Grazing marshes and dyke, Halvergate Marshes SSSI, Norfolk

22. Coastal floodplain and grazing marsh

Climate Change Sensitivity: **Medium**

Introduction

Coastal and floodplain grazing marsh is dependent on periodic inundation and high water levels, which means that it is sensitive to the projected changes in patterns of rainfall and extreme events such as drought and flooding. Coastal grazing marsh is at additional risk from sea level rise, leading to increased inundation, potential coastal erosion, and coastal squeeze, with freshwater sites adjacent to the coast sensitive to saline intrusion. Coastal grazing marsh is also vulnerable to human responses to sea level rise, including losing space to intertidal habitats following managed realignment schemes.

As coastal and floodplain grazing marshes are maintained by grazing, climate change driven changes to the economics of grazing systems may also have a significant impact.

Habitat Description

Coastal and floodplain grazing marsh is not a specific habitat but a landscape type which supports a variety of habitats; the defining features being hydrological and topographical rather than botanical. Grazing marsh is defined as periodically inundated pasture or meadow, typically with ditches or rills containing standing brackish or fresh water. The majority of sites have low botanical grassland interest, but nevertheless support bird species of high conservation value, while the ditches can be especially rich in plants and invertebrates.

Almost all areas are grazed, and some are cut for hay or silage. Sites may contain seasonal water-filled hollows and permanent ponds with emergent swamp communities, but not extensive areas of tall fen species like reeds, although they form part of the mosaic of river valley habitats and may abut fen and reed swamp communities. The habitat is characterised by the control of water levels through the use of pumps and /or sluices.

Grazing marshes are particularly important for the number of breeding waders they support, such as snipe *Gallinago gallinago*, lapwing *Vanellus vanellus*, redshank *Tringa tetanus*, and curlew *Numenius arquata*. Internationally important populations of wintering wildfowl also occur, including Bewick's swans *Cygnus bewickii* and whooper swans *Cygnus cygnus*.

Grazing marsh grasslands are typically dominated by the more common grasses of neutral soils, for example meadow foxtail *Alopecurus pratensis*, crested dog's tail *Cynosuarus cristatus*, rye grass *Lolium perenne*, and Yorkshire fog *Holcus lanatus*; while on coastal marshes, red fescue *Festuca rubra* and creeping bent *Agrostis stolonifera* grassland are frequently found.

Ditches have a wide variety of plant species, with the principal environmental variables influencing vegetation being salinity, water depth, substrate and successional stage. Characteristic species range from common reed *Phragmites australis*, along with species more typically associated with freshwater swamps and fens, such as greater pond-sedge *Carex riparia* and reed sweet-grass *Glyceria maxima*; duckweed *Lemna spp.*,flote-grass *Glyceria fluitans* and frogbit *Hydrocharis morsus-ranae* dominated communities; and sea club-rush *Bolboschoenus maritimus*.

The dominant freshwater and brackish aquatic macro-invertebrates of drainage ditches include beetles, bugs, snails, and fly larva. The ornate brigadier soldierfly *Odonomyia ornata* and the great silver diving beetle *Hydrophilus piceus* have been recently described as 'flagship species' for grazing marshes. Grazing marshes are also important habitats for dragonflies. For example, 14 species out of a British total of 44 occur on the Essex marshes.

There are an estimated 220,000 ha off coastal and floodplain grazing marsh in England. However, only approximately 5,000 ha of this grassland is semi-natural and supports a high diversity of native plant species.

Potential climate change impacts

Cause	Consequence	Implications
Hotter summers	Longer growing season	■ Phenology may change significantly, with flowering and seed setting occurring earlier in the season. ■ The earlier onset of the growing season may lead to less favourable conditions for ground nesting birds such as Lapwing that require a short sward.
Drier summers	Drought	■ Drier conditions will favour stress tolerant (eg deep-rooted) and ruderal species. ■ Food availability for ground nesting birds in late spring and summer could be reduced. ■ In peat rich areas, dryer conditions could cause damage to soil structure and increase erosion. ■ Any increase in water abstraction could lower water tables and reduce water availability, and potentially lead to increased saline intrusion on coastal sites.
Wetter winters	Winter flooding Higher winter water table	■ Changes to inundation patterns on wetter sites could lead to changes in floodplain wetland plant communities and affect suitability for over-wintering water birds. ■ Higher spring soil moisture levels (combined with higher spring temperatures) may boost total biomass and favour more competitive species. ■ Wetter ground conditions may create difficulties for grazing.
Altered seasonal rainfall patterns	Altered flow regimes Greater fluctuation of water tables	■ Plant communities on wetter sites may change as specialist wetland species are outcompeted by more generalist species adapted to drier and/ or fluctuating conditions (Toogood, Joyce & Waite 2008). Floodplain wetlands dependant on marked flow peak and snow melt are especially sensitive. ■ Increased disturbance could increase susceptibility to the spread of invasive species.
More extreme events	Flooding	■ More frequent flooding will increase the risk of pollution run-off. ■ Flooding of brackish water bodies and sites with fresh water could lead to the loss of specialist species. ■ Unseasonal summer flooding could affect the breeding success of waders.
Sea Level Rise	Altered coastal dynamics Saline Intrusion Increased frequency of saline inundation Managed realignment, or unmanaged realignment following the abandonment of coastal defence structures	■ Sea level rise could result in the loss of intertidal habitats, increasing the threat of inundation and erosion of adjacent grazing marsh. ■ Saline intrusion will lead to a change in community structure on freshwater sites close to the coast and estuaries, with a shift from freshwater to brackish communities. ■ More frequent inundation could increase the area of exposed mud, making marshes more susceptible to invasive plants and erosion. ■ Coastal realignment could lead to the loss of both coastal and floodplain grazing marsh (Gardiner et al 2007), in favour of intertidal and salt marsh habitats.
In combination	Increased pollution and nutrient loading	■ Increased mineralisation at higher temperatures, combined with reduced dilution due to lower flows, could lead to increase nitrogen loading in water courses, which could contribute to the eutrophication of ditch networks and watercourses (Mooij et al 2005, Moss et al. 2011).

Adaptation responses

Coastal grazing marsh is a man-made habitat created by drainage and flood defence, as it occupies former intertidal zones. On-site adaptation of these coastal sites is therefore likely to involve the active management of flood defence and drainage systems, combined with off-site planning, including managed realignment, that will need to take into account the full suite of coastal habitats. Actions to promote adaptation should be integrated with the existing shoreline management planning process.

For inland floodplain grazing marsh, actions that ensure the continued supply of water and control over water levels are likely to be the primary objectives of adaptation.

Some of the potential adaptation options for this habitat are outlined below.

- Take action to ensure non-climatic sources of harm are reduced, such as reducing the risk of pollution, minimising the adverse impacts of drainage and abstraction, and managing visitor numbers.
- Plan and take action to achieve desirable water levels on site. This might include measures to reduce water loss, providing additional storage for water abstracted from rivers in winter when flows are high, securing additional supplies of water, and increasing the ability to move water around on site.
- Minimise over and under-grazing through flexible management, for example by adjusting stocking density and the timing of grazing regimes in response to seasonal variations in growing conditions. This may require an increase in layback land – land use to graze livestock when they are not on the marsh.
- Expand the area of grazing marsh by re-introducing appropriate water level management on improved grassland and arable land. This should be targeted to ensure the expansion and linkage of existing sites and to promote functioning coastal floodplains (ie those that permit natural flooding regimes).
- Increase the structural heterogeneity of grazing marsh on larger sites by varying the type and timing of management interventions, including allowing areas of bare ground and isolated scrub.
- Monitor and ensure the control of potential invasive non-native species through effective biosecurity measures. Identify potential sources of invasive species in the surrounding area, and undertake active surveillance to detect the arrival of potentially invasive species at an early stage, while they can still be eradicated.
- Anticipate and develop approaches to managing the landward movement of grazing marshes by identifying potential sites for habitat creation.
- Ensure that managed realignment for flood defence or the conservation of intertidal habitat such as mud flats and salt marsh do not compromise the area or quality of coastal and fluvial grazing marsh.
- Adjust designated site boundaries and interest features as coasts evolve, with the aim of creating larger functional units.

Cattle grazing, Cabin Hill NNR, Merseyside

Relevant Environmental Stewardship options

Maintenance of traditional water meadows (HD10)

Restoration of traditional water meadows (HD11)

These options maintain or restore the traditional management required on water meadows, including catch meadows, where irrigation is achieved through a system of inlet and outlet channels.

Restoration/Maintenance of wet grassland for breeding waders, wintering waders and wildfowl (HK09-12)

These options aim to continue or restore the management of seasonally wet grassland to support overwintering and breeding waders and wildfowl. Existing water management regime will be continued or modified to provide conditions that will continue to attract lowland breeding waders.

The following options can be used in combination with the HK options where relevant:

Management of ditches of very high environmental value (HB14)

This option is aimed at the management of ditches that support target species of plants, birds, mammals and insects.

Raised water level supplement (HK19)

This supplement is aimed predominantly at raising water levels in ditches, and thus adjacent land, at key periods of the year.

Inundation grassland supplement (HQ13)

This option is designed to provide additional areas of flooding by inundation with floodwater from adjacent watercourses.

Further information and advice

JNCC (2008) UK BAP list of priority habitats **Coastal and Floodplain Grazing Marsh**.

Rodwell JS, Morgan V, Jefferson RG & Moss D. (2007). JNCC Report, No. 394. **The European context of British Lowland Grasslands**.

Buglife. Advice Sheet **Coastal and Floodplain Grazing Marsh**.

Environment Agency **Shoreline Management Plans (SMPs)**. Information about Shoreline Management Plans, which aim to manage the risks of flooding and coastal erosion, using a whole coast approach.

Wetland Vision A partnership project which sets out a 50 year vision to improve the quality, distribution and functionality of England's wetlands.

Relevant case study examples

Lincolnshire Coastal Grazing Marshes
The Lincolnshire Coastal Grazing Marshes lie between the coastal strip and the Lincolnshire Wolds. The project supports local farmers and landowners to conserve the remaining traditional grazing marsh by providing access to grants, advice and training.

Essex Biodiversity Project **Lower Raypits and Lion Creek Higher Level Stewardship Restoration Project**

Key evidence documents

Dargie TC (1993) The distribution of lowland wet grassland in England (English Nature Research Report 49).

Drake CM, (2004) Grazing marsh assemblages and site classification using invertebrates (English Nature Research Report 579).

Drake CM, Stewart NF, Palmer MA & Kindemba VL (2010) **The ecological status of ditch systems: an investigation into the current status of the aquatic invertebrate and plant communities of grazing marsh ditch systems in England and Wales**. Buglife – The Invertebrate Conservation Trust.

Gardiner S, Hanson S, Nicholls R, Zhang Z, Jude S, Jones A, Richards J, Williams A, Spencer T, Cope S, Gorczynska M, Bradbury A, McInnes R, Ingleby A & Dalton H. (2007). **The Habitats Directive, Coastal Habitats and Climate Change - Case Studies from the South Coast of the UK**. Tyndall Centre for Climate Change Research Working Paper 108.

Mooij, W.M., Hülsmann, S., De Senerpont Domis, L.N., Nolet, B.A., Bodelier, L.E., Boers, P.C.M., Pires, L.M.D., Gons, H.J., Ibelings, B.W., Noordhuis, R., Portielje, R., Wolfstein, K., & Lammens, E.H.R.R. (2005). The impact of climate change on lakes in the Netherlands: a review. *Aquatic Ecology* **39**, 381-400.

Moss, B., Kosten, S., Meerhoff, M., Battarbee, R.W., Jeppesen, E., Mazzeo, N., Havens, K., Lacerot, G., Liu, Z., de Meester, L., Paerl, H., & Scheffer, M. (2011). Allied attack: climate change and eutrophication. *Inland Waters* **1**, 101-105.

Mountford, MO, Cooper JM, Roy DB & Warman EA (1999) Targeting areas for the restoration and re-creation of coastal and floodplain grazing marsh (English Nature Research Reporet 332).

Nicholls RJ & Wilson T. (2001). Integrated impacts on coastal areas and river flooding. Chapter 5. In: Holman I.P., Loveland P.J. (Eds.), Regional Climate Change Impact and Response Studies in East Anglia and North West England (RegIS). Final Report of MAFF project no. CC0337.

Toogood S, Joyce C, and Waite S (2008) Response of floodplain grassland plant communities to altered water regimes, Plant Ecology **197** pp 285-298.