

Statistical bulletin

Saltmarsh flood mitigation in England and Wales, natural capital: 2022

This data estimates the impact saltmarsh has on reducing flood risk in coastal areas in England and Wales.

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Correction

15 July 2022 15:35

A correction has been made to the supporting text to these estimates. We previously stated that funding was allocated to the Blue Recovery Fund to restore coastal and marine habitats, this was incorrect. We apologise for any inconvenience.

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1 . Main points

- The estimated value of flood mitigation by saltmarsh in 2019 was £62 million in England and £9 million in Wales.
- The total value of assets benefitting from saltmarsh flood mitigation is £1.79 billion for England and £0.26 billion for Wales.
- 1.8% of urban landcover and more than 87,000 properties in England benefit from some level of flood protection from saltmarsh; in Wales, 1.4% of urban landcover and more than 6,000 properties benefit from saltmarsh protection.
- Suburban land cover receives the highest flood mitigation service per hectare in both Wales and England, just over £18,000 and almost £9,500, respectively.

Warning: These are Experimental Statistics. The method is currently under development, which means there is uncertainty around the estimates produced. We advise caution when using the data.

2 . What is saltmarsh and what ecosystem services does it provide?

Saltmarsh is a coastal habitat, often composed of fine sediments, muds and vegetation, and is regularly but not permanently covered in saltwater. Saltmarshes can be found along parts of the UK coastline and estuaries. Saltmarshes vary considerably in their individual characteristics, for example, trenches or varying gradients, and density and structure of vegetation. The spatial variability of the landcover types that may be protected and the number of properties at risk are also variable, given the spectrum of saltmarsh characteristics found on our coastline. During its lifetime, a saltmarsh can move inland as erosion occurs or can be pushed along coastlines depending on water currents.

Saltmarshes provide a range of ecosystem services. They help to mitigate flooding, provide an important habitat for a variety of wildlife, process nutrients found in water, and can also sequester carbon from the atmosphere. Saltmarshes also support recreation activities, such as birdwatching. In our [UK Marine Natural Capital Accounts](#), we estimated that saltmarsh removed 81,000 tonnes of Carbon dioxide equivalent (CO₂e) in 2019.

Saltmarsh acts as a natural flooding buffer, reducing wave height and energy carried by waves. This publication focuses on the capacity of saltmarsh to limit the effects of coastal flooding. Given the range of characteristics of saltmarshes, their capacity to mitigate coastal flooding varies, making national assessments difficult.

As a vital coastal habitat, saltmarsh restoration and protection projects are taking place across the UK. This includes the recently established [Somerset Wetlands National Nature Reserve](#), which will protect 6,140 hectares of saltmarsh and will help protect nationally important wildlife populations.

These experimental estimates value the flood risk reduction benefits of saltmarshes. Blending maps, economic data, and recent developments in our understanding of the impacts of saltmarsh on flooding, we look at areas protected by saltmarsh, and how much less flooding these might expect to experience. This is based on an avoided cost method as without saltmarsh presence, these landcover types would flood more frequently and to a greater extent. These estimates are an important addition to our national natural capital accounts and can also be used to estimate the potential benefits of future saltmarsh restoration or protection.

3 . Our approach

This bulletin provides estimates for the annual and asset value of saltmarsh flood mitigation in England and Wales in 2019 for five landcover types. We also estimate the number of residential, ground-floor properties that receive benefits from saltmarsh flood mitigation. The value for agricultural land is calculated on a per-hectare basis and the urban and suburban value is calculated by estimating the number of ground-floor residential properties.

We would like to acknowledge the assistance received from Fairchild, Bennett, Day and Skov, at Swansea University, through their paper on [Coastal Wetlands Mitigation](#). This study covers Wales only, focusing on eight estuaries, but the approach was adapted to encompass England as well.

For more detail, please read our [accompanying methodology article](#).

4 . Area receiving benefits

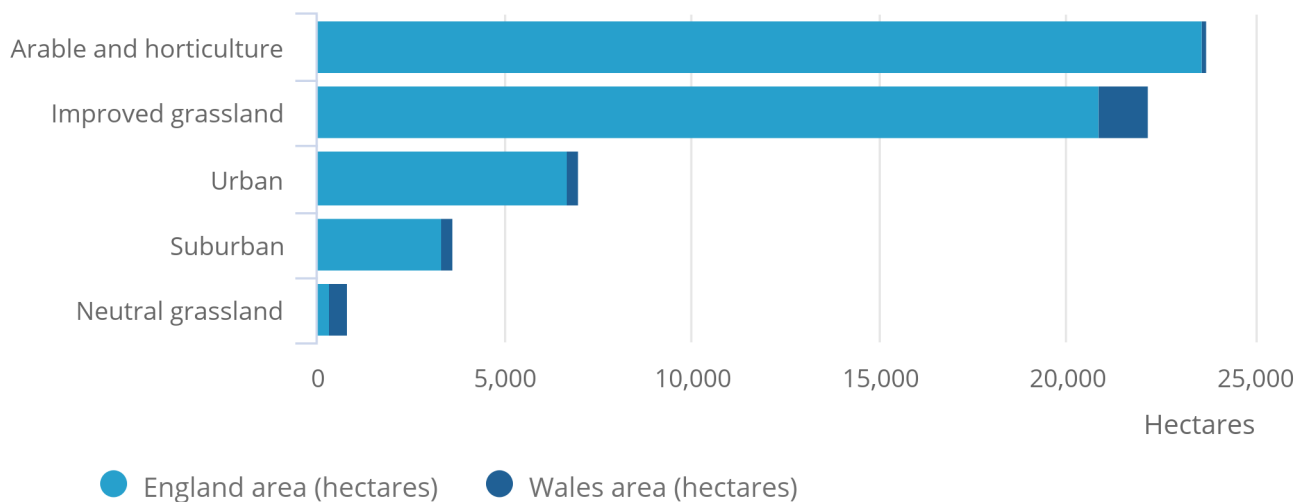
The estimates of value provided in this publication are for areas we have a flood damage estimate for per hectare (Farm Business Survey for agricultural land types) or per property (Environment Agency for urban and suburban land types). The five landcover types covered are: arable and horticulture, improved grassland, neutral grassland, suburban, and urban. These are broadly urban and agricultural landcover types.

Figure 1: Arable and Horticulture has the largest coverage, with over 23,000 hectares in England

Area of landcover that receive flood mitigation benefits from saltmarsh in England and Wales, hectares, 2019

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Area of landcover that receive flood mitigation benefits from saltmarsh in England and Wales, hectares, 2019



Source: Office for National Statistics, UK Centre for Ecology and Hydrology (Land Cover Map 2019)

Notes:

- Notes: Digital Object Identifier (DOI) for [LCM2019 Vector data for Great Britain](#). Contains Ordnance Survey data © Crown Copyright 2022, Licence number 100017572. Morton, R. D., Marston, C. G., O’Neil, A. W., and Rowland, C. S. (2020). Land Cover Map 2019 (land parcels, Great Britain) [Dataset]. NERC Environmental Information Data Centre.

Table 1: The estimated area for each landcover type in England which may benefit from saltmarsh flood mitigation, 2019

Landcover type	Area (hectares)	Percentage (%) of total landcover type in England
Arable and horticulture	23,596	0.51
Improved grassland	20,888	0.49
Neutral grassland	357	0.46
Suburban	3,326	0.30
Urban	6,671	1.82
Total	54,838	-

Source: Office for National Statistics, UK Centre for Ecology and Hydrology (Land Cover Map 2019)

Table 2: The estimated area for each landcover type in Wales which may benefit from saltmarsh flood mitigation, 2019

Landcover type	Area (hectares)	Percentage (%) of total land type in Wales
Arable and horticulture	170	0.19
Improved grassland	1,303	0.16
Neutral grassland	505	2.46
Suburban	319	0.29
Urban	308	1.39
Total	2,605	-

Source: Office for National Statistics, UK Centre for Ecology and Hydrology (Land Cover Map 2019)

For tables 1 and 2, each row illustrates the area (hectares), which may receive benefit from saltmarsh presence, and the proportion of the total area of that land type in England (Table 1) and Wales (Table 2).

Our estimates indicate that 87,723 ground-floor residential properties benefit from saltmarsh flood mitigation in urban areas in England. A similar number, 86,890 properties, receive some level of benefit in suburban areas. This is a total count of all ground-floor residential properties in urban and suburban areas in the high, medium, and low flood risk categories (and very low flood risk in England).

In Wales, we estimate that 6,150 properties in urban areas and 9,745 properties in suburban areas receive some level of benefit from saltmarsh flood mitigation.

Table 3: Number of residential properties in urban and suburban areas, England and Wales, 2019

	Habitat	High risk	Central risk	Low risk	Very low risk	Total
England	Suburban	40,065	6,286	39,320	1,220	86,890
	Urban	37,386	3,595	42,092	4,649	87,723
Wales	Suburban	7,608	1,142	995	N/A	9,745
	Urban	4,150	887	1,113	N/A	6,150

Source: Office for National Statistics – Ordnance Survey

It should also be noted that, in England, there were 40 residential properties identified in arable and horticulture landcover and 86 residential properties identified in improved grassland landcover. These properties have benefitted from saltmarsh flood mitigation, in addition to the value per hectare stated for these landcover types.

5 . Annual and asset value of benefits

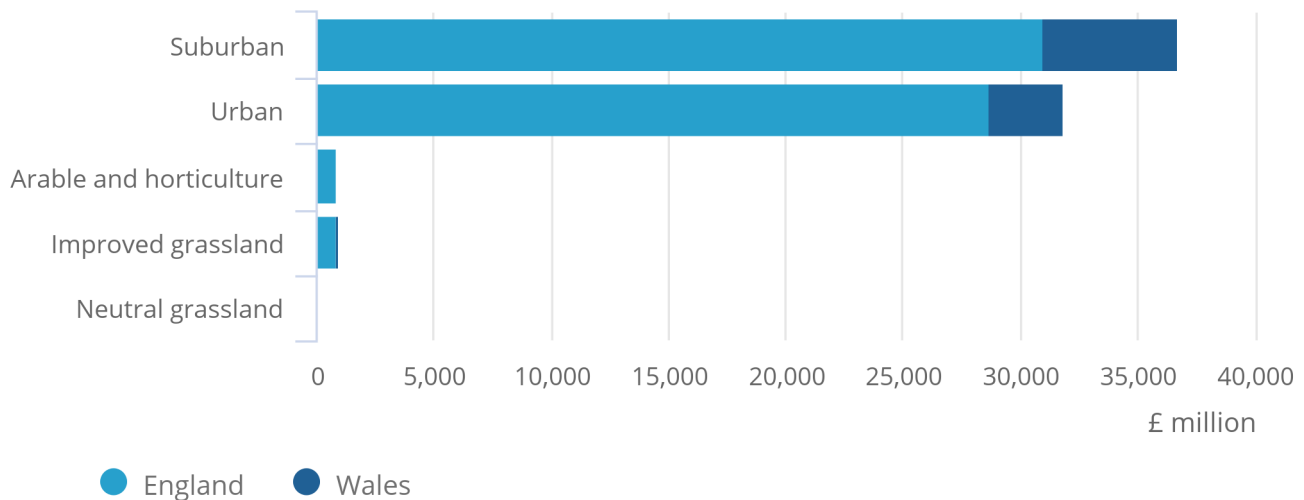
The estimated annual value of saltmarsh flood mitigation across the five landcover types currently valued in England is £62 million and £9 million in Wales. The flood risk ratios (for example, 1 in 15-year chance of flooding) and classifications used are based on estimates from 2019. We do not have data relating to future risk ratios and classifications, therefore over the 100-year asset lifetime, we do not account for a potential increase in coastal flooding risk. This falls under central risk and mitigation scenarios. Risk and mitigation scenarios are explained in Section 9: Strengths and limitations. As seen in figure 2 below, a large proportion of annual value comes from flood mitigation in urban and suburban areas.

Figure 2: The greatest annual value is in suburban areas in England, £ million, 2019

Annual value of saltmarsh flood mitigation in England and Wales by landcover type, 2019

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Annual value of saltmarsh flood mitigation in England and Wales by landcover type, 2019



Source: Office for National Statistics – Farm Business Survey

Table 4: Estimated annual value for each landcover type, England, £, 2019

Landcover type	Annual value (£)	£ per hectare
Arable and horticulture	847,677	36
Improved grassland	799,543	38
Neutral grassland	9,637	27
Suburban	31,393,512	9,438
Urban	28,671,431	4,298
Total	61,721,800	1,126

Source: Office for National Statistics, UK Centre for Ecology and Hydrology, Farm Business Survey, Environment Agency

Notes

1. The £ per hectare value is calculated by dividing the annual value for each landcover type by the total number of hectares of this landcover type that receive some level of flood mitigation benefit from saltmarsh.

Table 5: Estimated annual value for each landcover type, Wales, £, 2019

Landcover type	Annual value (£)	£ per hectare
Arable and horticulture	7,849	46
Improved grassland	58,881	45
Neutral grassland	14,391	28
Suburban	5,745,752	18,009
Urban	3,188,432	10,350
Total	9,015,304	3,461

Source: Office for National Statistics, UK Centre for Ecology and Hydrology, Farm Business Survey, Natural Resources Wales

Notes

1. The £ per hectare value is calculated by dividing the annual value for each landcover type by the total number of hectares of this landcover type that receive some level of flood mitigation benefit from saltmarsh.

Despite a much lower annual value for landcover type in Wales, the value per hectare in urban and suburban habitats is almost double that of England, indicating a greater benefit to these areas and greater housing density.

The larger value, in British pounds per hectare, for suburban areas may be because of the higher proportion of ground-floor residential properties in this area while urban areas are more likely to have multi-storey residential properties and non-residential properties.

The estimated asset value of flood mitigation by saltmarsh across England and Wales is £2.05 billion, of which £1.79 billion is in England and £0.26 billion is in Wales.

6 . Saltmarsh flood mitigation in England and Wales, natural capital: 2020 data

[Risk of flooding from rivers and sea, November 2021, Environment Agency](#)

Dataset | Released 24 June 2022

Shows the chance of flooding from rivers and/ or the sea.

[Areas benefiting from flood defences, 2022, Environment Agency \(England\)](#)

Dataset | Released 23 May 2022

Shows those areas that benefit from the presence of defences in a 1 in 100 (1%) chance of flooding each year from rivers; or 1 in 200 (0.5 %) chance of flooding each year from the sea.

[Areas benefiting from flood defences, 2022, Natural Resources Wales \(Wales\)](#)

Dataset | Released 18 March 2022

Shows areas in Wales that benefit from flood defences that protect against flooding from rivers and the sea.

7 . Glossary

Ecosystem services

Ecosystem services are the flows of benefits that people gain from natural ecosystems. This includes provisioning services such as food and water, regulating services such as flood protection and pollution removal, and cultural services such as recreation and heritage.

Natural Capital

Natural capital is a way of measuring and valuing the benefits that the natural world provides to society. These benefits from natural resources include food, cleaning the air of pollution, sequestering carbon, and cleaning fresh water.

8 . Measuring the data

In this bulletin we have used a range of data to produce these experimental estimates. Data sources include:

- UK Centre for Ecology and Hydrology
- Environment Agency
- Swansea University (Fairchild and others)
- Natural Resources Wales
- Farm Business Survey
- Ordnance Survey

A more detailed list of the data sources used can be found in the methodology.

The Office for National Statistics' (ONS's) natural capital accounts are produced in partnership with the Department for Environment, Food and Rural Affairs (Defra).

Department for Environment Food and Rural Affairs



Department
for Environment
Food & Rural Affairs

9 . Strengths and limitations

For both England and Wales, we tested three sets of risk ratios for flooding risk (High, Central, and Low), and three different percentages for saltmarsh flood mitigation (High, Central, and Low).

For the central risk ratios, each risk class is: High - 1 in 15, Medium - 1 in 65, Low - 1 in 550, Very Low - 1 in 1000. England's risk classes range from High to Very Low and Welsh risk classes from High to Low.

For the central flood mitigation values, the percentage reduction of flooding extent from the presence of saltmarsh is 34.5% (non-grazed saltmarsh). Changes in the mitigation percentages reflect changes in the value per hectare - the cost of damages is reduced by 34.5% owing to the presence of saltmarsh.

Our sensitivity testing involved exploring the impact of changing risk ratios and the percentage reduction of flooding extent (flood mitigation) on annual and asset values across landcover types. We find that the primary driver in annual and asset values is the alteration of the risk ratios.

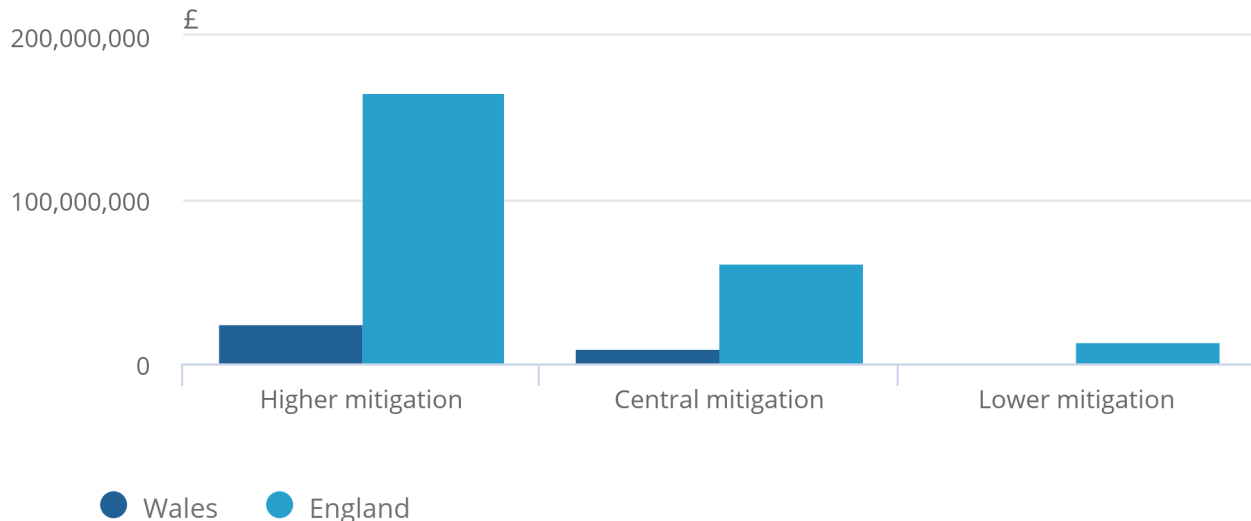
The full sensitivity analysis of values for England and Wales is in our supplementary tables.

Figure 3: Annual value within the higher mitigation bounds in England is substantially higher at over £165 million

Total annual value across all risk mitigation categories, England, £, 2019

Figure 3: Annual value within the higher mitigation bounds in England is substantially higher at over £165 million

Total annual value across all risk mitigation categories, England, £, 2019



Source: Office for National Statistics, UK Centre for Ecology and Hydrology

As we can see in Figure 3, there is a large variation in the annual value as we change the flood mitigation capacity of saltmarsh (while holding the risk ratios constant). We focus our estimates on the central value as this is the value primarily used in the work produced by Swansea University (as referenced above).

We conducted sensitivity testing based on the confidence interval presented in this (Swansea University) study to explore the impact on annual and asset values. We provide the low and high mitigation values to illustrate the variation in the capacity of saltmarsh to mitigate flooding.

The central bounds have been used in analysis, but it should be noted that the annual value for England within the higher risk mitigation is £165.9 million and £24.2 million for Wales, highlighting the huge variation in the value of saltmarsh protection.

While the central mitigation figures have been used in our analysis, the higher mitigation value is noteworthy, showing a total asset value for England of £4.8 billion. The total asset value for Wales is £703.6 million. Again, this highlights the substantial benefit that can be provided by saltmarsh flood mitigation at high-risk sites with higher levels of mitigation.

Please see our [accompanying supplementary tables] to see the outputs from our sensitivity testing. These outputs show the impact on annual and asset values as we change flood risk ratios and saltmarsh flood mitigation percentages.

Future improvements

There are several potential future improvements as we further develop methods, and a wider spectrum of more detailed data becomes available.

We would aim to increase the number of landcover types for which we produce estimates and provide more granular and precise pricing for each landcover type. This may include pricing for the cost of flooding to infrastructure, non-residential buildings, post-flood cleaning, and the cost of flooding on health, particularly on mental health.

We also hope to expand our analysis, with more data, to include Scotland and Northern Ireland and obtain more recent data, such as the 2020 Land Cover Map.

We would also aim to produce a more in-depth model of saltmarsh flood mitigation, taking greater account of individual saltmarsh characteristics. This may be completed on a local scale first, to better develop our model, before expanding the model to a national scale.

We could also conduct regression analysis to better understand the impact of saltmarsh presence on the coastal flood risk to nearby landcover types.

On the two points above, using a digital terrain model (a geospatial technique), we would aim to better understand the impact of the slope of a saltmarsh on its capacity to mitigate flooding and the risk interior landcover types face.

10 . Related links

[Marine accounts, natural capital, UK: 2021](#)

Bulletin | Released 6 April 2021

Natural capital accounts containing information on ecosystem services for marine and coastal areas in the UK.

[Habitat extent and condition, natural capital, UK: 2022](#)

Bulletin | Released 3 May 2022

The size of area and condition indicators for eight natural UK habitats, including woodland, enclosed farmland, semi-natural grasslands and coastal margins. Uses the System of Environmental-Economic Accounting framework for Ecosystem Accounting. Experimental estimates.

[UK natural capital accounts: 2021](#)

Bulletin | Released 10 February 2021

Estimates of the financial and societal value of natural resources to people in the UK.