Saltmarsh flood mitigation in England and Wales, methodology: 2022

Methods used to estimate the value of saltmarsh in mitigating coastal flooding in England and Wales.

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1 . Overview

This article outlines the methodology used to estimate the value of saltmarsh in mitigating coastal flooding. The methodology used remains under development. These estimates are experimental and should be interpreted as such.

Experimental Statistics are those that are in the testing phase, are not yet fully developed and have not been submitted for assessment to the UK Statistics Authority. They are published to involve users and stakeholders in their development and as a means of building in quality at an early stage.

The methodology outlined in this article covers both England and Wales. Scotland and Northern Ireland have not been included in this analysis because of limited availability and accessibility of flood map data. However, we aim to extend coverage for the entirety of UK in future work. The data sources differed across countries but represent the same type of input. These are outlined in full at the end of this article. We explain the broad approach to valuation and the overarching assumptions made in this article.

2 . Methods

Using the GB Land Cover Map (LCM) 2019 we selected saltmarsh across Great Britain. We then added a 439.8m buffer (extended boundary) around this to determine which landcover types might be benefiting from saltmarsh flood mitigation.

This buffer size is a broad assumption based upon the average extent of flooding where saltmarsh is present. This was provided by the open dataset used in the Coastal wetlands mitigate storm flooding and associated costs in estuaries paper (Fairchild et al, 2021). Flood mitigation extent will vary by saltmarsh as they vary considerably in size, trenches, slope, confounding cliffs and density and structure of vegetation.

To only capture areas where a flood mitigation benefit was being provided, we removed saltmarshes (and their surrounding habitats) which were near artificial flood defences. The flood defences were identified using the Areas benefiting from flood defences, 2022, Environment Agency (England) including standardised attributes, and the Areas benefiting from flood defences, 2022, Natural Resources Wales (Wales).

To determine the value of the benefit provided, we estimated flooding risk or extent levels with and without the saltmarsh present. Flood risk levels with saltmarsh (reflecting current reality) were taken from the Risk of flooding from rivers and sea map for England and the National Flood Risk – flood risk from sea map for Wales. Shown in Tables 1 and 2, the flood risk mapping provides the likelihood of flooding within a set period of years. We calculated and used the central bounds for each flood risk category.

Table 1: Flood risk categories in England

Category	Year Range	Lower	Central	High
High	greater than 1 in 30 (3.3%)	1 in 30	1 in 15	1 in 1
Medium	between 1 in 30 (3.3%) and 1 in 100 (1%)	1 in 100	1 in 65	1 in 30
Low	between 1 in 100 (1%) and 1 in 1000 (0.1%)	1 in 1000	1 in 550	1 in 100
Very Low	less than 1 in 1000 (0.1%)	1 in 1000	1 in 1000	1 in 1000

Source: Environment Agency - Risk of flooding from rivers and sea

Table 2: Flood risk categories in Wales

Category	Year Range	Lower	Central	High
High	greater than 1 in 30 (3.3%)	1 in 30	1 in 15	1 in 1
Medium	between 1 in 30 (3.3%) and 1 in 100 (1%)	1 in 100	1 in 65	1 in 30
Low	between 1 in 100 (1%) and 1 in 1000 (0.1%)	1 in 1000	1 in 550	1 in 100

Source: National Resources Wales – National flood risk maps

Flood risk levels without saltmarsh was estimated based upon a 34.5% (standard deviation (SD) plus or minus 24.1) reduction in flood extent from saltmarsh presence (Fairchild and other 2021). Accordingly, this figure was increased by 24.1 percentage points (confidence interval) for the upper bounds (58.6%) and decreased by 24.1 percentage points for the lower bounds (10.4%).

With the central estimate risk bands, this means that a medium risk area’s chance of flooding would increase from 1 in 65 years to 1 in 43 years if saltmarsh was not present. This is just one way to understand the flood mitigation benefit of saltmarsh, alternatively we could assume risk levels are unchanged, but the area flooded is reduced 34.5%. Changes in the mitigation percentages reflect changes in the value per hectare – the cost of damages are reduced by 34.5% because of the presence of saltmarsh.

We estimate the probabilistic cost of flooding annually for both with and without saltmarsh presence. The difference between the two annual values is an avoided cost, representing the regulating service value of flood mitigation by saltmarsh.

The five land cover classes of interest are:

- agriculture and horticulture
- improved farmland
- neutral farmland
- suburban
- urban

These habits were chosen because of their broad coverage and availability of data for valuation. Note that urban and suburban habitats cover only residential households. We are unable to produce a reasonable average flooding cost for non-residential properties as this would be highly specific to each type of property.

The GB Land Cover Map (LCM) 2019 was stripped back to focus on these five habitats of interest. Within the area protected by saltmarsh, 96.6% were categorised within these habitats. As the data is in vector format, some polygons did contain other habitats, for example, freshwater, but this was a minority extent which explains the 3.4% which does not match the five habitats. At present, we are unable to estimate the value of other habitats.

The Farm Business Survey data builder provided data on arable and horticultural, improved grassland and neutral grassland habitats and enabled calculations on the cost of flooding (per hectare). This was divided between cost to crops and cost to livestock. These figures were then adjusted to 2020 prices and provided a basis for the annual value of saltmarsh mitigation of flooding in these habitats. This covered both England and Wales.

The cost of flooding for suburban and urban habitats focused on the number of residential ground floor properties as means to capture the benefit of saltmarsh mitigation in these areas. Data provided by the Ordnance Survey AddressBase Premium database showed all ground floor Unique Property Reference Numbers (active on 15 June 2019). These were then split across the different habitat types and risk levels and matched (by using a gid - a unique identifier for each land parcel) on the existing LCM map, giving the household figures below:

Table 3: Number of households for each landcover type, across all risk categories, England

	No. households			
Habitat	**High Risk**	**Central Risk**	**Low Risk**	**Very Low Risk**
Arable and horticulture	40	3	38	0
Improved grassland	86	2	28	2
Neutral grassland	0	0	0	0
Suburban	40,065	6,286	39,320	1,220
Urban	37,386	3,595	42,092	4,649
Total	77,577	9,885	81,479	5,871

Source: Ordnance Survey – AddressBase Premium

Table 4: Number of households for each landcover type, across all risk categories, Wales

	No. households		
Habitat	**High Risk**	**Central Risk**	**Low Risk**
Arable and horticulture	2	0	1
Improved grassland	14	1	2
Neutral grassland	1	0	0
Suburban	7,608	1,142	995
Urban	4,150	887	1,113
Total	11,775	2,030	2,110

Source: Ordnance Survey – AddressBase Premium

3 . Resources

The GB Land Cover Map (2019) was provided by the UK Centre for Ecology and Hydrology, used as the base map for both England and Wales. This map was stripped down to show saltmarsh habitats across England and Wales.

The buffer around the saltmarsh (highlighting the land cover which benefitted from saltmarsh mitigation) was calculated from the open dataset, used in the Coastal wetlands mitigate storm flooding and associated costs in estuaries research paper (Fairchild et al, 2021).

The following map layers, provided by the Environment Agency, were then applied for England:

- Areas benefiting from flood defences, 2022, Environment Agency (England)
- Risk of flooding from rivers and sea, November 2021, Environment Agency

For Wales, the flood defences and flood risk mapping layers were provided by Natural Resources Wales:

- Areas benefiting from flood defences, 2022, Natural Resources Wales (Wales)
- National Flood Risk – flood risk from sea, 2019, Natural Resources Wales

The cost of flooding for arable and horticulture, improved grassland and neutral grassland was calculated using data provided by the Farm Business Survey data builder, 2019. This covered cropland and livestock costs for both England and Wales.

The costs of flooding for urban and suburban calculated in England and Wales were informed by the Environment Agency's paper, Estimating the economic costs of the 2015 to 2016 winter floods.

In the future we hope to develop this methodology, estimating flooding costs and explore other cost sources. These costs were focussed on residential ground floor properties and data on the number of these properties for both countries were provided by the Ordnance Survey AddressBase Premium.

4 . Related links

Saltmarsh flood mitigation in England and Wales, natural capital: 2022
Bulletin | Released 15 July 2022
This data estimates the impact saltmarsh has on reducing flood risk in coastal areas in England and Wales.