



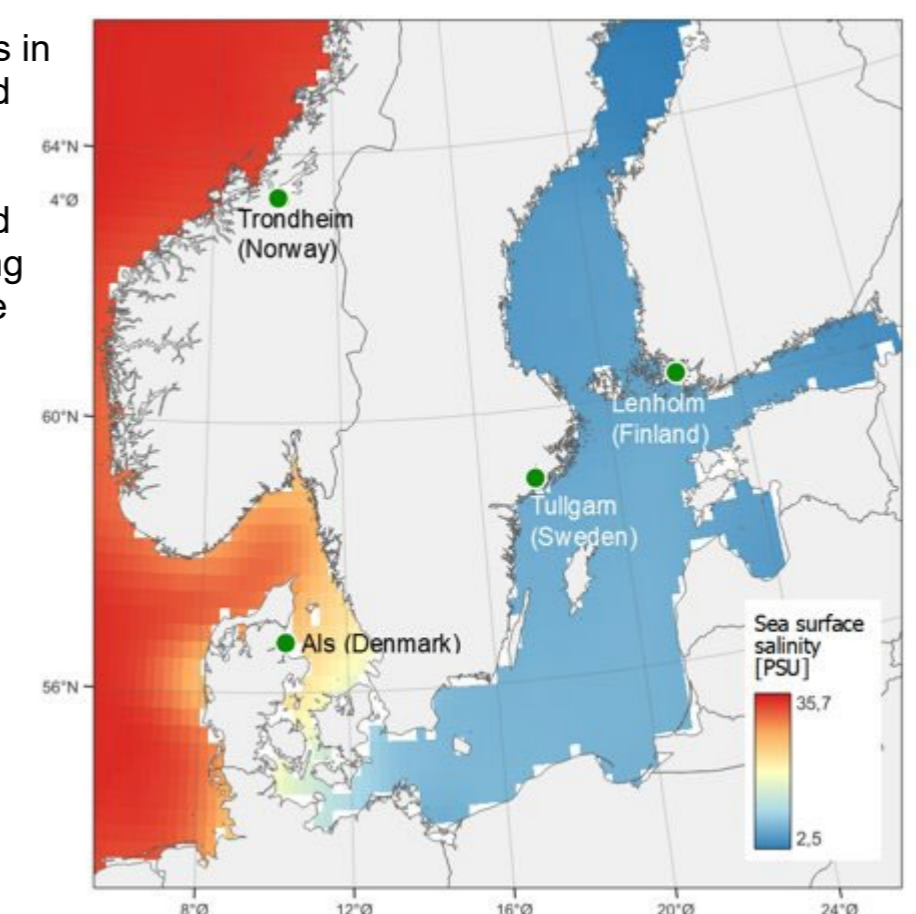
What are Nordic Salt Marshes – and why are they important?

Salt marshes support biodiversity, help protect the coastline and represent an estimated 50% of the coastal 'blue' carbon globally stored by vegetated coastal habitats (seagrasses, saltmarshes and mangroves). Salt marshes in the Nordic region have received limited scientific attention e.g. in regard to their carbon storage capacity and how management practices may affect salt marsh capacity for storage as 'blue' carbon. The NordSalt project targeted this knowledge gap by quantifying and compiling information on salt marsh ecology and ecosystem functions and services from the German **Wadden Sea** (south), the **Norwegian coast** (west) and the **Baltic Sea** from Danish and Swedish coastal waters to the Finnish coast (east), representing a variety of environmental variables (gradients in salinity, climate, etc.). This project assessed the potential effect of grazing on saltmarsh blue carbon capacity and biodiversity, particularly because grazing is the most common management practice for Nordic salt marsh habitats.

The NordSalt team studied 4 main salt marsh sites (grazed and ungrazed areas in each, green dots in the map to the right) and included additional sites in surveys and from literature. NordSalt quantified habitat distribution, plant community biodiversity, Blue Carbon storage, sequestration and greenhouse gas (GHG) fluxes in relation to local management practices and environmental gradients. A mesocosm experiment explored the effect of warming on saltmarshes, and project leaders engaged with local stakeholders to understand their views on salt marsh habitats. With a better understanding of these habitats, informed decisions can be made to promote regulations that protect and preserve these areas from vulnerabilities.

Salt marshes as diverse ecosystems

Nordic salt marshes differ from 'classic' macrotidal salt marshes due to the wide climate and salinity gradient and microtidal nature of the Baltic Sea. We now understand a little more about the role of these Nordic ecosystems regarding climate change mitigation and coastal protection. The diversity of the region in combination with the general neglect of these ecosystems have even resulted in a variety of nomenclature and habitat classification schemes across the region that has hampered a common understanding and management recommendations across the region.



Climate change in 'no man's land' between land and sea

- Salt marshes are not consistently protected under land or ocean policies. Salt marshes are typically "left out" with implications in not being considered for their role, importance or link between terrestrial and marine habitats.
- A variety of terms has divided salt marshes, possibly leading to less support or awareness in promoting policies to protect them. These terms include salt meadows, coastal or seashore meadows, coastal marshes, grasslands, and wetlands, to name but a few.
- These ecosystems provide a number of measurable benefits to biodiversity and inhabitants, ranging from beautiful scenery, protection from storms and flooding events, and even providing important habitats for birds, fish and other species.
- These habitats are important for local stakeholders, especially land owners, farmers, and recreational users. There is a long tradition of using Nordic salt marshes as coastal grazing meadows, but this is challenged with increasingly wetter conditions. These habitats are important breeding and foraging habitats for many bird species.
- In addition to direct uses, salt marshes deserve attention for other important ecosystem services they provide (coastal protection, water and nutrient regulation).



Saltmarsh in Finland (Chris Boström, Åbo Akademi)

“Salt marshes help bridge the gap between land use management and coastal management, [two] sectors that are often not working together.”

Who cares about the Nordic Salt Marshes?

Anyone living near or enjoying a coastal area should care about these habitats, but they are often overlooked or taken for granted. Local community members may have a higher interest in understanding and protecting Nordic salt marshes given their direct use of these habitats. The roles and impacts from these habitats are important to more than just local residents – as our project explored in workshops with a variety of interested stakeholders. Trying to better understand these habitats in terms of climate mitigation, particularly carbon storage and sequestration, is what we studied in the NordSalt project.

The NordSalt team found several important factors that should be addressed to support salt marshes and promote protection and preservation practices. Here are 3 main, interconnected themes on grazing practices, mapping and ‘universal’ classification, and biodiversity.



Grazers in a salt marsh, Denmark (Dorte Krause-Jensen)

Understand the differences in sites that follow grazing vs. non-grazing practices and the impact on climate.

Overall, we found that grazed sites can sequester (net accumulate and bury) as much C as non-grazed sites. This is likely due to higher soil densities associated with grazed areas, likely from trampling effects and lower water content in the soils, despite non-grazed sites having more standing C stocks due to larger plant biomass in non-grazed marshes. Another important consideration is GHG emissions from marshes. Multiple factors affect GHG; one tradeoff for grazed sites: they host additional producers of GHG. Understanding GHG dynamics in grazed vs. non-grazed salt marshes needs to be evaluated.

The implications for farmers, inhabitants, and other important stakeholders of these regions is that no one-size-fits-all approach can be found. Instead, balance is needed to mitigate human-induced climate change activities.



Saltmarsh in Sweden (Line Andersen)

Apply one complete synthesized classification system to improve data availability and sharing.

Nordic coastal marshes, salt marshes, coastal meadows, reed beds, salt swamps.... These coastal vegetated habitats have many names in the Nordic region, and are classified using different systems in each Nordic country. Having multiple names and classifications makes it difficult to make comparisons for similar work labeled in different ways.

Expert stakeholders agree that having one unified system would improve the knowledge and understanding of Nordic salt marshes across Norway, Sweden, Finland, Denmark, and even Germany. NordSalt has suggested such a common classification framework and how that can be used.



Saltmarsh in Norway (Lacie Setsaas)

Biodiversity and ecosystem services from plant communities are diverse and impacted by management.

There is a large range of parameters that affect the plant communities of Nordic salt marshes (moisture, salinity, grazing, temperature, and additional unique local soil and hydrological conditions). This affects their capacity and ecological functioning as Nature-based Solutions. This in turn has implications for protection and management practices and policies.

The NordSalt project has recommendations toward the management of these habitats. Reports, data, and other important documentation continue to be updated on our website and other outreach platforms.

This report updated April 2024.

Important take away messages

1. Grazed sites store as much if not more C than non-grazed marshes despite having less aboveground plant biomass
2. GHG emissions are dynamic and change on daily a daily and seasonal basis, but are likely controlled to a large extent by soil moisture, salinity and water levels
3. Salt marshes and meadows in the Nordic region are called by many different names and there is a need for a more coherent classification system in the region
4. Global warming threatens to reduce the BC potential of these habitats by increasing the rates of soil carbon remineralization and thus lowering C preservation and storage. Sea level rise and associated coastal squeezing further threaten these marsh ecosystems.