# ECONOMIC DIMENSIONS OF WASHLAND CREATION IN ENGLAND: A CASE FROM SOMERSET

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**Abstract:** Flood defence for farm land, along with high levels of subsidies, was for many years an important element of Britain's production oriented agricultural policy. Many flood plain areas benefited from publicly funded flood defence and land drainage schemes which reduced crop damage and facilitated a change to more intensive farming systems.

Recently, however, policy emphasis has been placed on environmental enhancement, on greater diversity of economic activity as a basis for sustainable rural livelihoods, and on public enjoyment of the countryside. Funds previously committed to support farm output are increasingly diverted to encourage land managers to deliver environmental benefits.

In this context, there is reduced justification for high standards of flood defence for agriculture. Indeed, there may be substantial benefits if some flood plain land is returned to its previous unprotected, un-drained condition

Drawing on the UK experience, this paper explores the technical feasibility of flood storage and washland creation, which vary according to catchment and floodplain characteristics and the purposes to be served. The water regime requirements for alternative rural land management options, notably farming and wildlife, are identified in broad terms, exploring scope for synergy.

The paper then examines the likely costs and benefits of washland creation, with particular reference to impact on the incomes of land managers. The type of incentives that might be required to encourage adoption of washland options are considered. Following this, the paper critically assesses alternative administrative and funding mechanisms that might be adopted to implement washland development that integrates flood management, biodiversity and rural livelihood objectives.

## INTRODUCTION

Flood defence for farm land, along with high levels of subsidies, has for many years been an important element of Britain's production oriented agricultural policy. Many flood plain areas benefited from publicly funded flood defence and land drainage schemes which reduced crop damage and facilitated a change to more intensive farming systems.

Recently, however, policy emphasis has been placed on environmental enhancement, on greater diversity of economic activity as a basis for sustainable rural livelihoods, and on public enjoyment of the countryside. Funds previously committed to support farm output are increasingly diverted to encourage land managers to deliver environmental benefits.

For these reasons, there is reduced justification for high standards of flood defence for agriculture. Indeed, there may be substantial benefits if some flood plain land is returned to its previous unprotected, un-drained condition. In some areas, the positive creation of washland and/or flood storage facilities could: provide relief to areas presently subject to unacceptable flooding; reduce the need for expensive flood defence measures elsewhere in the catchment; help the management of

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scarce fresh water resources; provide wildlife and amenity benefits, and, through credits for flood storage and extensive farming methods, provide alternative sources of income to land managers.

Many of these issues come together in the Somerset Moors and Levels, the largest body of lowland were grassland in the UK. The natural and human characteristics of the area are largely defined by the interface between land and water with its a history of flood defence, land reclamation and farming practices (Williams, 1970). It contains many sites with habitats of national and international significance. A large proportion is classified as an Environmentally Sensitive Area (ESA) whereby farmers have options to adopt practices that protect or enhance the wetland landscape and ecology.

## AIM AND APPROACH

In this context, this study reported (Morris et al, 2002) here explored how public funds might be used most effectively to achieve better flood moderation through appropriate use of agricultural land in the mid and lower Parrett catchment of the Somerset Levels and Moors. It set out to determine the technical feasibility of flood storage and washland creation, the likely economic impacts of this type of development, and the financial and institutional mechanisms required to achieve implementation.

For this purpose the researchers carried out site review and visits, discussions with land managers and a participatory workshop with key stakeholders which captured responses to the broad options for the delivery of washland creation. The enquiry used a number of 'indicative' case study sites which provided a basis for analysis. This paper focuses on environmental benefits, incentives to land managers and the institutional arrangements to support a washland option.

## TECHNICAL FEASIBILITY

The identification process classified broad categories of flood storage initiatives or 'project types', which could be pursued in different parts of the Parrett Levels and Moors. The projects variously involved more effective discharge of excess water to sea, temporary storage and managed evacuation of water in the lower levels, and holding back potential flood waters in the middle catchment.

Criteria for screening site selection for storage were developed and applied. These were hydraulic suitability (ease of filling, evacuation and containment), existing flooding regimes, opportunity for environmental enhancement, suitability of land use, and site constraints such as that imposed by settlements and infrastructure. Following a reconnaissance level enquiry, four possible sites were identified out of a larger number. These sites were used to progress the study objectives with respect to environmental and economic assessment. Detailed proposals for and appraisal of development on these sites were not carried out, rather they were used to progress the concept of managed flood storage and washland creation.

## RANGE OF BENEFITS OF WASHLANDS

The Parrett hydraulic system reflects a long history of flood defence and land drainage activities and there are wide ranging benefits and costs associated with managed flood storage. There are important links between flood defence, water regime management, land use and farming practice. Commercial agriculture is dependent on managed water regimes. In recent years, flooding in some areas of the Levels and Moors has been excessive, to the point where farming futures are threatened.

There is scope, through a managed approach to flood storage, to provide relief to those farmed areas worst affected by long duration flooding at the present time, and simultaneously provide new opportunities for washland creation in other areas. There is scope to develop, through the use of appropriate promotional mechanisms, washland areas which will simultaneously accommodate winter inundation, support extensive farming methods, deliver environmental benefits, and do this in a way which can underpin the rural economy.

Tourism and recreational activities can also benefit from a flood regime that served to enhance the wetland characteristics of the area, provided that access and mobility were maintained. The same could be said for the preservation of archaeological remains. However, the traditional production of willows would suffer from long duration flooding or permanently high water levels, although this could be relocated beyond the washland areas.

Managed washlands would, as previously stated, alleviate flood damage and disruption borne by those areas currently at risk, as well as incidental flood damage in other areas in all but the most extreme events. Given that the washlands offer a managed facility, they could take pressure off flood defences which protect urban property and infrastructure. They could also reduce the impact of uncontrolled flooding of communications infrastructure and the disruption this causes to economic and social activity, both locally and regionally.

The flood storage options could re-orient capital and revenue expenditure in the Levels and Moors more towards flood 'management' than flood 'defence' per se. This would serve to reduce the uncertainty of the impacts of flood events and provide responsible agencies with greater flexibility for flood management. The flood storage options would contribute to sustainable flood management in so much as they could provide a cost-effective basis for reconciling social, economic and environmental objectives in the Parrett flood plain.

## ENVIRONMENTAL BENEFITS IN THE STUDY AREA

The main conservation objectives in the Somerset Levels and Moors concern:

- Wintering wildfowl;
- Breeding waders;
- Rare aquatic invertebrates and diverse aquatic plant communities;
- Species rich lowland wet grassland features; and,
- The wider wetland.

These objectives are pursued through the designation of Special Protected Area status, Ramsar and SSSI sites, and the Natural Area Biodiversity Action Plan (English Nature, 2001). In that these objectives require management of water regimes, with respect to both flooding and groundwater levels, they can be met through judicious management of flood storage areas and washlands.

Fig. 1. illustrates the variation in water regime requirements, measured in terms of depth of the water table level from the surface, for selected environmental characteristics during the calendar year. The gap in the diagram which runs through the year shows the minimum and maximum heights of water table levels which would satisfy the water regime needs of specific characteristics For example,

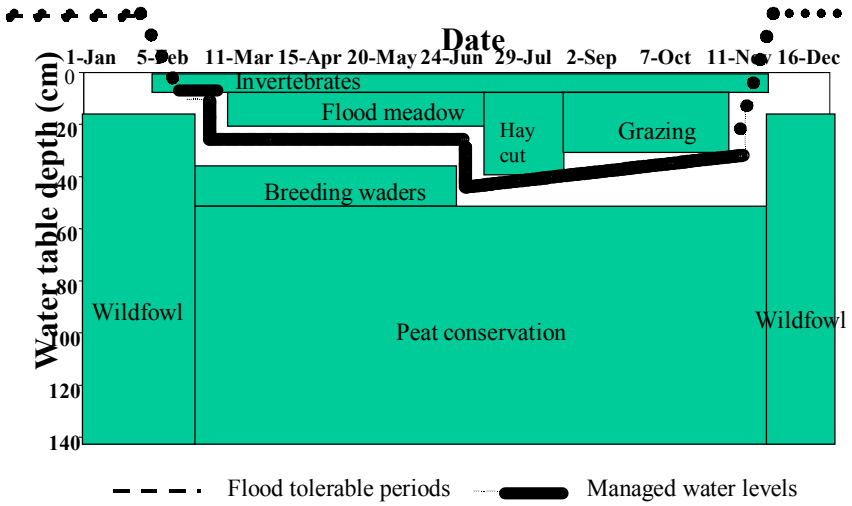


Figure 1. Water Regime Requirements for Environmental Characteristics.

breeding waders require water table levels are at least within 35 cm of the surface during the period March to mid June inclusive. Species rich flood meadow, however, require water tables that are at least 20 cm below the surface during the mid March to end June period. The diagram also shows that there is general tolerance to flooding during the winter months. Indeed, wintering wildfowl are attracted by this facility. Of course, other fauna, such as small mammals, would need to be able to take refuge on higher ground during flood periods.

Fig. 1. illustrates two main points. First, water regime requirements and tolerances vary between species and habitats through the year. For example, although flooding and water logging in winter suit visiting wildfowl, excessive flooding in spring is detrimental to breeding waders, invertebrates, small mammals and some plant species. Second , it is possible to manage water tables during the year (for example along the ranges shown by the gap in the diagram) in order to deliver multiple environmental and farming objectives. This is the essence of water level management.

## IMPACTS OF WASHLAND CREATION ON FARMING

### Agri-environmental Schemes

Land use within the flood risk areas of the Parrett catchment is predominantly down to grass for dairy, cattle and sheep production. Where flood risk is low, cereals and maize for fodder are sometimes grown, in some cases assisted by private pump schemes.

The flood plain areas correspond closely to the eligible area of the Somerset Levels and Moors Environmentally Sensitive Area (ESA). The voluntary scheme pays farmers annual amounts in return for the adoption of agreed prescribed practices which are classified in 'tiers' of compliance (Table 1) Designated in 1987, it now covers over 29,000 hectares, of which almost 18,000 ha (60% of the total eligible area) are subject to a total of over 1000 agreements. Farmers receive annual payments of about £125/ha to retain permanent grassland, and between £200/ha and £430/ha to maintain wet grassland. The higher rate applies for permanently raised field water levels. These payments reflect a mixture of compensation and incentive. It is possible that a similar payment regime could be designed for washland creation/flood storage.

Table 1. ESA Payments: Somerset Levels and Moors

| **Tiers and Supplements** | **Annual payment rate (2001) £/ha** |
|---|---|
| Tier 1 Permanent Grassland | £125 |
| Tier 1A Extensive Permanent Grassland | £200 |
| Tier 2 Wet Permanent Grassland | £225 |
| Tier 3 Permanent Grass Raised Water Level Areas | £430 |
| Buffer Strip Supplement | £110 per ha equivalent |
| All Year Penning Supplement on Peat Soils | £18 |
| Raised Water Level Area Supplement | £80 |
| Public Access Tier | £170 |

(source: www.Defra.gov.uk)

Agricultural land use, farming practice and performance are critically dependent on flood defence and land drainage. Flood defence for agriculture, as for most land-engaging activities, refers to acceptable levels of flooding above and below the surface of the ground with implications for reduced yields and cropping options, increased costs and reduced overall financial performance. On grassland, productivity is a function of the production and use by animals of energy from grass. Drainage and flooding can affect the quality of the grass sward, grass growth conditions, ability to apply nitrogen, and access to fields for grazing livestock or machinery (to apply nitrogen and cut grass). Estimates were derived of the financial performance of farming under different water management regimes drawing on previously developed methods (Hess and Morris, 1987; Dunderdale and Morris, 1997a, b; Penning-Rowsell et al , 2002)). Given the changing policy context and deteriorating terms of trade for farming, farmers have found that switching to extensive systems and drawing assistance under an agri-environment schemes (especially Tier 1) has helped to maintain the viability of their farm business.

## Assessing the Financial Impact of Washland Options on Farm Incomes

In order to assess the impact of adopting flood storage options, two broad scenarios were identified for the assessment of changes in flood regimes which were distinguished in terms of their severity and impacts, namely:

- Damage and recovery scenario: relatively small changes in annual flood risk, which may include infrequent long duration events, but not to the degree that results in changes in agricultural land use. Examples include damage to the yield of grass or cereals, in some cases requiring reseeding of grass or winter cereals.
- Land use change scenario: significant change in flood risk which results in a shift in land use and farming practice, for example a shift from arable to grassland, or from intensive to extensive grassland.

With respect to damage and recovery, Fig. 2 contains estimated flood damage costs on improved grassland according to the duration (in weeks) and depth (75mm to over 750mm) of flooding during the winter (October to March). Short duration flooding of about 1 to 2 weeks in mid winter has little impact, with costs of around £15/ha, including clean-up costs. Long duration floods of 2 months or so are likely to kill 'improved' ryegrass varieties and require reseeding at a cost of about £200/ha. Persistent long duration flooding of more than 2 months would encourage a switch to a lower intensity land use with an estimated cost of about £170/ha to £220/ha. (£1 ≈ €1.5).

Fig. 3 shows the impact of flooding on ESA Tier 1 type grassland which is subject to limits on fertiliser use and hence livestock carrying capacity. Flood costs are proportionately lower than for improved grass, but the same principles apply.

For arable crops, it is assumed that winter flooding of more than a few days would destroy the crop and require reseeding with a lower yielding spring cereal, if feasible. Damage costs could be about £450 to £500/ha.

Figures 2 and 3 also indicate the value of flood alleviation relief that might be obtained where there are reductions in flood risk due to controlled washland flooding elsewhere.

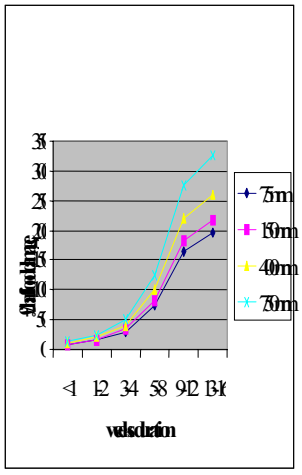


Figure 2. Winter Flood Damage Costs (£/ha) on Improved Grassland by Duration and Depth of Flooding

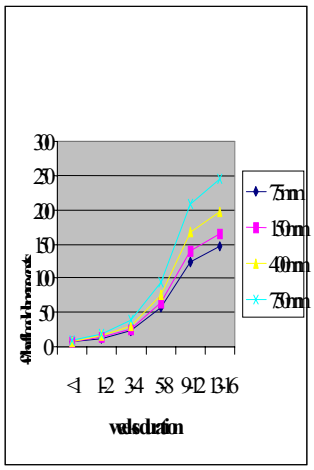


Figure 3. Winter Flood Damage Costs (£/ha) on Tier 1 Grassland by Duration and Depth of Floodin

With respect to land use options, standards of flood defence have a major influence on agricultural practices, not only as a consequence of surface flooding but also, and often more critically, as a consequence of waterlogging of soils. In many respects the land use in the Parrett catchment reflects these drainage circumstances, modified by ESA prescriptions where these apply. A change in flood risk associated with the adoption of flood storage options could involve a change in land use, for example from intensive to extensive grassland

A 'washland package' was identified comprising flood tolerant grass species and related grassland management offering potential advantage over the current Tier 3 arrangements. Financial indicators

include gross margins (output less direct costs such as fertiliser and feed), and different definitions of net margins according to whether semi-fixed costs are charged (such as some direct labour and machinery operating costs) or full fixed costs (including full labour costs and depreciation on machinery and buildings). In the longer term, the net margin is a better indicator of performance.

By way of example, Table 2 shows the income losses (excluding ESA payments) associated with a switch from Tier 1 Grassland (the dominant grassland system) and arable systems to an extensive washland system. For the overall dairy and livestock mix in the Parrett catchment, the reduction in gross margins is about £260/ha, and in net margin (after full fixed costs) about £90/ha. The impact of a switch from cereal-based arable cropping to washland is also shown.

At present ESA rates (with Tier 1 at £125/ha), annual payments for a washland option would probably need to be about £300/ha/yr (in 2001 values) to attract farmer interest. An analysis of whole farm budgets for dairy farms and beef farms in the catchment showed that a payment of about £300/ha/yr would maintain the viability of these farms in a washland environment. Site specific environmental enhancements would need to be identified and built into the washland prescriptions. It envisaged that the washland option would specify grassland management requirements such as grass sward composition, grazing/cutting regimes, and zero chemical nitrogen.

An economic analysis of washland creation (MAFF, 1999, Penning-Rowsell et al 2003), which strips out the value of subsidies from commodity prices, showed that, at current levels of government support to agriculture, there appears to be economic advantage of moving to extensive washland farming systems. That is, there would be a net benefit to the national economy of reducing the intensity of farm production in the Moors and Levels. Furthermore, it can be argued that agri-environment payments to farmers are indicative of society's willingness to pay for environmental goods. Registering these as a benefit of washland development increases the economic value of the washland option. Given the opportunity to achieve economic and environmental benefits through washland creation, and through targeted support to help sustain incomes to the farming community, it would appear in the public interest to redirect funding, both from agricultural support and flood defence for agriculture, into flood storage and washland creation.

Table 2 Reduction in the value of financial indicators associated with a switch from Tier 1 type grassland or arable to extensive grazing on washland (before ESA payments, but including area payments on arable)

| **£/ha/yr reductions 2001 values** | **Dairy** | **Beef** | **Beef and Sheep** | **'Average' Catchment Dairy and Livestock** | **Arable** |
|---|---|---|---|---|---|
| Gross Margin (before forage costs) | 410 | 280 | 260 | 350 | 300 |
| Gross Margin (after forage costs) | 330 | 190 | 170 | 260 | 300 |
| Net Margin after semi fixed costs* | 215 | 140 | 100 | 170 | 150 |
| Net Margins after full fixed costs** | 150 | 80 | 0 | 90 | 90 |

* direct labour and machinery operating costs only

** including labour costs, machinery operating and depreciation, and housing/building costs for stock.

## ADMINISTRATIVE OPTIONS FOR FLOOD STORAGE

Alternative forms of management and administration for washland creation and operation were identified including include land purchase, easements on flooding, management agreements

supported by annual payments and leaseback partnership arrangements. These were screened against the criteria of effectiveness, efficiency, fairness, risks and whether they had a good chance of meeting the overall objective of wise use of flood plains. It was shown that the suitability of these options varies according to the purposes to be achieved, the need to provide long term robust solutions, and, linked to these, the preferred link between the farming community and the management of the land (Tab. 3)

The diversity of circumstance and practice in the Levels and Moors suggests that a range of approaches to washland administrative arrangements will be needed. A mosaic of land tenure arrangements may be acceptable provided this can deliver the scale, integration and reliability of service required.

Table 3. Administrative Options for Washlands.

| ***Option*** | ***Strengths*** | ***Weaknesses*** |
|---|---|---|
| **Land Purchase** and transfer of ownership to authority or trust | *Good chance of delivering flood storage and environmental objectives*<br>*Efficient up-front funding*<br>*Funded under capital budgets*<br>*Provide exit route for some farmers* | *Risk of reduced ties to farming community*<br>*Problems of attracting and negotiating tenants*<br>*Difficult to arrange purchases in large blocks*<br>*Relies on voluntary participation, unless made compulsory* |
| **Easement**: one-off payment to compensate future flood risk | *Focus on flood defence aspects*<br>*Suited to compensating risk of infrequent flood events*<br>*Attractive to flood defence agency: one-off payment funded out of capital* | *Less suited to significant changes in flood risk*<br>*Less suited to delivering environmental enhancement* |
| **Annual Payments** to compensate for income loss and /or environmental enhancement | *Potential to deliver range of objectives: social, economic and environmental*<br>*Maintain farmer and community links with land*<br>*Farmer familiarity with payment mechanism*<br>*Integrate with ESA scheme*<br>*Can be adjusted over time according to objectives/circumstances* | *Inflate land prices, encourage subletting*<br>*Mixed success of ESA schemes*<br>*Participation dependent on 'incentives'*<br>*Expensive, dependent on 'revenue' budgets*<br>*Create dependency* |
| **Lease-back**; transfer of ownership or control to authority or trust with tenancies to previous owners | *Ability to focus on scheme objectives*<br>*Partnership approach*<br>*Farmers/community engaged in implementation*<br>*Diverse 'partner' funding sources* | *Administratively and legally complicated to establish*<br>*Reluctance to transfer assets, until scheme proven*<br>*Requires clear community of interest amongst participants* |

## CONCLUSION

The study concluded that the washland option can offer an economically attractive means of exploiting the synergies amongst flood management, biodiversity enhancement and support to the rural economy. It is important however, that ways are found to overcome some of the barriers to achieving this, through appropriate design of flooding and water level regimes that reconcile the various interests, especially the interface between farming and biodiversity in a washland environment. Furthermore, it is important that funding mechanisms, drawing on and consolidating the existing experience of agri-environment schemes, can provide the incentives for land managers to carry the washland option forward in ways that provide good value for the public purse.

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