



Protection of coastal values.

LIFE
Coast
Adapt





Through the LIFE Coast Adapt project, the largest nature-based coastal adaptation in Sweden has been implemented. The project has been ongoing for five years along the coasts of Skåne, demonstrating that both small and large efforts in harmony with nature are effective. When asking the public, an overwhelming majority prefers measures that protect the natural coastal environment and its ecosystems – something that needs to be considered in future decisions.



Sea holly
(*Eryngium maritimum*).

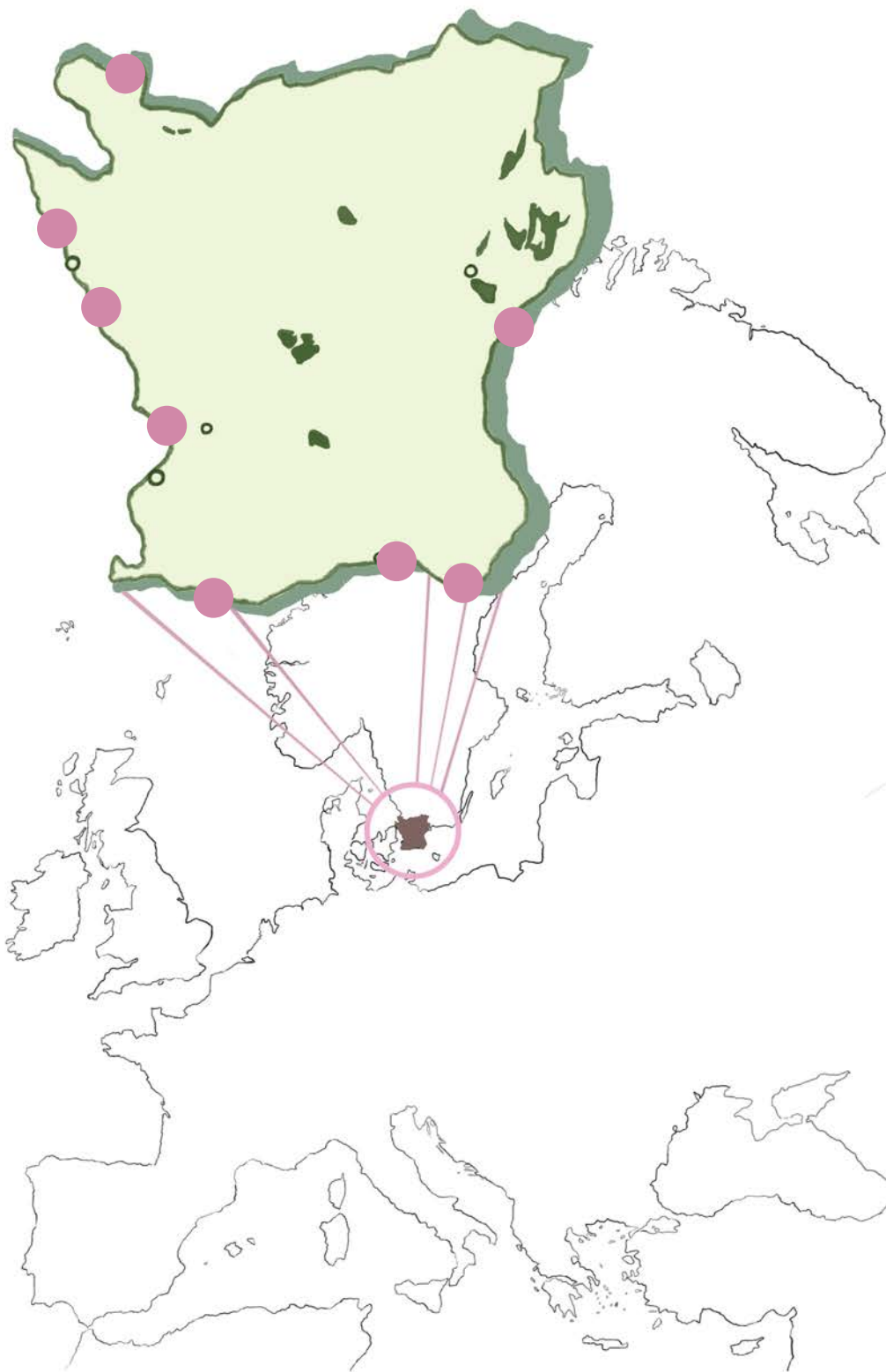
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500 kilometers of coastline

Skåne is the southernmost county of Sweden, with a 500-kilometer long coastline, which is exposed to waves from the East, South, and West. Almost half of the coastline is sandy. Tidal activity is minimal, yet sea levels fluctuate because of weather conditions. The coastline is frequently urbanized and there are more houses within 300 meters of the sea than anywhere else in Sweden. Climate change is having increasingly significant consequences for both private and public values.

Tests of nature-based measures have been carried out in 14 locations, within six coastal municipalities in Skåne, Sweden. Read more on pages 8–9.



“Nature-based solutions are often both economically and ecologically more sustainable.”



Little ringed plover
(*Charadrius dubius*).

LIFE Coast Adapt

LIFE Coast Adapt has tested the effectiveness of nature-based solutions to mitigating the negative effects of coastal erosion. Nature-based solutions can serve multiple functions and act as cost-effective buffers, protecting and enhancing the values of the coastal zone by working with natural biological and geological processes. At the same time, biodiversity and human well-being are promoted. The project is the largest nature-based coastal adaptation initiative in Sweden, demonstrating that both small and large efforts in harmony with nature are effective.

From an international perspective, the project is unique, partly due to the collaboration among various stakeholders and the combination of different measures that give nature more space and promote coastal protection. After five years of testing, we know how nature-based solutions can be developed along the Skåne coast and why they should be the preferred choice.

Complex prerequisites

Hard solutions can protect against coastal erosion, but nature-based solutions are often both economically and ecologically more sustainable. They cost less, contribute added values to the site, are flexible, are adapted to nature, and require no concrete.

The process from identifying a need to implementing a measure can be simple or complex. It depends on the conditions at the site, the need for preparation, applicable laws, and the available expertise. Collaboration is a significant factor for success. Knowledge is required in several areas, such as biology, coastal hydrogeology, legislation and at multiple decision-making levels in society. Therefore, it is important to be prepared to change one's approach during the process and be flexible.



Knowledge and cooperation

Several municipalities in Skåne, Lund University, the County Administrative Board of Skåne, Skåne's municipalities, and Region Skåne have collaborated. Experts and researchers in biology, engineering, and law have conducted both investigations and the design of measures.

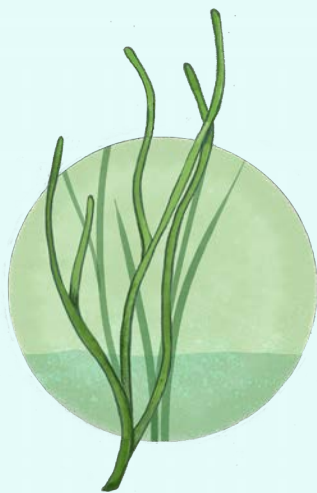
The project has been a learning process and has initiated networking that would otherwise have been unlikely to develop. The result is a practical, useful knowledge bank for prioritizing, planning, establishing, and maintaining nature-based solutions in the coastal zone. LIFE Coast Adapt has improved knowledge and understanding, and shortened workflow.

LIFE Coast Adapt has reached residents and local politicians, while nature-based solutions are referenced in relevant national guidelines.

“The project has been a learning process and has initiated networking that would otherwise have been unlikely to develop.”

Protection of coastal values.

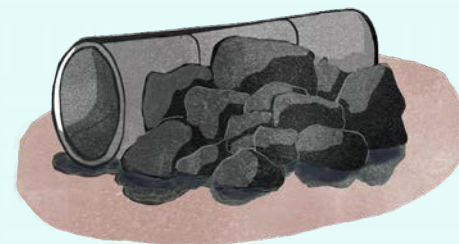
During the five project years, various nature-based solutions have been tested and developed along the coast of Skåne. This has shown why they should be the preferred choice in many locations.



1 Planting of eelgrass

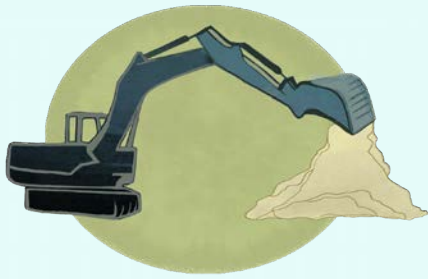


2 Removal of invasive plants



3 Removal of hard structures





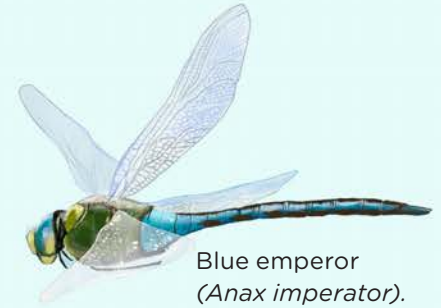
4 Establishment of sand dunes and beach nourishment



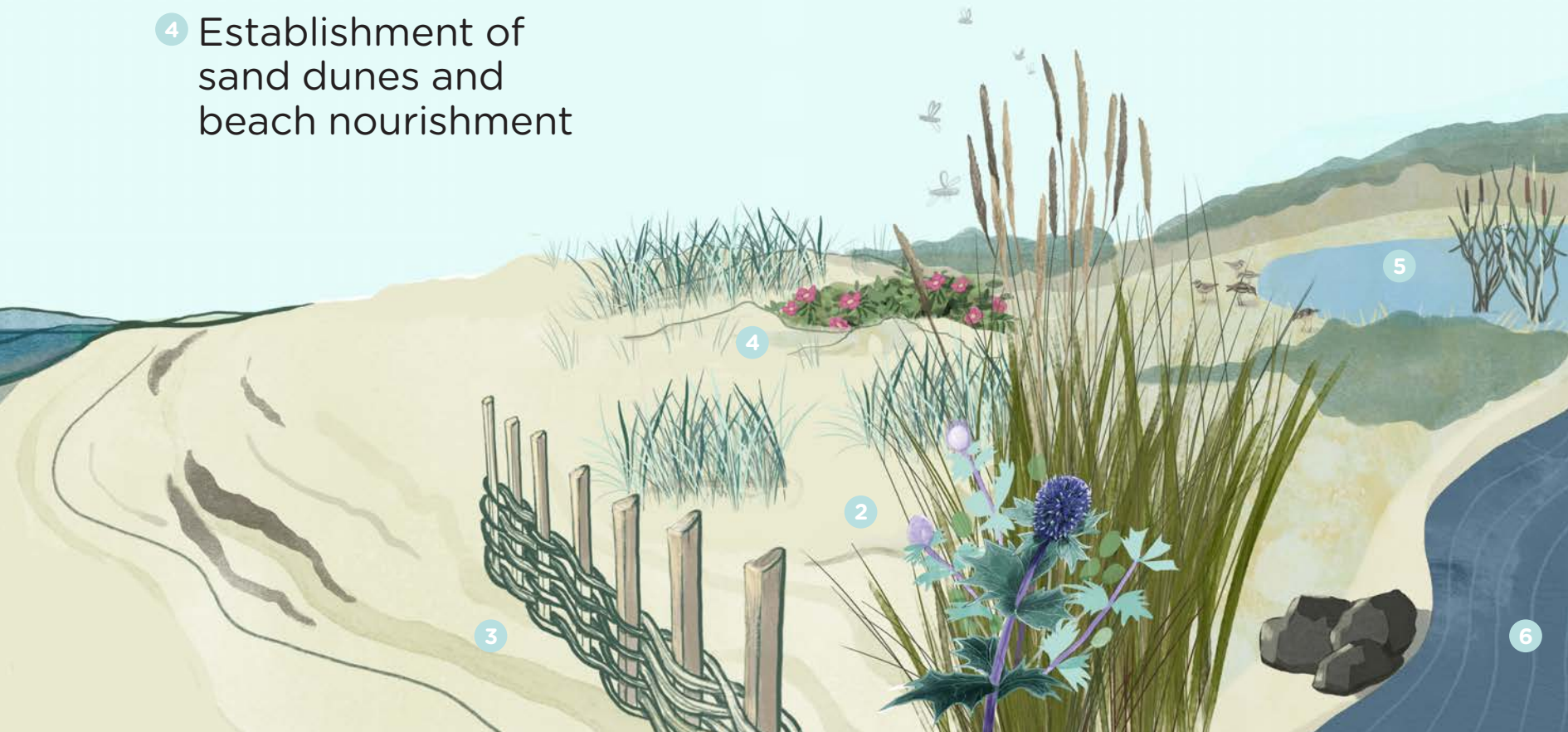
5 Creation of a coastal wetland

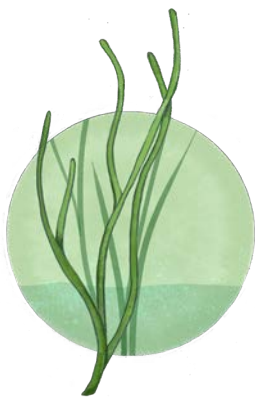


6 Restoration of a coastal stream



Blue emperor
(*Anax imperator*).





1 Planting of eelgrass

Eelgrass captures carbon dioxide, binds sediment, and protect shores from erosion under certain circumstances. Simultaneously, eelgrass creates a habitat that is essential for many marine species. Throughout Skåne, test plantings were conducted to compare different planting methods. These included planting of individual shoots, clusters of several shoots as well as different anchoring of the shoots. The most suitable method for large-scale planting in sandy substrates was the planting of individual shoots without any anchoring. Marine life thrived in planted eelgrass to the same extent as in naturally occurring eelgrass meadows. Over time, it is possible to restore eelgrass beds in locations where they have disappeared, thereby enhancing natural resilience in the area.

A large-scale eelgrass planting was carried out in:

1 location in Båstad municipality.

Test plantings of eelgrass were carried out in:

1 location in Båstad municipality
1 location in Helsingborg municipality
1 location in Trelleborg municipality
2 locations in Ystad municipality
1 location in Kristianstad municipality

See how it was done: <https://bit.ly/3SSd2RM>



2 Removal of invasive plants

Invasive plants bind the sand, but form impenetrable stands and displace natural species. Where invasive plants were removed, lyme grass and marram grass quickly flourished and bound the sand as effectively as the invasive plants had done before. Additionally, herbs like sea rocket and blue bonnets bloom, providing a thriving environment for pollinating insects. Sand dunes are crucial for both animal and plant life, as well as for the resilience and recovery of beaches after storms. The beaches become more accessible for the public, which is appreciated by residents and visitors.

Removal of invasive plants were carried out in:

4 locations in Helsingborg municipality
1 location in Lomma municipality
2 locations in Ystad municipality



3 Removal of hard structures

Hard structures can cause and exacerbate erosion. In the project, concrete pipes or culverts and stone blocks have been removed in several locations. Subsequently, the sites have been restored with new materials, and the newly created surface can then be rehabilitated in various ways. On sandy beaches this can be made through sand replenishment, and in the coastal stream by creating space for the water's natural processes. This approach improves the resilience of the coast.

Removal of hard structures were carried out in:

1 location in Helsingborg municipality
2 locations in Lomma municipality
1 location in Ystad municipality
One measure involved placing rocks in the sea to create an artificial reef outside Kristianstad municipality. This action could not be implemented in this project.



4 Establishment of sand dunes and beach nourishment

The sand protects geological, biological, and social values of the coast. Sand dynamics can be altered in ways that provide benefits from erosion. This can be done by adopting gentler cleaning methods for beaches, reusing sand from other projects, and use seaweed and plant material to establish and repair sand dunes. Sand dunes can be created with the help of wind, using sand fences and planted vegetation. Building an artificial sand dune on the beach allows for the quick establishment of a new dune, which is a useful method if a beach has been damaged by a storm. Creating sand dunes by planting beach grass takes more time, but the resulting new sand dune is more stable. Beach nourishment must be done with careful consideration for natural values and ecosystems, both at the site where the sand is deposited and where it is sourced.

Establishment of sand dunes and beach nourishment were carried out in:

- 1 locations in Helsingborg municipality
- 1 location in Lomma municipality
- 1 location in Ystad municipality

See how it was done: <https://bit.ly/3SSdsHQ>

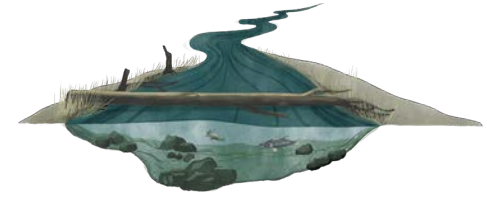


5 Creation of a coastal wetland

Wetlands purify water and protect against both drought and flooding. They are one of the most species-rich natural environments. A stormwater culvert was opened, and a wetland was created near a residential area. The wetland allows water to flow freely, reducing flow peaks and flood risk as water moves more slowly. With decreased flow velocity, particles settle, thus providing cleaner water flowing to the sea. At the same time, many new habitats for animals and plants are created, also benefitting recreation and other outdoor activities.

Creation of a coastal wetland was carried out in:

- 1 location in Lomma municipality



6 Restoration of a coastal stream

Erosion is a natural process that can be beneficial. Built structures in streams can, however, cause problematic erosion and prevent the stream from evolving and moving laterally. By removing hard structures and placing deadwood in the streambed, a more natural dynamic can be created. During high flows, the deadwood guides the water toward one streambank, causing erosion. This introduces sediment to the stream, and finally to the sea. The sediment contributes to the formation of a more varied streambed, less erosion in the coastal zone, and the restoration of floodplains through sediment deposition. More species thrive and biodiversity is promoted. When the water flow is redirected, floodplains along the stream will be inundated. Floodplain inundation reduces the rate of water flow, thereby ceasing unwanted erosion downstream.

Restoration of a coastal streams was carried out in:

- 1 location in Ystad municipality

Monitoring and maintenance

Sandy beaches are dynamic environments that are shaped by waves, wind, and human activities. The physical processes involving sand are a crucial aspect of the constant disturbance in the coastal zone, creating vital habitats for animals and plants. Too much or even too little disturbance can result in the entire sand system functioning poorly, or that animals and plants may not have the necessary living space. Nature-based solutions can have effects precisely where they are implemented but also within a broader area. It is, therefore, essential to monitor both physical processes and biological diversity to understand the effects of different measures.

Frequent monitoring and inventories across seasons and weather events are necessary at the beginning of a monitoring process and have been a crucial part of LIFE Coast Adapt. Several experts and researchers have tracked the project's measures both before, during, and after their implementation. Comparisons have also been made with sites where no measures have been taken. During the project period, several storms and other weather events have stress-tested the measures.



European common spadefoot
(*Pelobates fuscus*)

In a short time, sufficient results have been gathered, building an understanding and experience of how nature-based solutions and the coast are affected and changed with different weather events. All coastal protections require maintenance, and nature-based solutions often require restoration efforts after weather events. However, rebuilding nature-based solutions costs less than repairing hard solutions, roads, and houses, while still preserving all the coastal values.

An evaluation regarding how the public perceives risk, coastal erosion, and coastal values has also been conducted through validated methods, including questions about how they view the implemented measures. A clear majority were positive to the implemented measures, and 64% considered the most important thing to protect was the coastal environment and its natural habitats. Next in importance were plant and animal species. Only 22 % and 18 % considered that houses and roads, respectively, are the most important to protect against the effects of coastal erosion.

Monitoring and maintenance of the nature-based solutions need to continue to develop a long-term, vibrant, and dynamic coastal zone in harmony with the local perspective and a changing climate.

Communication

Understanding local conditions is a fundamental requirement for long-term sustainable solutions, like nature-based measures. Therefore, engaging with the public and local communities has been a crucial part of the project. It has required substantial resources but has contributed to better shaping the implementation of nature-based solutions and fostering local understanding, especially when done at an early stage. The dialogue between the municipality and state authorities has also been facilitated by early-stage involvement. The experience in the project is that shared knowledge and understanding of each other's needs and conditions for taking action, facilitate the possibilities of implementing them.

Press and media have consistently shown recurring interest in the project's activities since the beginning. On a few occasions, media have been invited, but most often, the media have

contacted us. There is significant and broad interest in using nature-based solutions to protect the biological, geological and social values of the coast.

Guidelines

The LIFE Coast Adapt project has focused on adapting the coast to reduce the impacts of climate change. By disseminating the knowledge gained from the project's results, we can facilitate the implementation of nature-based solutions in more locations along the Swedish coast. Therefore, the County Administrative Board of Skåne has developed guidelines for nature-based solutions along coasts based partly on the results from LIFE Coast Adapt*. These guidelines include technical and legal guidance, as well as process support for practitioners, consolidated into publicly available reports and maps.

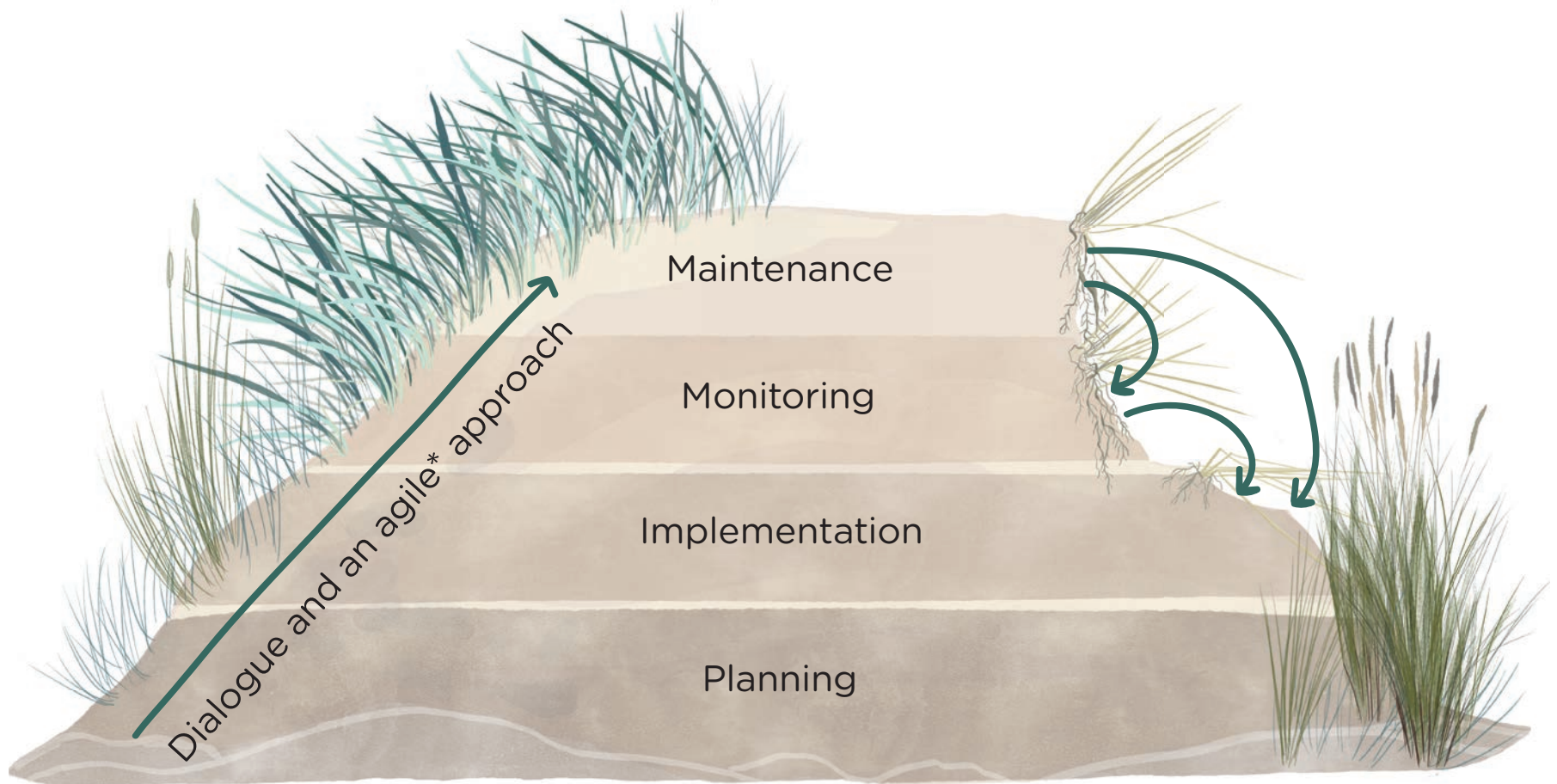
* [LÄNSSTYRELSEN.SE/SKANE](https://lansstyrelsen.se/skane)

- Vägledning - implementering av naturbaserade åtgärder för att minska negativa effekter av erosion längs kusten (Dnr 424-41329-2023)
- Ärendepolicy avseende stranderosion längs Skånes kust (Dnr 424-41330-2023)
- Användarguide: Karta - lämplighetsanalys för klimatanpassningsåtgärder längs Skånes kust (Dnr 424-41333-2023)
- Prövningsprocessen kring anläggande av klimatanpassningsåtgärder för att minska effekterna av erosion (Dnr 424-21056-2021)

Nature-based solutions

require long-term commitment but offer significant returns.

The forces of the coast require space but also patience as the location constantly changes. Throughout the project, a receptive and agile approach has been a key factor in implementing measures in sensitive environments. Gradually, different needs for the working process can be identified.



Depending on the progress in coastal management processes, the number of implementation steps needed can vary. The arrows to the right indicate that in case of damages, one may need to restart at different levels in the process when repairs are required.

“Throughout the project, a receptive and agile approach has been a key factor.”

Planning

In the initial planning stage, it's crucial to identify purposes and values, including potential ones, from a broad perspective. In addition, future maintenance requirements should also be identified. Therefore, collaboration with a diverse range of expertise and stakeholders is important. Collaboratively maturing in the planning stage is a key factor. This is to ensure that the measures are in the best location, with the best technology and materials, but also to gain support and understanding. Thorough planning in this stage can help avoid resource-intensive mistakes in later stages.

Implementation

In the implementation stage, it is important to allocate time for permits and approvals. Here, there is a continued need to be prepared to further change and adapt the measures to meet new requirements and different views.

Monitoring

The monitoring stage is crucial for a continued successful project. Ongoing inventory or measurements of implemented measures as well as tracking changes over time are necessary for gaining knowledge. Modifications may be required as climate change impacts the coast. Again, working with dialogue and readiness to revise previous assessments is important.

Maintenance

In the maintenance stage, one needs to work both preventively and reactively. After weather events, repairs may be necessary of

the nature-based solutions, which should have been anticipated in earlier stages. An annual review of the measures can help plan for the more long-term maintenance needs.

Throughout all stages, an agile* approach is required, contributing to a more transformative** coastal management – something that will be completely necessary in a future climate.



***Agile approach**

Working in small and short cycles where there is room for improvement.

**** Transformative management**

In the EU's and Sweden's perspective on what is required to prepare and protect society for climate change, the concept of a transformative approach is used. It can be defined as a comprehensive change in both attitude and administration, as well as policy instruments. The change needs to occur at all levels and sectors of society.



LIFE Coast Adapt has demonstrated that:

- Skåne's coast benefits from being adaptable and dynamic
- natural values both underwater and on land can be favored while simultaneously protecting against weather events by using nature-based solutions
- coastal values such as nature and outdoor recreation can be promoted while protecting the coastal zone against weather events
- small-scale nature-based measures should not be underestimated
- local knowledge and understanding of the unique conditions of the location are important prerequisites for successful nature-based solutions
- frequent monitoring of nature-based measures is important for the continued development of the solutions
- in a dynamic coastal system, there must be a good supply of sand for beach repair following storms
- the public considers it more important to protect natural values than technical structures
- learning is reinforced by establishing networks that promote collaboration on nature-based solutions
- proactive communication is important towards everyone affected by coastal protection measures
- inviting stakeholders to a dialogue about measures in an early stage creates interest, understanding, and acceptance, and streamlines the work
- an agile approach contributes to better solutions under changing conditions.



Production report

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Broadnosed pipefish
(*Syngnathus typhle*).

LIFE Coast Adapt:

Has shown examples of how nature-based measures can be implemented along Skånes coasts in Sweden. Tests have been carried out to monitor if various nature-based adaptation measures may protect the coast and at the same time promote biological, geological and social coastal values.

Project period: 2018–2023

Budget: 45 MSEK (EU-LIFE and Swedish agency for marine and water management).

Locations: Tests of nature-based measures were carried out on 14 locations within six coastal municipalities in Skåne.

Project partners: Region Skåne, Helsingborg municipality, Lomma municipality, Ystad municipality, Lund University, County Administrative Board Scania, Skåne Association of local Authorities.

Final report: <https://bit.ly/3wmS8RV>

Acknowledgement: We want to thank our competent reference group who has been an important support throughout the project.



Havs
och Vatten
myndigheten



SKÅNES
KOMMUNER

