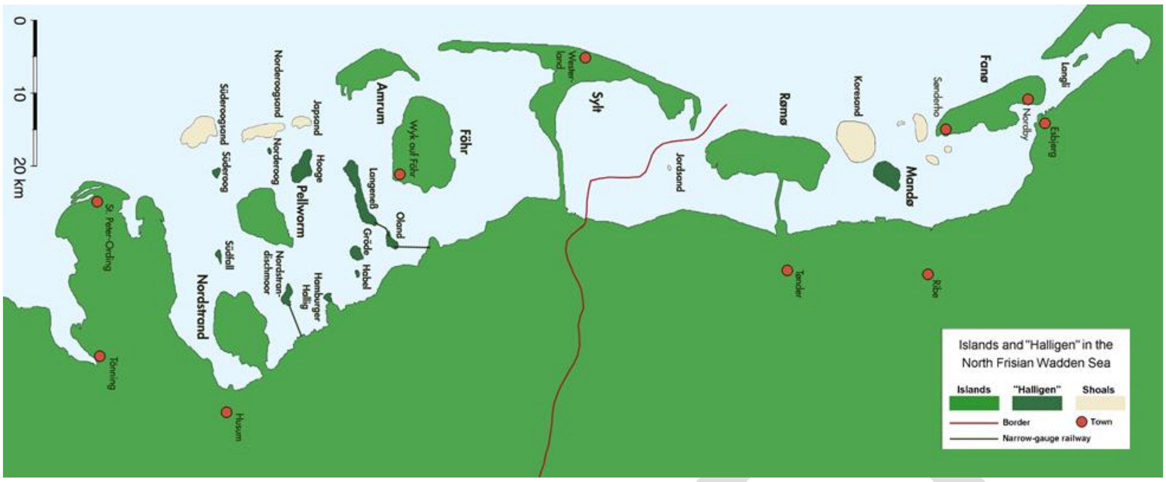
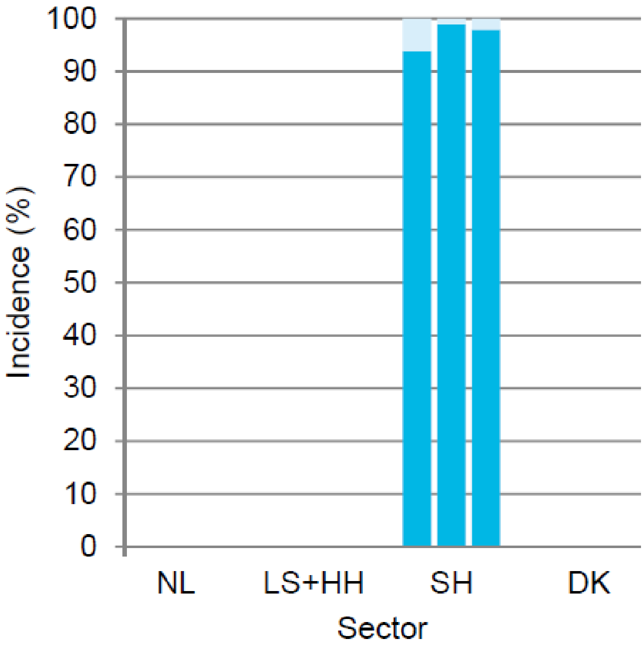
Landward Solutions Halligen



The Halligen (halliger in Danish) are salt marsh islands with no or low protective dikes. These islands struggle to keep up with MHW rise. Does nourishing with mud provide a solution or is it enough to open dikes and allow more frequent flooding?

There are ten German Halligen on Schleswig-Holstein's Wadden Sea and one in the Danish Wadden Sea, with areas ranging from 7 to 956 ha. The Halligen result of frequent floods and poor coastal protection during the Middle Ages. Originally, these islands were former parts of the mainland or bigger islands, separated therefrom during storm surges. The salt marshes of the Halligen thus accreted on low-lying old land. Sometimes, owing to sediment deposition, islands have grown together to form larger ones (Langeneß) or amalgamated with the mainland (Hamburger Hallig).

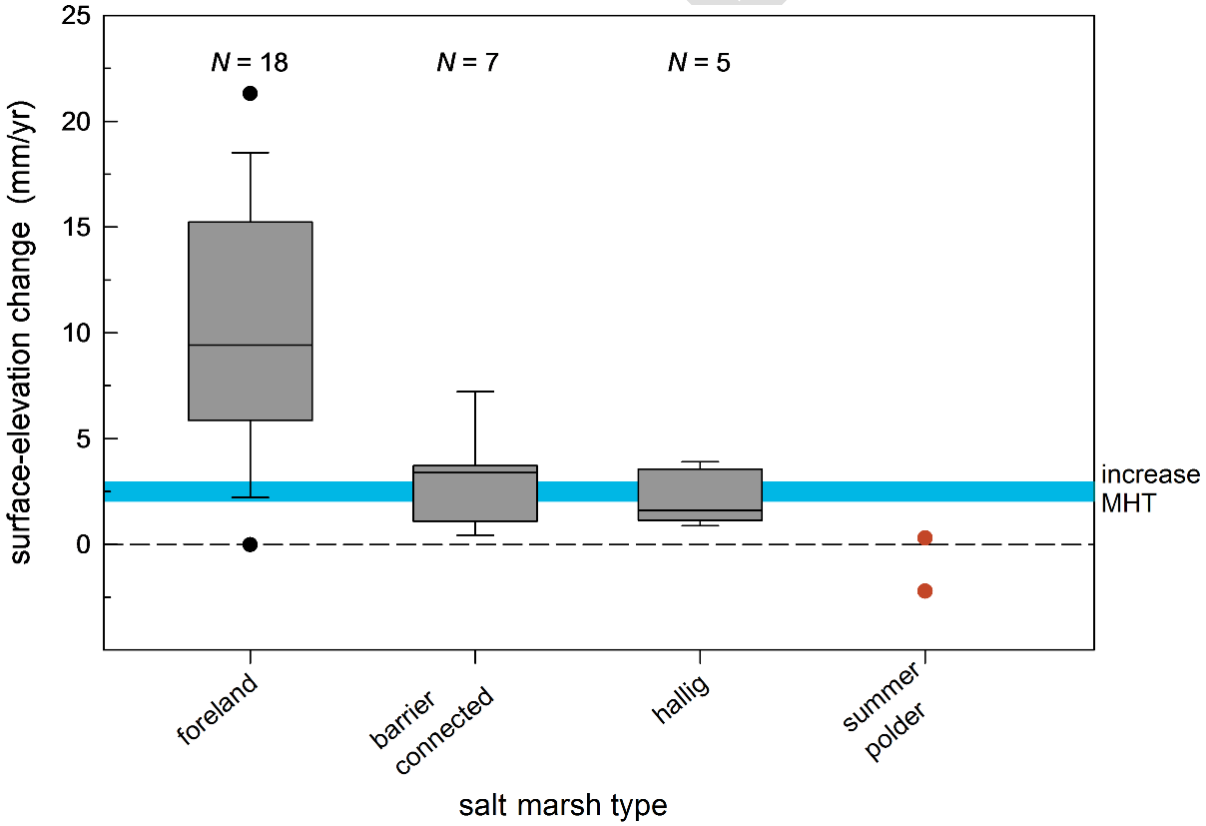


Development of the extent of artificial drainage in the Halligen salt marshes over the periods 1995/2001, 2002/07 and 2008/2014 (left to right). Darker blue shows: last human intervention more than ten years ago. Light blue shows last human intervention less than 10 years ago (Esselink et al., 2016).

On the islands one or several meters high, man-made mounds are present, the so-called Warften (Værft in Danish), to provide protection against storm tides. Hallig salt marshes are generally protected by revetments and are recently not increasing or decreasing in surface area. Some Halligen have overflow dikes, comparable to summer dikes on tidal marshes. For centuries, flooding events happen on average of 4-5/year on Halligen with low dikes, and between 40-50/year on those without coastal defense. During such storm surges sediment is deposited that has enabled the islands to grow apace with sea level rise, allowing them to keep above MHW. Furthermore, the Halligen and other islands form a barrage against waves which allows the mainland dikes to be lower.

On several islands, such as Hooge, low dikes were constructed to reduce the number of flooding events during the summer months, when cows and sheep still graze on the salty land. Next to that sluice gates and culverts are used to help keep the islands drained. The reductions in flooding frequency lead to a smaller sediment deposition on the Halligen, leading to slower vertical growth. This is a problem considering accelerated sea-level rise. On non-diked Warften, net-sedimentation rates depend mainly on the distance to the tidal flats and on the distance to larger creeks. In central parts sedimentation rates may become lower than MHW rise.

For salt marshes, the increase of mean high tide (MHW) is an important parameter. Over the last century, increase of MHW varied within the Wadden Sea due to differences in vertical land movement and changes in wind climate. Since 1900, average increases of MHW in the Wadden Sea have been in the order of 2–3 mm/yr with highest values in the German sector east of the Elbe.



Vertical sedimentation rates in salt marshes and summer polders, based on various measurement techniques. Elevation changes based on overlapping and varying periods in time, mostly starting around 1990 or later. Grey boxplot with median and 25 and 75 percentiles. Vertical lines give the minimum and maximum values or 1.5 times the interquartile range of the data. Black dots show outliers. The horizontal blue bar gives the range of the long-term increase of MHT level since about 1900 (Esselink et al., 2016).

Discussion Points

Tidal marshes situated near tidal flats and creeks silt up relatively quickly if enough shelter is present. As a result, the tidal marshes can expand rather quickly. However, as a result the central parts of tidal marshes are positioned at an increasingly larger distance from the tidal flats and sometimes from creeks as well. Due to this sedimentation rates decrease, and succession is slowed down or even reversed. The same result can be reached by decreasing the management of the area so that outer tidal marshes do not silt up as rapidly. The discussion point therefore is: should we expand tidal marshes so that central parts can regress, or should we not strive for expansion of tidal marshes? Would a decrease in tidal marsh area in combination with removing of dikes help the central area of the Halligen to silt up more rapidly? What are the implications for natural values and agricultural values?

Literature

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