperating to jointly address system-wide challenges? If yes, which challenges and how?
- If you see room for improvement in the integrated management of multiple landscape assets, what would be the necessary steps to take according to you? Briefly state
- On a scale from 1 (room for improvement) to 10 (superb) how much is this principle applicable to your organization?

1 2 3 4 5 6 7 8 9 10

MANABAS Coast principle 3: “Embrace and leverage upon the natural dynamics of the system”

- Is this principle applicable to your situation/organization?
- What are the main natural processes that should be considered? Are these well-known with all the stakeholders?
- How are using natural processes incorporated in the management practices within your organisation?
- On a scale from 1 (room for improvement) to 10 (superb) how much is this principle applicable to your organization?

1 2 3 4 5 6 7 8 9 10

Additional MANABAS Coast mainstreaming questions:



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- In your view, what is essential in the mindset or way of working of people (policy makers, managers, professionals, general audience) to promote mainstreaming of NBS? Do stakeholders need more information on mainstreaming?
- What other leading principle(s) would you suggest?
- How can we make these principles more applicable to the context of pilots?
- Finally: What does mainstreaming mean for your pilot? Please briefly describe.

Climate adaptation measures are implemented in plans for maintenance of protected areas and budget is sufficient for implementing NbS.

Flood protection is based on NbS when Municipalities start planning measures for coastal protection.