relu
Rural Economy and Land Use Programme

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Integrated management of floodplains

A Rural Economy and Land Use project to investigate the factors influencing changes in land use on flood plains, and the ways in which land and water can be managed to meet the diverse and competing demands of agriculture, nature conservation, flood control and recreation.

Flooding on the River Avon in 2007

Policy and Practice Notes

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The Rural Economy and Land Use Programme is a UK-wide research programme carrying out interdisciplinary research on the multiple challenges facing rural areas. It is funded by the Economic and Social Research Council, the Biotechnology and Biological Sciences Research Council and the Natural Environment Research Council, with additional funding from the Scottish Government and the Department for Environment, Food and Rural Affairs.

In England, over one million hectares of agricultural land lie within the indicative floodplain, that is, they have an annual risk of flooding of 1% or greater from rivers or 0.5% or greater from coastal flooding. Although this accounts for only 9% of the total agricultural area, it includes some of the most fertile and productive areas that have been 'reclaimed' and 'improved' for agricultural purposes over many years. The agricultural productivity of this land is maintained by the management of hydrological regimes in the form of flood alleviation and land drainage. Priorities for the use of rural land in England have, however, changed considerably in the last 50 years or so, affecting the way land is managed and the benefits provided. This is particularly the case in rural floodplains where the multiplicity of purposes, such as farming, nature conservation, recreation, and control of flooding, presents a major challenge for policy and practice – how can land be managed to meet such diverse and competing demands? This challenge is made all the more complicated by climate change.

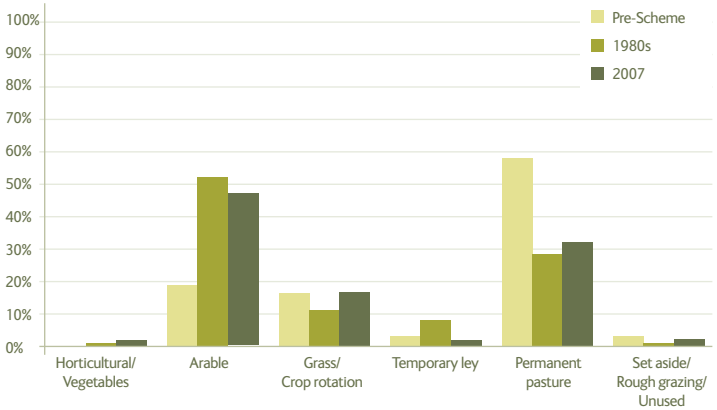
What changes have taken place in rural floodplains?

Between the 1930s and 1970s the focus of policies and environmental regulation was predominantly on agricultural production to achieve national self sufficiency in food. During this period, many rural floodplains were drained to increase agricultural production.

- Since the 1980s, environmental objectives and more recently the conservation of water resources, have exerted greater influence over the way land is managed.
- Historically, agricultural production and flood risk management led decision making on the use of floodplains, but more recently other stakeholders are asserting their interests by influencing policy and legislation or by acquiring land, causing tensions in the floodplain.
- Different objectives are typically the concern of different stakeholders, such as farmers, conservationists or flood-risk managers, who are interested in particular benefits provided by land.
- Recent concerns about flooding call for a 'joined up' approach which includes using agricultural land to contribute to the management of flood risk alongside other purposes, whether farming, biodiversity or recreation.
- Although the land use in rural floodplains changed significantly following the land drainage improvement schemes, since the 1980s there has been little change in land cover. There has, however, been a tendency towards less intensive land management, reflecting national trends in response to changing policies and market conditions.

- The management of rural floodplains is a product of policy interventions that have promoted particular objectives at different times.
- 'Reclamation and improvement' for agriculture were the dominant purposes for over 50 years until the 1990s. In the past decade greater recognition has been given to the range of ecosystem services provided by lowland floodplains, including water regulation, carbon sequestration, landscapes and wildlife, and recreation and amenity.

Observed changes in floodplain land use on 8 case study sites in England



How can ecosystem services delivered by rural floodplains be measured and valued?

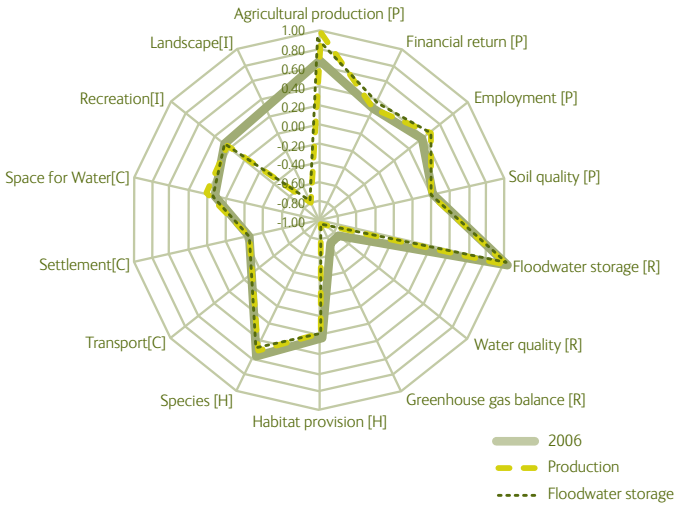
The project developed estimation methods to value a range of ecosystem services provided by floodplains. Scenarios considered management options that focus on single objectives, such as maximising agricultural production, or biodiversity or flood storage capacity. The degree to which different land uses could deliver a range of ecosystem services was assessed, as shown below. This approach showed that:

- There are both synergies and conflicts between ecosystem services delivered by rural floodplains and the value they generate for stakeholders. Different ecosystem services are of interest to different stakeholders.
- As expected, high agricultural productivity is likely to compete with other possible objectives such as nature conservation, landscape, recreation and control of greenhouse gas emissions.
- Other relationships, however, are less obvious and may challenge commonly held beliefs. For example, there is potential conflict between flood storage and biodiversity. Some types of wetland nature conservation can be extremely sensitive to flooding and yet require high ditch and water-table levels that use up potential flood storage capacity. The Government's strategy of 'Making Space for Water' includes reconnecting rivers with floodplains to provide natural flood storage. However this may not always provide flood managers with the degree of control over the extent and timing of the retention and release of floodwaters that is required to avoid flooding of downstream urban areas.
- Locally relevant and targeted agri-environment options can help to balance production and environmental protection, and may be able to offer the greatest combined output of ecosystem goods and services.

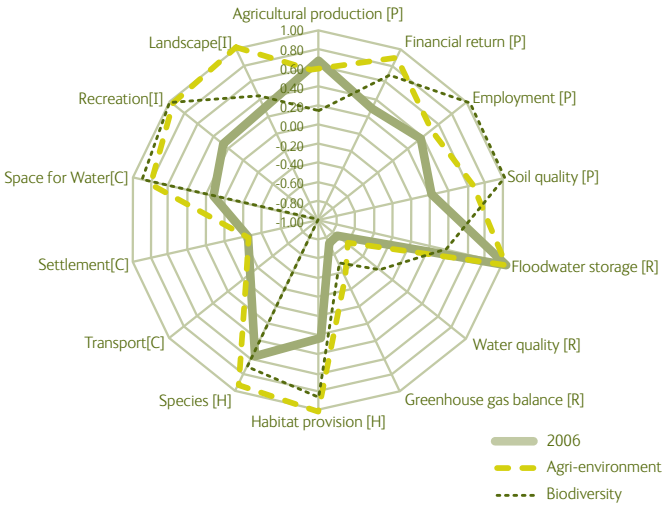
Ecosystem Functions	Examples of Goods and Services	Example Stakeholders	Example Values
Production	Crops, livestock products, bio-fuels	Farmers, Defra	Economic gains from crop and livestock production
Regulation	Flood storage, drainage, carbon cycling, water quality	Environment Agency, flood risk managers, drainage organisations, farmers, residents, local industry, insurance industry, carbon traders	Avoided flood damage costs, savings in water treatment costs, tradeable carbon permits
Habitat	Maintenance and enhancement of bio-diversity	Government and non-Government conservation organisations, local residents, general public	Contribution to Biodiversity Action Plan targets, agri-environment payments, willingness to pay.
Carrier	Infrastructure and human settlements	Local residents, local industry, farmers, Local Government	Property and service values, costs of alternatives
Information/Culture	Amenity, landscape, recreation, history	Local residents, Local Government, non-Government organisations, academia, general public	Enjoyment of the countryside, cost of alternatives, willingness to pay

Ecosystems performance of alternative floodplain land management scenarios classified by main functions (P-production, R-regulation, H-habitats, C-carrier and I-information) – Beckingham Marsh, River Trent, Nottinghamshire:

2006 land use compared with land use scenarios for maximum agricultural production and flood storage options



2006 land use compared with land use scenarios for agri-environment and maximum biodiversity options



How much are we prepared to pay for nature conservation?

The value of the nature conservation interest is probably the most difficult to assess. The project examined alternative methods for this. Some of these use predefined targets for biodiversity, some use preferences expressed by stakeholders, and others use monetary values.

- Different methods emphasise different aspects of conservation value, potentially leading to different rankings of alternative land uses on any one site. Therefore, care has to be taken to use a valuation method that suits the purpose of the assessment.
- Where required and appropriate, monetary values can be based on estimates of citizens' willingness to pay for nature conservation, or alternatively their willingness to pay famers 'compensation' for not farming intensively. These agri-environment payments tend to reflect the value of agricultural production lost rather than the ecological value gained.
- When the views of stakeholders are important, particularly at the local scale, stakeholder-choice techniques or stakeholder-derived criteria can be used.
- If ecological objectivity is the aim, the Ecological Impact Assessment, which uses predefined targets to prioritise particular habitat and species, is probably the most suitable method.

Further information

The research has been carried out at Cranfield University and the Open University.

Key contact: Professor Joe Morris, Natural Resource Management Centre, Cranfield University, email: j.morris@cranfield.ac.uk

Useful resources:

Morris, J., Posthumus, H., Hess, T.M., Gowing, D.J.G. and Rouquette, J.R. 2009. Watery land: the management of lowland floodplains in England. In Winter, M. and Lobley, M. (eds.) What is Land For? The Food, Fuel and Climate Change Debate. Earthscan. pp.320. ISBN 9781844077205.

Posthumus, H., Morris, J., Hess, T.M., Neville, D., Phillips, E. and Baylis, A. (2009). Impacts of the summer 2007 floods on agriculture in England. Journal of Flood Risk Management. 2009:1-8.

Rouquette, J.R., H. Posthumus, D.J. Gowing, G. Tucker, Q.L. Dawson, T.M. Hess, J. Morris (2009) Valuing nature-conservation interests on agricultural floodplains. Journal of Applied Ecology 46(2): 289-296. doi:10.1111/j.1365-2664.2009.01627

Project website:
http://www.cranfield.ac.uk/sas/naturalresources/research/projects/relufloodplains.jsp

What price do rural areas pay for flooding?

Managing land for flooding can be beneficial for downstream, often urban, areas but involves costs for rural areas. A survey of farms affected by the severe summer 2007 floods showed an average of almost £1,200 per hectare flooded and a total cost of about £50 million on 42,000 ha of agricultural land flooded:

- Over 80% of damage costs were associated with loss of crop output or extra costs such as animal feeds, the remainder involved damage to property and machinery, and clean-up.
- Damage costs per hectare flooded varied according to land use: over £5,000 -£10,000 for horticultural and vegetable crops, between £1000 and £1,500 on arable land, and about £400 on improved grassland.
- Most agricultural losses were not insured. On average, compensation payments only covered 5% of the total damage costs. In this respect, farmers are particularly vulnerable to possible increases in flood frequency associated with climate change.

- Livestock farmers could reduce their vulnerability by creating buffers of livestock feed, such as reserves of grazing land or purchased feed.
- Arable farmers could replace crops which are susceptible to flooding with crops that are more resilient.
- Resilience could be increased by maintaining or restoring land drainage in farmed areas as a means of evacuating flood water and controlling ground water levels after flooding.

How can an ecosystems services approach contribute to land use policy?

This type of ecosystem approach can help us to:

- identify and quantify the range of services provided by floodplains under different management options.
- understand the synergy and trade-off between different types of benefits and costs associated with land and water management options.
- appreciate how benefits and costs are distributed amongst different stakeholder groups, facilitating dialogue amongst them and showing what can and cannot be achieved through collaborative working.
- design and promote new forms of land and water management that can deliver intended outcomes more cost effectively.
- design targeted policies that reward land managers for providing the desired range of beneficial services.
- support the 'joining-up' of hitherto fragmented policy themes and funding mechanisms in floodplains.