Workshop Report

Integrated Floodplain Management

London, 28 April 2008

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Executive summary

The RELU[1] research project Integrated Floodplain Management explores the causes, processes and consequences of change in land and water management in lowland floodplains, focusing on sites previously engineered for flood defence purposes. The broad purpose of the project, carried out by researchers from Cranfield University and the Open University, is to inform future decisions on the sustainable management of these important areas. Rural lowland floodplains (and associated freshwater environments in coastal areas) deliver a range of ecosystem goods and services, but priorities placed on these benefits have varied over time and also between different geographical areas.

As part of this research project, a workshop attended by 15 stakeholder representatives and 7 researchers was held in London on 28th April 2008. The purpose was to inform stakeholders with interests in floodplains about the research project and to seek their views on research methods and preliminary outcomes.

Following an overview of the project, the workshop comprised 4 participatory sessions dealing respectively with:

1. Classification and prioritisation of ecosystems services attributable to floodplains
2. Relative importance of biodiversity characteristics in floodplains
3. Classification of stakeholders with interest in and influence on floodplains
4. Analysis of alternative land and water management scenarios in floodplains

The outputs of the workshop are contained in a detailed workshop report. The main points are summarised below.

- The ecosystems approach was thought to be a potentially useful way of classifying the types of benefits provided by floodplains, distinguishing between those linked to production functions (e.g. farming), regulation functions (e.g. flood risk management, carbon sequestration), habitat functions (e.g. nature conservation), carrier functions (e.g. human settlement) and cultural functions (e.g. landscapes and public access). Workshop participants noted that there was considerable overlap amongst some of these functions. Nonetheless, the approach helps to recognise the diversity of benefits provided by floodplains and also the potential synergy and conflict that might arise, for example between production and habitat functions.
- It was noted that a number of ecosystem services are unique to rural lowland floodplains, namely: flood risk management, space for water, biodiversity and habitat provision. These were highly valued by workshop participants. It was argued that some of these unique services should therefore receive priority in floodplain management. It was pointed out that many floodplains contain high quality agricultural land. The economic and strategic importance of this production function was prioritised by some participants.
- Regarding valuation of floodplain habitats, workshop participants tended to place greater value on those with high species-richness (especially lowland meadow, lowland fen and wet woodland) compared with habitats with a low diversity (such as reed bed and floodplain grazing marsh). Participants concluded that the

[1] Rural Economy and Land Use Programme is a collaboration of UK Research Councils that aims to advance the understanding of the challenges faced by rural areas in the UK

most important criteria for assessing the value of habitats were: overall sustainability (linked to resilience and fragility), connectivity, cultural heritage, and relative scarcity and uniqueness. The ‘designation’ status of a site was considered to be a misleading indicator of importance. There was considerable convergence of opinions on habitat valuation between groups of ‘specialist conservationists’ and ‘others’ in the workshop.

- Participants classified stakeholders such as farmers, regulators and conservationist organisations into different categories according to their perceived levels of interest in and influence on floodplain management. ‘Key players’ (with high interest and high influence) were identified as mainly comprising stakeholders with interests in production and regulation ecosystem functions, such as farmers and Internal Drainage Boards. ‘Context setters’ (low interest, high influence) were seen to have typically an interest in the carrier function, such as local government and developers. Many stakeholders with an interest in the habitat and information/cultural function were categorised as ‘subjects’ in that they had high interest, but relatively low influence, unless they owned land as a basis for enhancing their influence.
- Scenario analysis was used to explore the generation of goods and services from alternative land and water management in floodplains. Indicators used to measure inputs and outputs from each scenario were discussed, and some preliminary results were presented for two case study sites. The latter helped to explain methods for quantification of benefits and to highlight synergies and conflicts. There was considerable discussion about the use of scenarios, especially the challenge of using theoretically defined scenarios to inform practical management. It was noted that conditions ‘on the ground’ vary much according to local (and historical) context, prevailing property rights and opportunities for funding. Recognising these local factors was critical for research results to be meaningful to practitioners.
- It was strongly argued that it is important to take all costs and benefits of floodplain management into account, including capital and maintenance costs and the economic values of the range of goods and services provided by the floodplains, especially non-market public goods. It was also argued that catchment-scale effects should be included, such as the contribution of flood storage to catchment flood risk management, expressed in monetary terms if possible.
- The participants emphasised the need to provide guidance on the design and implementation of strategies to achieve integrated solutions in practice. The use of ‘composite’ rather than pure scenarios was suggested, recognising that in reality floodplain land uses landscapes are likely to contain a mix of management approaches with potential to meet a range of objectives simultaneously. This requires bringing together the range of stakeholder interests and joining up the various elements of policy and funding that currently appear to be fragmented.

Workshop participants expressed a wish to continue to be informed of the progress of the research project. The research team thank the workshop participants for their interest and support.

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Introduction

This report presents the results of the workshop on Integrated Floodplain Management held on 28 April 2008 in London. The aim of the research workshop was to bring key stakeholders together to critically discuss how, using an ecosystems approach, rural floodplains can be managed for multiple purposes. The workshop was delivered by Cranfield University and the Open University as part of their RELU[2] research project on integrated floodplain management. The workshop had two purposes:

- To inform stakeholders on the research project, its methods and preliminary outcomes, and
- To incorporate stakeholder views to help ensure that the research outputs are robust and suited to the needs of potential end users.

The workshop programme was as follows:

1. **Introduction** and presentation of the research project on integrated floodplain management; led by Joe Morris.
2. **Ecosystem services**: a short presentation on ecosystem functions and services, followed by (a) an interactive group exercise to determine the goods and services delivered by rural lowland floodplains and (b) an individual exercise to prioritise ecosystem goods and services; led by Helena Posthumus.
3. **Biodiversity valuation**: an interactive session with individual and group exercises on the valuation of different habitat types supported by lowland floodplains; led by Jim Rouquette.
4. **Stakeholder analysis**: a short presentation on stakeholder analysis, followed by an interactive group exercise to determine the levels of interest and influence that the various stakeholders groups have regarding floodplain management; led by Paul Trawick.
5. **Scenario modelling**: a presentation on the method and preliminary results of various scenarios for floodplain management, followed by plenary discussion; led by Helena Posthumus and Joe Morris.

This report follows the same structure as the workshop programme. The results of the exercises, as well as questions and comments raised by the participants, are included and discussed in the report. The report concludes with a summary of the main points arising at the workshop, with implications for the direction of the research project.

[2] The Rural Economy and Land Use (RELU) Programme aims to advance the understanding of the challenges faced by rural areas in the UK, and funds interdisciplinary research projects in order to inform future policy and practice with choices on how to manage the countryside and rural economies. The RELU Programme is a collaboration of the Economic and Social Research Council (ESRC), the Biotechnical and Biological Sciences Research Council (BBSRC) and the Natural Environment Research Council (NERC), with additional funding provided by the Scottish Government and the Department for Environment, Food and Rural Affairs (Defra).

RELU project Integrated Floodplain Management

Key messages 'RELU project Integrated Floodplain Management'

- Rural lowland floodplains deliver multiple benefits, but priorities placed on these benefits vary amongst different stakeholders and over time. Though some benefits are in synergy and can thus be delivered simultaneously, other benefits might be conflicting with each other.
- Lowland floodplains are distinguished from other rural spaces by the hydrological processes that shape the potential for these benefits to be delivered.
- The management of flood and soil-water level regimes defines land use options, directly shapes the ecology, and determines the types of goods and services generated by the floodplains.
- One of the benefits delivered by rural lowland floodplains is their specific contribution to flood risk management at catchment level through floodwater storage.

After a welcome and brief introduction of the participants, Joe Morris presented an overview of the RELU research project on Integrated Floodplain Management.

This project explores the causes, processes and consequences of change in land and water management in lowland floodplains previously engineered for flood defence purposes in order to inform future decisions on sustainable management.

Agricultural Flood Defence Schemes in floodplain and coastal areas were an important component of Government support for farmers in England and Wales in the 1960s until the 1980s. More recently, however, changing priorities in rural and environmental policy, evident for example in the Reform of the European Common Agricultural Policy and the Water Framework Directive, are encouraging a re-appraisal of land management options for floodplain areas. Very recently, in the face of global food and energy shortages there has been renewed interest in agricultural production.

Focussing on low-lying floodplains and fenland, the project addresses the following research questions:

1. Is it possible to achieve multiple objectives in ways which are appealing to major stakeholders, especially farmers?
2. What data and methods are needed to support decision-making?
3. What are the best ways of achieving widespread adoption of integrated management solutions?

For this purpose, eight agricultural flood defence schemes throughout England and Wales, previously studied by the research team in the 1980s, have been selected as case studies for this research project. The selection was based on the sample of sites studied in the 1980s and to ensure variation in region, climate, water management regime (in terms of level of control of water inflow or flood protection, and outflow or land drainage) and land use in the sample. The consequences of changes for agricultural production, farm livelihoods, nature conservation, and the management of flood risk are assessed by combining the perspectives of social and natural sciences. Figure 1 summarises the approach that sets floodplain management within the framework of ecosystems functions and institutional arrangements (such as land ownership and occupancy) that determine entitlements and priorities. Of all the functions, the hydrological processes in particular distinguish floodplains from other parts of the rural space. The management of flood and soil-water level regimes defines land use options, shapes the ecology, and determines the type and value of ecosystem goods and services generated by floodplains.

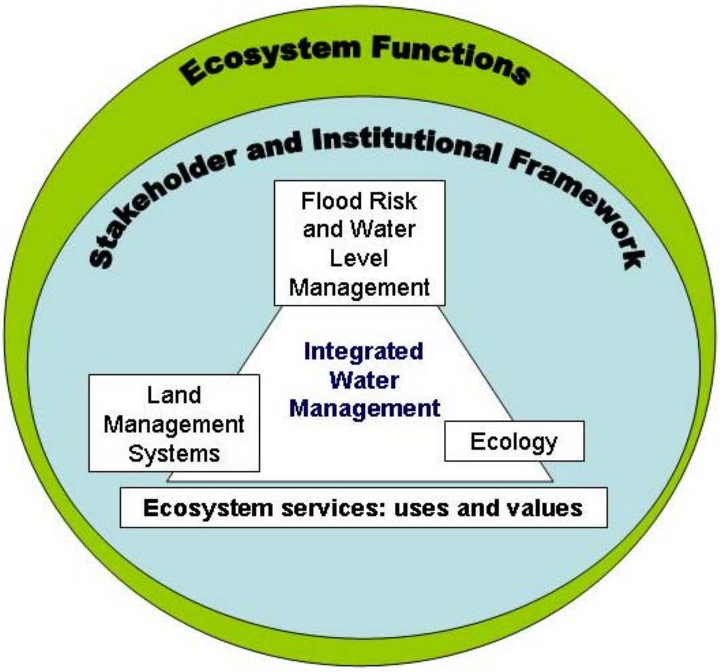

Figure 1 Conceptual model used for integrated analysis of floodplain management

In order to explore the implications of alternative land use, generic ‘extreme’ scenarios are being produced for each study site. These consider management options that focus on single objectives, namely: maximising agricultural production, enhance biodiversity within an agricultural system, enhance biodiversity without agricultural systems, maximise flood storage, minimise carbon emissions, and maximise farm income. Options that attempt to combine multiple objectives are also explored, highlighting synergies and conflicts between multiple objectives.

Textbox 1 Beckingham Marshes

By way of example, the Beckingham Marshes in Nottinghamshire is one of eight selected floodplain case studies. The site covers about 900 ha and is situated in north eastern England on the river Trent, opposite the town of Gainsborough. The Beckingham Marshes are characterised by a fixed controlled inflow of water (river overtopping the banks) and a controlled outflow of water through sluices and pumps. Prior to 1945, the area was covered by a mix of grassland, marsh and willows. During the 1960s and 1970s pumps were installed, flood defences strengthened and subsequently the land drainage was improved. Beckingham Marshes also provides flood storage for 1:10 year floods. The flood defences and improved drainage enhanced the conversion from grassland into arable production. In 2005, the RSPB liaised with the Environment Agency (the major landowner in the Beckingham Marshes) to develop a plan for re-converting the site back to wet grassland to enhance habitat for breeding waders. The case illustrates how land and water management has changed over the years in response to changing policy, market drivers and stakeholder motivations. These have placed different emphasis on particular goods and services, whether food production, flood management, or nature conservation. Our RELU project seeks to understand the dynamics of change, and how this can inform actions to achieve desired benefits from the management of land and water in the future, whatever these might be.

Ecosystem goods and services delivered by Beckingham Marshes:

Agricultural production

Floodwater storage

Habitat for lapwings

Comments and questions concerning presentation session 1

- A question was raised about the emphasis on flood storage in floodplains rather than the contribution to flood risk management. Participants argued that the benefits of storage for alleviating risks of flooding elsewhere depends on a number of local and catchment specific factors, not least of which are the location, size and hydraulic features of the storage facilities. In response, it was pointed out that the focus here is on storage facility at the individual scheme level. The aim is to better understand the relationship amongst flood storage and other land and water management objectives, such as farming and nature conservation, and how a given floodplain site might make a potential contribution to flood risk management at the catchment scale by attenuating peak flows.

Session 2: Ecosystem goods and services

Key messages 'Ecosystem functions, goods and services'

- Ecosystem functions are perceived to be processes and capabilities, such as the production of biomass and the regulation of water regimes. Often as a result of human actions, these 'natural' functions produce flows of ecosystem goods and services that are of benefit to people, such as food production and flood alleviation.
- It was thought that the Ecosystem Functions and Uses framework is useful for classifying and assessing the range of benefits delivered by rural lowland floodplains. It is also considered useful for exploring synergy and conflict amongst different land uses and benefits. However, there was some concern that classifications were somewhat arbitrary and overlapping.
- The ecosystem services that are unique to rural lowland floodplains (that is: flood risk management, space for water, biodiversity and habitat provision) were highly valued by the workshop participants.
- Though food production is not unique for rural lowland floodplains, many floodplains contain high quality agricultural land. The economic and strategic importance of this was prioritised by some participants, especially in the context of concern about food security.

The ecosystem goods and services framework that is applied to classify and assess the benefits derived from rural floodplains was presented by Helena Posthumus. The concept of 'ecosystem functions' represents the capacity of natural processes (methods of continuous operation) to provide goods and services (items that confer benefit and advantage) to meet human needs, directly or indirectly (de Groot, 2002, Zhang et al, 2007). The concept has gained much currency following its adoption by the recent Millennium Ecosystem Assessment (MEA, 2005) to represent the flow of benefits to society arising from stocks of renewable natural resources and related ecosystems.

Within this research project five different ecosystem functions are distinguished:
- Production function: the capacity to provide resources
- Regulation function: the capacity to regulate essential ecological processes
- Carrier function: the capacity to provide space for activities and processes.
- Habitat function: the provision of unique habitat for plants and animals
- Information/Cultural function: the capacity to contribute to human well-being through knowledge and experience.

The ecosystem functions thus provide the capacity for a range of uses, that in turn generate a range of goods and services that are of value to key stakeholders (Figure 2). Some stakeholders are more interested in some functions and uses than others. Farmers, for example, are interested in production functions and land use for farming. Conservationists are interested in habitat functions and land use for nature reserves. These functions and uses, and related stakeholder interests, may be in conflict. Stakeholders are usually able to pursue their interest by acquiring property rights or 'entitlements to benefit', through, for example, land ownership or legal protection.

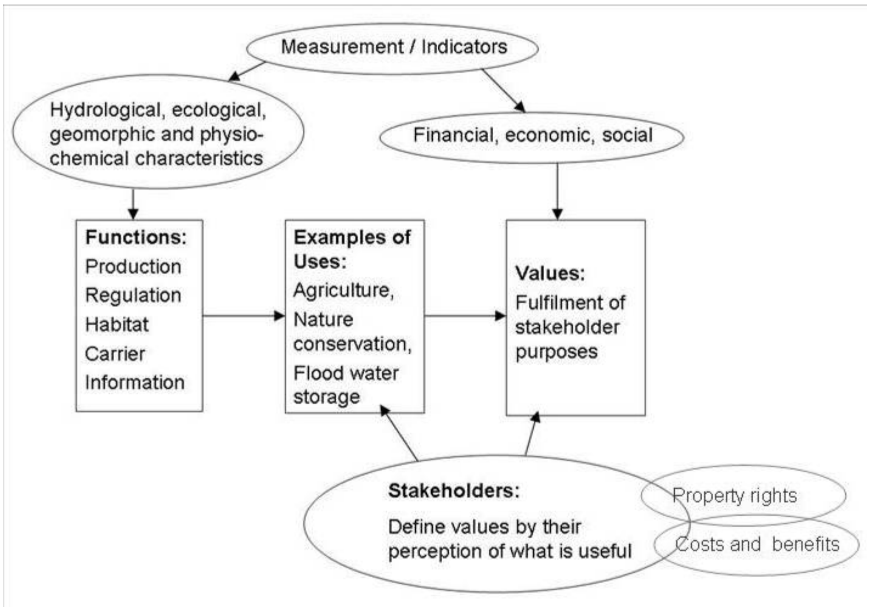

Figure 2 Ecosystem functions and uses framework

Comments and questions concerning presentation session 2

- It was pointed out that Defra has its own approach to valuing ecosystem services and it was asked whether the project's approach was consistent with Defra's guidelines. It was reported that the project team is familiar with Defra's guidelines and a similar classification of function and services is being used such that the approach is consistent. Furthermore, the approach here explicitly makes the link between ecosystem services and stakeholder interests.
- The question was raised why five categories of ecosystem functions are used instead of the four categories defined by the Millenium Assessment. The research literature commonly uses five categories as shown in Figure 2. Some use four categories, arguing that the 'carrier' function is subsumed within the other functions; carrier, the provision of location and space is contained for example in habitats for wildlife. It is thought useful to retain the carrier function to represent the provision of services such as settlement, navigation, communications and industrial location in floodplains. Agriculture, however, because it engages the land in a production process, is classified under the production function.

Following this short introduction, the workshop participants were asked to think about and answer the following question:

> *What ecosystem goods and services are delivered by rural lowland floodplains in England?*

The participants were divided into five groups and rotated along the five different functions so each group took its turn to consider goods and services provided under each function, namely: production, regulation, habitat, carrier and information/cultural. Table 3 lists the ecosystem goods and services identified by the participants. With respect to the earlier comment on classification, it was apparent that there is perceived to be much overlap amongst the carrier and other functions.

Table 3 Goods and services derived from rural lowland floodplains

Production	Regulation	Habitat	Carrier	Cultural / Information
Food crops (incl. livestock) Bio-energy crops Woodlands (biomass) Crops for pharmaceutical industry Building material (willow, reed, timber) Fish Wildfowl Fish (farms) Water (drinking water, waste, cooling for energy plants) Extractive industries (quarries, peat) Energy (hydropower) Waste management industry (landfills, energy production)	Water resources storage Groundwater recharge Temperature (local) – air / soil Flood storage Energy dissipation (water) Greenhouse gasses: methane emissions, NO_x; carbon storage, organic matter storage Water quality: nutrient stripping; nutrient deposition; toxins / metals storage / release Erosion / sediment supply Sediment deposition	Space for climate change High quality habitat of high conservation value Resilience Biodiversity store Populations Vulnerability Connectivity Re-creatability Dynamics Habitat structure + function Diversity of habitat Social value Rarity Focal point Protection of existing resource	Energy / power stations Industry Settlements (towns / villages) Infrastructure (roads, utilities) Water transport navigation Utilities Leisure facilities Tourism Location for education Recreational navigation Recreation (formal / informal) Open space Landscape Water space Wild space Agriculture Commercial business Archaeological features Human use Resilience (society)	Historic information / archaeology Sense of well-being Spiritual attachment Health benefits (green space, reduce stress) Environmental awareness / education Biodiversity information Research in environmental change (dynamism of landscape) Attachment to landscape (heritage) Cultural information (local knowledge, memories, traditional techniques) Arts (literature, painting) Sense of place Transience / permanence (sense of time)

The goods and services identified by participants were then grouped into a number of generic categories of ecosystem services. Workshop participants were asked to give their preferences amongst these by responding to the following question:

> *How much relative value do you place on the ecosystem goods and services from rural lowland floodplains in England?*

The participants received 20 tokens to be divided among the different categories according to their preferences. Table 4 summarises the results. The production of food crops was especially highly valued by some participants. Ecosystem goods and services that were perceived to be natural functions of floodplains were highly valued: e.g. flood risk management, space for water, biodiversity and habitat provision. Other goods and services that were not directly associated with floodplains were valued less: e.g. water cycle, greenhouse gas balance, industry, education and research. The five categories of ecosystem services with the highest scores (food crops, flood risk management, biodiversity, habitat provision and space for water) received more tokens per person than the other uses (1.6 token per person on average).

Table 4 Stated preferences by workshop participants for ecosystem goods and services delivered by rural lowland floodplains

Function	Services	Nb. of tokens	Nb. of people	Average tokens per person
Production	Food crops (incl. game)	29	9	3.2
	Non-food crops	8	5	1.6
	Extraction industries	5	3	1.7
	Water cycle	2	1	2.0
Regulation	Flood risk management	26	11	2.4
	Water resources	14	9	1.6
	Sediments & nutrients	7	6	1.2
	Greenhouse gas balance	2	2	1.0
Habitat	Biodiversity (population & species)	26	10	2.6
	Habitat provision	22	8	2.8
	Ecological processes	14	6	2.3
	Rare species	11	6	1.8
Carrier	Space for water	20	8	2.5
	Utilities & infrastructure	8	5	1.6
	Settlements	8	4	2.0
	Industry	4	2	2.0
Information	Well-being	18	11	1.6
	Cultural heritage	15	9	1.7
	Tourism & leisure	14	9	1.6
	Education & research	7	6	1.2

Comments and questions concerning exercise session 2

- It was suggested that economic value should be viewed as a separate benefit. For example Grade 1 land could be viewed as a good in itself and a large proportion of high quality agricultural land is typically found in floodplains. It was explained that estimates of economic benefits are covered in the ecosystems framework by placing monetary values on the goods and services generated. For example, the economic value of agricultural land is represented in the value–added (ie profits net of subsidies) by commercial agriculture. This is addressed in the scenario modelling where high value crops are grown on good quality agricultural land. The economic value, expressed in monetary terms, will be attributed to non-market goods where information allows such as carbon sequestration, and possibly habitat creation. The economic value will also be taken into account in a cost-benefit analysis of the floodplain management options at a later stage in the project.

– A short discussion followed on the term valuation. Some participants questioned whether the use of “valuation” was an appropriate term because valuation, in economic terms, was difficult to do and the term “preference” would be a more appropriate alternative. Others responded that “valuation” was valid because goods and services have an intrinsic value, not necessarily linked to financial considerations. It was argued that expressing preferences amongst environmental options, such as different landscapes and habitats, was best made with respect to particular contexts, e.g. an eastern counties context or a southwest context, and information on the relative ‘scarcity’ of these features. It was noted that when stating preferences, the participants were doing this as individuals, not as representatives of their organisation.

Session 3 Biodiversity valuation

Key messages 'Biodiversity valuation'

- Assigning values to 'biodiversity' is complex and depends on context, personal preferences and decision criteria.
- The workshop participants tended to appreciate floodplain habitats with high species-richness (lowland meadow, lowland fen and wet woodland) more than habitats with a low diversity (reedbed and floodplain grazing marsh).
- The workshop participants viewed the following criteria as important for assessing the value of habitats: sustainability, connectivity, cultural heritage, proportion of national resource and diversity. Some felt that the criterion based on 'official site designation' could be subsumed within these other criteria.
- There was a remarkable convergence of values and preferences revealed by the two groups of stakeholders ('biodiversity professionals' and 'others') for each exercise, with similar comments made by both groups. However, the 'others' group placed greater emphasis on cultural heritage and aesthetics and was not interested in reverting to "wild" habitats. The biodiversity professionals were more likely to value habitats that maximised biodiversity and restored ecological processes.

It is possible to derive monetary estimates of the value of biodiversity benefits using social survey techniques that estimate 'willingness to pay' (WTP) for the protection or creation of particular habitats and species. However, it is not the intention in this study to derive WTP estimates for specific sites, but it may be possible to use generic estimates of economic value for 'types' of habitats derived from previous studies.

The project team is exploring the use of non-monetary preference methods. One such approach is to ask stakeholders to determine relative value. This approach was explored during this session, led by Jim Rouquette.

Participants were divided into two groups: the 'biodiversity professionals' consisting of stakeholders working on biodiversity issues as professionals or experts, and 'others' consisting of stakeholders not immediately involved with biodiversity issues in their daily work.

In a first exercise, participants were asked to compare and give relative preferences to five different habitats that were shown in pairs, and to explain the criteria on which they based their preferences. The five habitats (all UK Biodiversity Action Plan priority habitats) were:

- Floodplain grazing marsh: periodically inundated pasture, non-intensively managed. This habitat is ideal for breeding waders and overwintering wildfowl. The average plant species richness is eight.
- Lowland meadows: unimproved neutral grassland, usually cut for hay. This habitat used to be the dominant habitat type in lowland England. It contains a very high diversity of flowers, often including rare species, and ideal for skylarks and other farmland birds. The average plant species richness is 26.

- Lowland fen: peat land with high water levels year-round. This habitat contains a high diversity of native plant species, is rich in insects (e.g. dragonflies, water beetles) and has an average plant species richness of 15.
- Reed bed: wetlands dominated by stands of common reed *Phragmites australis*. This habitat is amongst the most important habitats for birds in the UK, with several rare species such as the bittern, and many insect species. The average plant species richness is five.
- Wet woodland: occurs on poorly drained or seasonally wet soils, usually with alder, birch and willows as the predominant tree species. The main wildlife interests are mosses and liverworts, and it is an excellent habitat for insects and the otter. The average plant species richness is 21.

Participants were presented with images and brief information on each habitat, and then asked to consider pair-wise comparisons answering the question: if you had a total of 10 units of value to award, how would you share the allocation between Habitat A (e.g. lowland meadows) and Habitat B (e.g. Reedbed)? If respondents were indifferent, they were advised to award 5 points to each option.

The average relative scores obtained (from 0 to 10) are as follows:

- Lowland meadows: 5.9
- Lowland fen: 5.6
- Wet woodland: 4.8
- Reed bed: 4.4
- Floodplain grazing marsh: 4.3

On this basis, lowland meadows attracted the greatest overall preference score. The supporting explanations provided by the participants revealed that they based their personal preferences on a range of decision criteria, e.g. aesthetics, biodiversity, rarity or cultural heritage. ‘Biodiversity professionals’ and ‘others’ tended to rank the habitats in a similar order, although reed bed was the least favoured habitat by ‘others’. Biodiversity professionals expressed slightly stronger preferences, revealed by higher and lower scores for the top and bottom ranked habitats. Biodiversity professionals were most likely to use biodiversity as the main decision criteria, whereas the other stakeholders used a wider range of criteria, with personal preference and aesthetics being the most commonly chosen.

In a second exercise of this session the participants were asked to discuss criteria to assess biodiversity values in groups. The criteria used by Ratcliffe (1977) in his nature conservation review were discussed as a starting point:

- *Designation* status of the habitat: is it important?
- *Proportion* of the national resource that could be maintained, restored or created at a site: should that be considered?
- *Size*: are large areas of habitat considered more important than smaller areas?
- *Diversity*: is it more important to conserve / create habitats with the highest biodiversity?
- *Naturalness*: are habitats least modified by human activity more highly regarded?
- *Fragility*: should a habitat that is more vulnerable or takes longer to restore if damaged, be considered more important?

Divided into two groups ('biodiversity professionals' and 'others'), the participants discussed the validity of the criteria and other potential criteria that might be taken into account as well.

The 'others' group made the following points with respect to the six criteria listed:

1. The validity of designation was questioned by several in the group. Some felt it was an amalgam of the other criteria and therefore need not be listed separately. Others felt that designation was often done as a result of special pleading by one or two interested individuals and was therefore not objective. Only one on the panel felt designation was a strong criterion for evaluating nature conservation importance.
2. The proportion of the national resource was considered as important by some, but others felt local abundance was more important. It was felt that habitats should be valued with respect to the traditional land use and new habitats should not be created in areas where they had not previously existed just to meet a national target.
3. Size had some value with respect to sustainability, but overall it was lowly ranked. Connectivity was considered to be much more important. The idea of big blocks of single habitat type was considered a bad thing if not the norm for locality. A patchwork landscape was generally more favoured.
4. There was disagreement as to whether diversity per se was important. Some low diversity habitats (e.g. reed bed) were considered to have high value. Again the concept of traditional land use was rated more important than altering management to promote diversity.
5. The term naturalness was not clearly understood. Many in the group assumed it to refer back to the rural idyll of the early 18th century. With that definition it was popular and linked to cultural heritage. When the convenor defined it in terms of the Water Framework Directive where pristine reference sites without human modification are held up as an ideal state, it received no support whatsoever and was clearly an anathema to many in the group.
6. Fragility was not seen as important. In fact it was viewed as a negative characteristic. Sustainability was seen as the converse and as a positive criterion.

The group of 'others' discussed a number of criteria beyond the six listed above:

- There was a general consensus that a habitat – rather than species – approach should be taken.
- It was suggested that a cost-benefit analysis of restoration costs versus biodiversity gain would be a useful criterion.
- There was a consensus that criteria relating to cultural heritage and the historical state of the land needed to be included in its valuation.
- Sustainability and resilience were considered important criteria.
- Connectivity within the landscape was considered important especially with respect to climate change and the need for the habitat to coexist in the landscape with a variety of other land uses.

Similarly, the group of 'biodiversity professionals' discussed the criteria and reached similar conclusions regarding the six criteria:

1. There was considerable discussion about the validity and reliability of designation. It was thought that the designation should embrace all of the

other criteria rather than being a criterion on its own and that sites are usually designated because of some of these other criteria. As for the 'others' group, the 'biodiversity professionals' thought that designations were typically 'historical' and reflected interests of particular conservation groups. Designation often did not adequately reflect existing importance or potential, especially at the local scale. Designations are an important basis for attracting and allocating resources, and sometimes this can reduce funds for other options.

2. Proportion of the national and local resource was considered important. As for the 'others' group it was thought that 'scarcity' was an important criterion, and this was often linked to other aspects, such as fragility.
3. There was considerable discussion about size as criterion, starting of with the view that 'the bigger the better' but then moderating towards consideration of habitat-dependent scales. Size might be important to avoid disturbance, but strategic location and connectivity were thought to be of a higher importance than the size of a particular habitat.
4. It was noted that the term "biodiversity" is often misunderstood and not always taken to reflect species diversity. Some highly valued habitats are not particularly diverse. It was argued that biodiversity can be managed at different scales and does not require that any one site need to be diverse as such. It was thought that biodiversity was not in itself a very useful criterion.
5. Naturalness was considered an unhelpful criterion by many, especially as most habitats and landscapes are managed and have been for centuries. As for the 'others' group, naturalness is typically interpreted mainly as a traditional managed landscape, including important features associated with farming such as meadows, hedgerows and farm woodlands. It was pointed out that it is the landscapes, more than the habitats and species that occupy them that people most relate to.
6. Fragility, and linked to this resilience to changes and pressures, was thought to be important, justifying action to protect and enhance. However, it was argued that the term sustainability could be a better criterion where sustainability was defined as being well matched to the environment and hence less fragile.

The participants also assessed the relative importance of each criterion by distributing 100 points between the six criteria. The group consisting of biodiversity professionals decided to do this exercise individually and average values are presented here, whereas the other group made a collective decision on the distribution of the points (see Figure 3). Note that both groups found that connectivity was more appropriate than size, and that sustainability was to be preferred above fragility. These two criteria are therefore replaced in Figure 3. The group 'biodiversity professionals' interpreted the term 'naturalness' as pristine habitats, whereas the group 'others' associated this with traditionally managed floodplains which is captured in the additional category 'cultural heritage' in Figure 3.

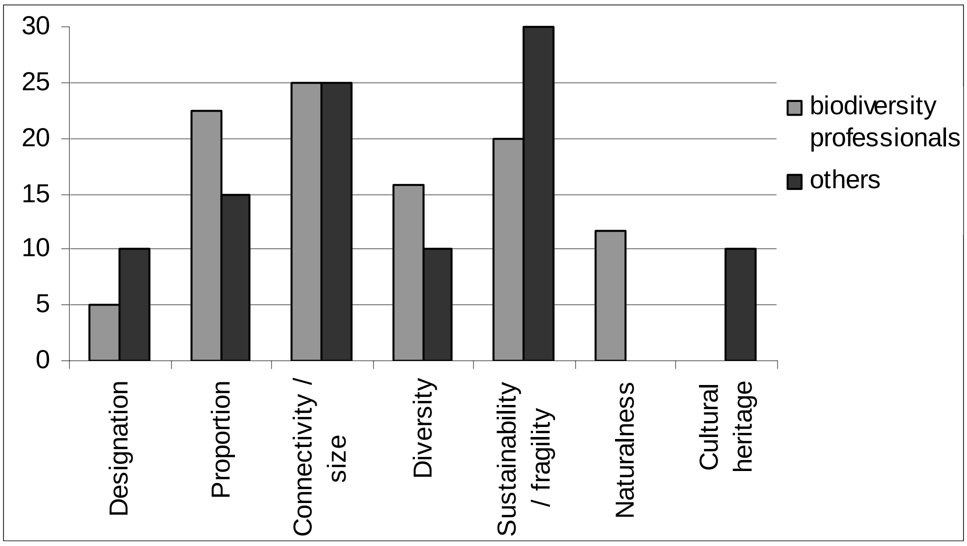

Figure 3 Relative importance assigned by participants to criteria developed for nature conservation review

Finally, participants were asked to place species with different designation status on a scale of 0 (no importance) to 100 (extremely important). Both groups had similar results (see Figure 4) and the averaged outcomes were:

– Undesignated common species: 49
– Species designated as important at local level: 64
– Species designated as important at national level: 75
– Species designated as important at international level: 87

The group 'biodiversity professionals' noted that the relative importance of undesignated species could range from 0 to 100, dependent on the specie. Likewise, it was thought that the relative importance of international designated species could range from 80 to 100. It is noted that both groups gave relatively high importance to undesignated species, reflecting possible high local importance.

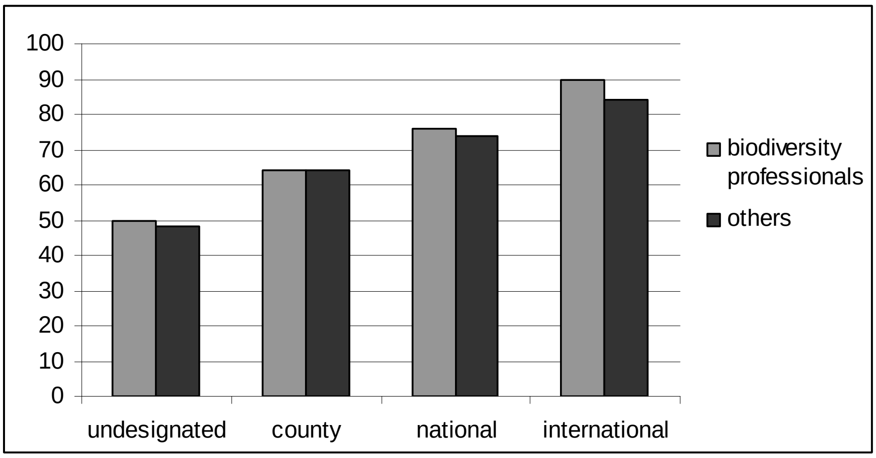

Figure 4 Relative importance assigned by participants to species of different designation status

Session 4 Stakeholder analysis

Key messages 'Stakeholder analysis'

- Based on their levels of interest in and influence on floodplain management, stakeholders can be classified into four categories: key players, context setters, subject and crowd.
- The workshop participants identified as 'key players' (high interest, high influence): ABI, CLA, Defra, EA (FRM), Farmers, IDBs, Natural England, NFU and local residents – the latter bordering with subjects.
- The workshop participants identified as 'context setters' (low interest, high influence): Developers, Local Government, Media, and Treasury.
- The workshop participants identified as 'subject' (high interest, low influence): Angling clubs, EA (other than FRM department), Industries, Local communities, National History Societies, Prince Charles, RSPB, Wildlife Trust and local residents – the latter bordering with key players.
- The workshop participants identified as 'crowd' (low interest, low influence): Academics, Consultants, English Heritage, FWAG, Highways Agency, and National Trust
- The 'key players' are mainly stakeholders with an interest in production and regulation ecosystem functions. The 'context setters' have typically an interest in the carrier function. Many stakeholders with an interest in the habitat and information/cultural function are categorised as 'subject'.

Paul Trawick introduced the stakeholder analysis method. A stakeholder is defined as a person or organisation who has an interest or 'stake' in a particular issue; e.g. the utilization of a resource or the activities of an organisation. Stakeholders also have a degree of 'influence' over that particular issue or resource. In this case, the resource is rural lowland floodplains and the ecosystem goods and services they provide, the issue is how floodplains are managed and the organisations in question are all groups or entities involved in, or affected by, decisions about management policy. For this exercise, influence is defined as the capacity to influence the management and use of floodplains. Participants were asked to map stakeholders on a matrix with one axis indicating level of interest and another axis indicating level of influence. This technique enables the classification of stakeholders into four major categories: key players, context setters, subject and crowd (see Figure 5).

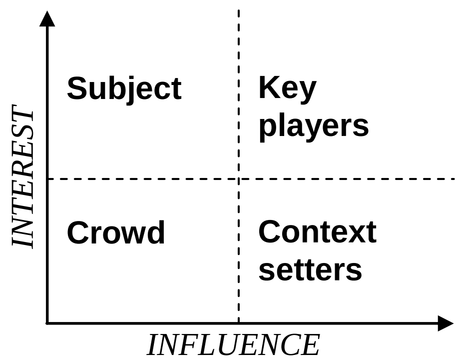

Figure 5 Stakeholder mapping according to level of interest and influence

Three groups of participants were formed: red, yellow and blue. They produced somewhat different results for the stakeholder mapping exercise (Figures 6a-6c). This can partly be explained by the scale of the perspective taken by the group (e.g. national policy as opposed to individual floodplains) and partly by the composition of the group.

The red group mapped the stakeholders according to their interest and influence of an individual floodplain (Figure 6a). The following criteria were used to place the stakeholders on the matrix:

- Power over land-management decisions – particularly the planning system.
- Number of members an organisation has plus their lobbying power.
- Ability to supply funding (Defra, EA) or to apply financial constraints (ABI, Treasury).
- Statutory powers were strongly weighted.
- Consenting powers were slightly less strongly weighted.
- Little weight was given to consultee status.

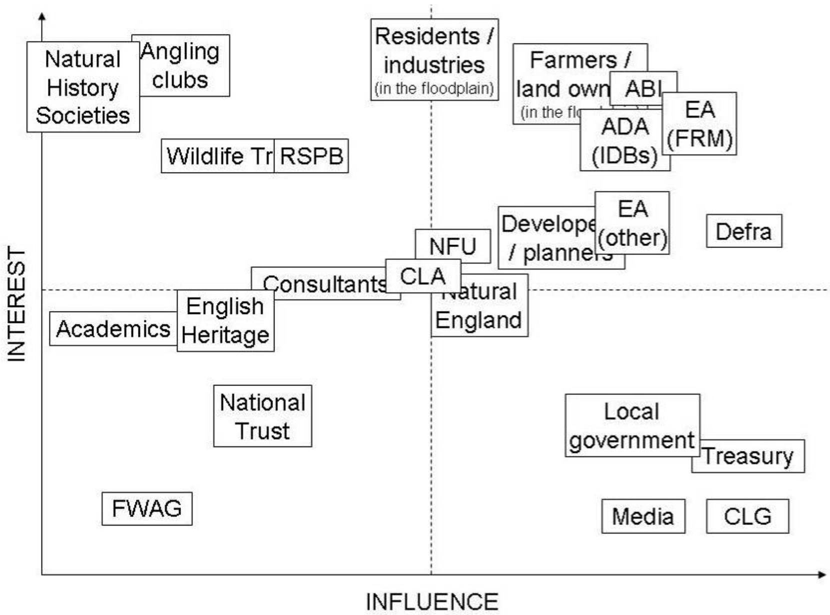

Figure 6a Stakeholder map (red group)

The yellow group focussed on who influences local outcomes in specific floodplains (Figure 6b), thus similar to the approach taken by the red group. But they focussed particularly on stakeholders with high interest. Some of the arguments for placing the stakeholders are listed below:

- The point was taken by all that, depending on the ‘kind’ of academic, they can be said to have a lot of influence and interest in policy, but usually have little or no influence on actual local outcomes.
- Natural England was said to exert less influence than their potential, being largely confined to their role as shapers and enforcers of policy at the highest level.
- Local government, it was noted, now has a huge interest in flood prevention, and a great deal of influence at both national and local levels, simply because it represents the people, i.e. the voters, in the planning process.

- The interesting placement of the EA, with high interest and relatively low influence, was said to reflect the fact that the organisation, although definitely a key player, is largely confined to implementing measures decided upon by other stakeholders such as Defra and the government more generally.
- Defra were seen as having a high interest and high influence at the national level, but as not having much local reach. It was noted that they have 24 people working on floodplain policy, whereas the EA reportedly have 24,000.
- Other stakeholders – farmers with land in floodplains, IDBs – were characterised as having high interest and high influence, respectively, but only at the local level, while the general public were said to have a lot of influence and, for people who were actually impacted by floods, high interest as well.

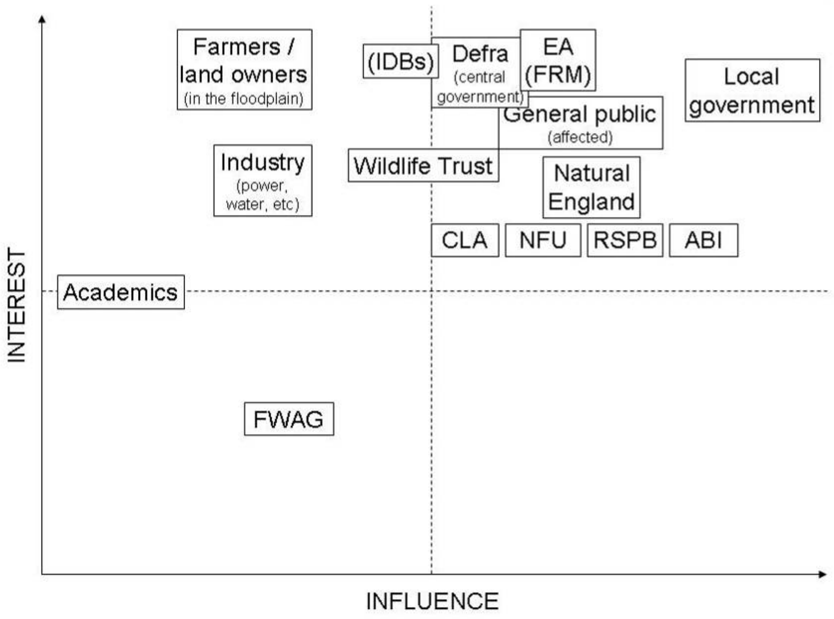

Figure 6b Stakeholder map (yellow group)

The map made by the blue group (Figure 6c) is based on generic interests in floodplains, but for some stakeholders (e.g. local government) it was acknowledged that the interest depends on the local situation. There was discussion about what determines interest: it was considered largest where the management of floodplains was linked to achieving organisational purposes, e.g. habitats for RSPB and Natural England, and livelihoods for farmers. Influence was highest amongst stakeholder owning land, controlling funding or with powers to regulate land use. Farmers, it was thought, had high interest and influence linked to livelihoods and land ownership. By comparison, conservation organisations had high interest but less influence, unless they controlled land use, or had, like Natural England, an ability to regulate or incentivise others. The group also determined the ecosystem function interests of stakeholders. It was noted that the influence of stakeholders with interests mainly in production (Farmers) and carrier (ABI) functions tended to exceed those with main interests in habitat functions. Stakeholders with regulatory functions, local government, Defra, IDBs, tended to have relative high influence, but their interest varied according to local conditions.

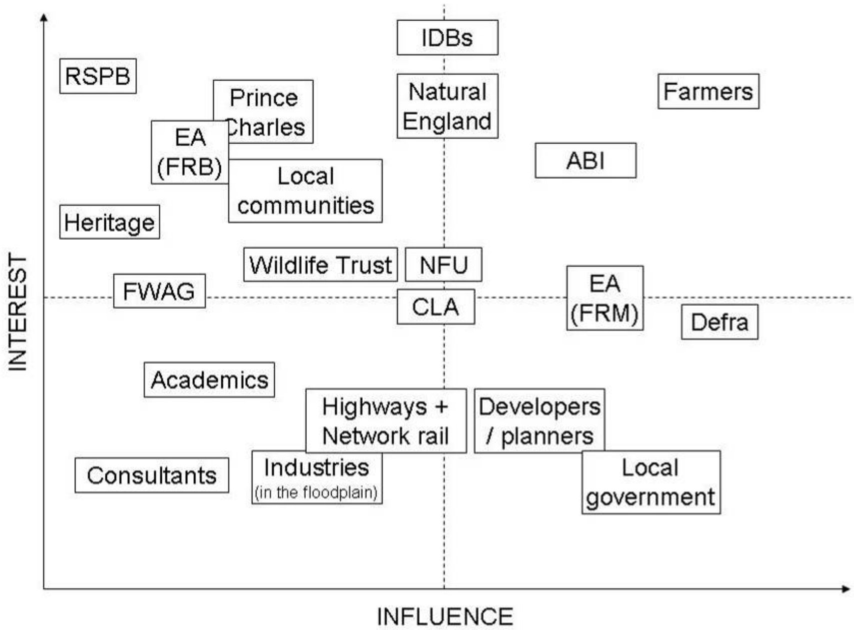

Figure 6c Stakeholder map (blue group)

Table 5 summarises the outcomes of the three maps. The disagreements between the groups on the correct placing of some stakeholders suggest that for some stakeholders the level of interest and / or interest depend on context or perceptions of other stakeholders.

Table 5 Stakeholder mapping: differences and similarities

	Function interest	**Red**	**Yellow**	**Blue**	**Disagreement on**
Level of analysis		*Local level*	*Local level*	*National policy*	
CLA	Production	Subject / Key player	Key player	*central*	Influence
Defra	Production / Habitat	Key player	Key player	Context setter	Interest
Farmers	Production	Key player	Subject	Key player	Influence
FWAG	Production / Habitat	Crowd	Crowd	Subject / Crowd	
NFU	Production	Key player / Subject	Key player	Subject / Key player	
Prince Charles	Production			Subject	
EA (FRM)	Regulation	Key player	Key player	Key player / Context setter	
IDBs (ADA)	Regulation	Key player	Subject / Key player	Subject / Key player	
EA (other)	Habitat / Regulation	Key player		Subject	Influence
National Trust	Habitat / Information	Crowd			
Natural England	Habitat / Production	Context setter / Key player	Key player	Subject / Key player	
RSPB	Habitat	Subject	Key player	Subject	Influence
Wildlife Trust	Habitat	Subject	Subject / Key player	Subject	
ABI (insurance)	Carrier	Key player	Key player	Key player	
Developers	Carrier	Key player		Context setter	Interest
Highways + Network rail	Carrier			Crowd / Context setter	
Industries	Carrier	Subject / Key player	Subject	Crowd	Interest / Influence
Local communities / residents	Carrier / Regulation	Subject / Key player	Key player	Subject	Influence
Local government	Carrier / Regulation	Context setter	Key player	Context setter	Interest
Treasury	Carrier / Production	Context setter			
Academics	Information	Crowd	Subject / Crowd	Crowd	
Angling Clubs	Information	Subject			
Consultants	Information	Subject / Crowd		Crowd	
English Heritage	Information / Habitat	Crowd		Subject	Interest
Media	Information	Context setter			
Natural History Societies	Information	Subject			

Session 5 Scenario modelling

Key messages 'Scenario modelling'

- The scenario modelling method allows the assessment of the performance of a range of ecosystem goods and services subject to the maximisation of one objective, in order to highlight synergies and conflicts.
- However, there are challenges to go from the abstract theoretical analysis to the reality of floodplain management practice, such as:
  - The assumptions made for the scenarios (e.g. land use or appropriateness of floodwater storage) should reflect the context of the floodplains.
  - All costs and benefits must be taken into account, including off-site impacts and the costs of benefits foregone (e.g. loss of biodiversity or loss of floodwater storage).
  - Property rights and funding mechanisms determine what happens in reality and these aspects must be taken into account as part of the stakeholder analysis.
  - Priority should be given to ecosystem goods and services that are solely delivered by floodplains, for example floodplain habitats or floodwater storage (dependent on location in catchment).
- There is a fundamental question to be addressed: what does society want from rural lowland floodplains now and in future? And how can these demands, which are likely to change over time, be best met?

Scenario modelling is an important component of the research project on Integrated Floodplain Management, and Helena Posthumus presented the methodology and preliminary results obtained. The objective of the scenario modelling is to assess how different scenarios (defined by particular objectives) deliver multiple ecosystem goods and services in order to reveal synergies and conflicts. For this purpose, 'extreme' hypothetical scenarios have been developed, each scenario maximising one objective or ecosystem good or service. For each scenario a water management regime (number of days with surface water, mean water table depth and flood probability per season) and land use are defined, which subsequently determine the estimated outcomes for other ecosystem goods and services. The scenarios are described below, making reference to two case study areas: the Beckingham Marshes and the River Idle in Nottinghamshire (see Table 6 for a summary):

- *Current situation*, based on farmer interviews carried out in 2006. In the Beckingham Marshes, current land use is mainly arable (winter wheat in rotation with oilseed rape and field beans) with one area of unimproved permanent grass (grazed by beef cattle) that is under management of the RSPB. By comparison, land use along the Idle is very mixed: improved grassland (for dairy cows), maize, cereals and root crops (potato, carrot, and onion).
- *Maximising agricultural production*. Land cover (crop type) is based on land suitability (or soil type), climate and current farming systems. The designed water management regime ensures a deep water table, no surface water during the year and a low flood probability. Under this scenario, the land use in Beckingham Marshes is cereals with root crops (potato and sugar beet) on grade 1 and grade 2 land. Along the Idle the land use remains largely the same but more intensive.

Table 6 Scenario characteristics for Beckingham Marshes and Idle

BECKINGHAM MARSHES

	Current	Production	Biodiversity / agriculture	Biodiversity	Flood storage	Income *2006 prices:*	Income *2007 prices:*
Water table (m below surface)	0.5	0.9	0.4	0.1	1	0.03	0.9
Surface water (days per year)	35	0	73	99	0	185	0
Flood probability	0.1	0.3	0.5	0.5	0.1	1	0.3
Land cover	Winter wheat, oilseed rape, peas, unimproved (wet) grassland	Winter wheat, oilseed rape, peas, potato, sugar beet	Wet grassland, hay meadow, improved grass	Reed beds, wet woodland, inundation grassland	Winter wheat, oilseed rape, peas, improved temporary grass ley	Reed bed	Winter wheat, oilseed rape
Livestock	Extensive beef		Extensive beef	Extensive beef	Intensive beef		

IDLE

	Current	Production	Biodiversity / agriculture	Biodiversity	Flood storage	Income
Water table (m below surface)	0.4	0.6	0.2	0.2	1	0.6
Surface water (days per year)	38	4	61	133	0	4
Flood probability	0.4	0.3	0.6	0.7	0.1	0.3
Land cover	Barley, carrot, onion, sugar beet, maize, wheat, improved temporary grass ley, set-aside	Barley, carrot, onion, sugar beet, potato maize, peas, improved temporary grass ley	Wet grassland, hay meadow, improved temporary grass ley	Species-rich fen, reed beds, hay meadow	Winter wheat, oilseed rape, beans	Carrots, onion, potato, winter wheat, sugar beet, improved temporary grass ley
Livestock	Dairy	Dairy	Extensive beef	Extensive beef	Dairy	Dairy

- *Maximising biodiversity within agricultural system*; this scenario seeks to enhance nature conservation interests within an agricultural system, typically through HLS options. Land use in both sites is typically wet grassland, hay meadows and limited areas of improved grass, grazed by beef cattle (medium store cattle). The water management regime consists of a shallow water table, regular periods with surface water during the winter season and frequent flooding.

– *Maximising biodiversity*; this scenario seeks to enhance nature conservation interests without the constraints of an agricultural system though it can include HLS options. The water management regime is characterised by annual flooding of long duration, allowing the creation of reed bed, wet woodland and inundation grassland in the Beckingham Marshes, and a mix of reed bed, species-rich fen and old hay meadow along the river Idle.
– *Maximising flood water storage*, in order to maximise the attenuation of flood peaks. To achieve this aim, drainage is effective (thus no days with surface water), water table is kept at 1 metre depth to allow maximum below-ground storage, and the flood probability is set at 1:10 year floods so the timing of filling the storage with floodwater is delayed in order to achieve maximum attenuation (see Textbox 2 for explanation). Crops with high transpiration rates (e.g. grass, winter cereals) are preferred. Beckingham Marshes shows a similar land use pattern under this scenario compared to the current situation: winter cereals and improved grass for intensive beef. The land use along the Idle is a mix of improved grass (for dairy) and cereals as well.
– *Maximising farm income*; this scenario seeks to maximise the income derived from the land and is defined by any of the previous scenarios with the highest estimated farm income. When using the 2006 prices, the HLS payments for reed beds actually resulted in the highest farm income for Beckingham Marshes. However, when a doubling of the wheat price is taken into account (as happened in 2007), cereals result in a higher income.

Textbox 2 Attenuation of hydrograph for flood storage

Figure A shows the attenuation of the hydrograph for uncontrolled and controlled floodplain storage. Once discharge exceeds bank full discharge (Q_{bf}) the floodplain starts to fill and water storage increases. This delays the flood peak and attenuates the discharge. The peak of the attenuated discharge must occur on the falling limb of the un-attenuated discharge as at this point change in storage is zero and therefore upstream inflow is equal to downstream outflow (assuming no gains or losses along the reach). In unmodified watercourses, bank full discharge, Q_{bf}, is approximately equal to the median annual flood, Q_{MED}. Where floodplains have been embanked and separated from the river, a degree of control allows the timing of start of filling of storage to be delayed. An effect of this is that, for the same storage volume, the degree of attenuation is increased. Förster et al. (2005) concluded that the full benefit of the storage capacity can only be achieved by controlled operation and good timing. Maximum flood attenuation is achieved by “flood peak capping” – which requires both control over the timing of the filling of the storage and knowledge of the flood hydrograph.

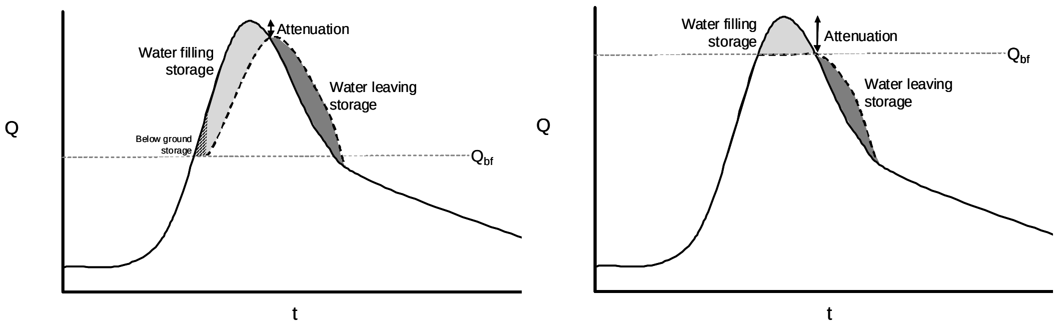

Figure A Attenuation of hydrograph for uncontrolled and controlled floodplain storage (after McCartney & Naden, 1995)

It was explained that, for each scenario, the outcomes are expressed in terms of a set of indicators, representing ecosystem goods and services delivered by lowland floodplains. Table 7 shows a sub-set of these indicators, the corresponding ecosystem good or service and the values that were assigned to these during the prioritisation exercise in session 2 (see Table 4).

Table 7 Indicators for ecosystem uses

Ecosystem function	Indicator	Unit	Ecosystem good or service	Value[1]
Production	Land cover with food crops and intensity production system	Ranking	Food crops	29
	Net margin	£/ha	Income from land	-
Regulation	Flood storage	Ranking	Flood risk management	26
	Emission of greenhouse gases	kg CO_2 equiv./ha	Green house gas balance	2
	Impact water quality by NO_3 leaching	kg NO_3/ha	Water resources	14
Habitat	Habitat conservation value[2]	-	Habitat provision	22
Carrier	Flood risk houses in floodplains	£/ha	Settlements	8

[1] The value is based on the number of tokens assigned by the workshop participants during the exercise on prioritisation of ecosystem uses.
[2] Habitat conservation value is a derived score based on applying Nature Conservation Review criteria to the habitats predicted to occur under each scenario. It has therefore no unit, but the higher the score, the greater the conservation value.

Table 8 shows the results for the different scenarios for the Beckingham Marshes and River Idle. Constant prices for the 2006 year are used throughout. Only the ranked scores are given in Table 8 (with the highest number representing the best performance), but they are based on absolute estimated values. Multiplying the ranked scores with the values from the prioritisation exercise allows the allocation of a final score for each scenario; the higher the score, the better the scenario delivers multiple ecosystem goods and services that were prioritised during the workshop. Using this approach, the current situation gives the best performance for the Beckingham Marshes, and the production scenario (maximisation of agricultural production) for the Idle. Obviously, this outcome is largely determined by the method and the indicators selected. It has to be noted that the habitat function is unrepresented whereas the ecosystem services related to habitat were highly prioritised by the participants.

Though these results are not yet complete, some synergies and conflicts between ecosystem goods and services can already be highlighted. There is a clear synergy between agricultural production and floodwater storage on both sites, as well as a synergy between wet habitat and low greenhouse gas emissions. However, agricultural production (and consequently floodwater storage) conflicts with wet habitat and low greenhouse gas emissions.

Table 8 Ranked scores for Beckingham Marshes and Idle

BECKINGHAM MARSHES	Current	Production	Biodiversity / agriculture	Biodiversity	Flood storage	Income *2006 prices:*	Income *2007 prices:*
Food production	4	7	3	2	6	1	5
Flood storage	6	4.5	3	2	7	1	4.5
Global warming potential	4	1	5	6	2.5	7	2.5
Water quality	4	2	5	6	2	7	2
Habitat conservation	5	1	6	7	2	4	3
Flood risk houses in floodplain	7	4	3	2	5.5	1	5.5
Total score	502	404	401	376	477	263	405
Net margin	1	2	4	5	3	6	7

IDLE	Current	Production	Biodiversity / agriculture	Biodiversity	Flood storage	Income
Food production	4	6	2	1	3	5
Flood storage	3	5	2	1	6	4
Global warming potential	4	2	5	6	3	1
Water quality	3.5	2	5	6	1	3.5
Habitat conservation	4	1.5	5	6	1.5	3
Flood risk houses in floodplain	5	3.5	2	1	6	3.5
Total score	379	397	316	291	344	394
Net margin	1	5	2	4	3	6

Comments & questions regarding scenario modelling

- It was pointed out that the industrial/urban potential of land should be considered as well; e.g. the oil wells in Beckingham Marshes or housing developments. In response, it is proposed to include these in carrier functions.
- It was asked whether HLS payments would be increased to reflect higher world market prices for crops and hence for income foregone. Other participants thought this was not the case "in the short term". These payments clearly affect the financial feasibility of options.
- A question was raised about the valuation of flood defence in terms of off-site benefits would be valued. Why take flood storage into account if the value is not assessed? The project team considers flood storage is an indicator of the flood risk management function of floodplains. The true contribution to flood risk management will be catchment specific. It is proposed to apportion a value to flood storage based on either the cost of damage avoided at the catchment scale

or on the cost of providing some alternative defence. These estimates will clearly vary amongst sites.

- It was asked how the costs of biodiversity management would be factored in. The project team will include relevant investment and maintenance costs in the cost-benefit analysis of each scenario.
- It was noted that HLS is only a proxy for biodiversity value. It does not necessarily reflect true value. As biodiversity declines, its unit value increases. It was pointed out that HLS payments mainly reflect ‘compensation’ costs of foregoing income from farming.
- A question was raised why arable land use is assumed for flood storage schemes as it imposes a cost in terms of crop losses when floods occur. It was also pointed out that below-ground storage is hard to realise and therefore of limited value. The below-ground storage is often taken up by the rainfall before the flood peak arrives. Furthermore, a blended approach to meet multiple objectives is preferable rather than looking at extremes. The project team responded that, though there is indeed a risk of crop losses due to flooding, this risk is considered worthwhile by farmers when the flood probability is reasonably low (0.1 or less). The crop losses are offset by the profits made in other years. The average annual damage costs (flood probability multiplied with damage costs) due to crop losses are taken into account in the scenarios. Furthermore, often the below-ground storage is taken up by rainfall, but if there is no below-ground storage available, the rain would have been stored above ground (resulting in a loss of storage) or run off and contributed to the flow.
- The disadvantage of looking at schemes on a site by site basis was pointed out. One may reach the same conclusion for each in terms of optimal land use, but when assessing floodplain management at a broader scale, one would actually want a mixture of uses to serve the national interest most effectively. The approach taken by the project team explores options at the scale of the individual floodplain or river reach. This allows the assessment of how a particular site of a given type could make a potential contribution to flood risk management at the catchment or sub-catchment scale. It is noted for example, that many proposed ‘set back schemes’ taken individually may make a minor contribution to overall risk alleviation, but have potential to make a significant contribution when joined-up- the notion of a string of storage ‘pearls’ along the floodplain.
- Others responded that it was right to keep “valuing” separate from “implementation. However, a fundamental question is what society wants from floodplains now? Reversibility and sequence of floodplain management options are important, especially with respect to the extractive industries.
- Balancing flood risk and biodiversity was discussed. They may be compatible at frequent return periods, but not when sites only flood once in 20 years and biodiversity features are damaged as a result. What is the best engineering solution? And who has ownership? A lot of work has been done on public expense.
- The view was expressed that biodiversity and flood storage need not conflict as suggested for Beckingham Marshes and Idle, but this usually requires some compromise on one or the other function. It was suggested that there is a need for a method of costing flood storage loss versus biodiversity gain in these systems where habitats are kept wet at all times.
- It was argued that floodplain habitats are limited to floodplains and therefore should take priority in terms of assigning floodplain land use. Many competing

uses could be located out of the floodplain and therefore should be accorded lower priority.

- The comment was made that there may be methods for valuing multiple objectives, but no structure to fund the implementation of the optimum result. Who is paying for ecosystem services that have no market value? Property rights were raised as another major impediment to optimising the public good. For this reason, the project team will expand the stakeholder analysis to get a better understanding of who owns the property rights and the means (e.g. statutory rights, power or financial means) to make things happen. The stakeholders' interests and attributes will be linked with the ecosystem uses. Furthermore, the type and magnitude of non-market ecosystem services will be identified for each scenario. The economic costs of achieving additional units of ecosystem services will be identified, e.g. in the form of income from agricultural production foregone to deliver habitats of given types. Where appropriate, standard estimates of ecosystem services will be included, such as the value of public access or landscape quality, but there are challenges doing this. In the case of carbon, the social value of reducing carbon emissions as proposed by Defra will be used. In summary, a variety of ways will be used to capture values for non-traded goods
- There was discussion about the challenges of implementation and that there was need to explicitly consider the institutional arrangements to implement preferred land use options, especially for biodiversity and flood risk management. It was suggested that a funding model is needed to facilitate implementation.
- It was argued that it was necessary to identify the primary objective of a scheme and then look for gains in terms of secondary objectives. It was argued by others that this is effectively what is already done in practice; i.e. looking for secondary win-wins. But the real challenge is to step back from the detail and identify how to maximise the potential benefits to the nation as a whole. Implementation should than follow from this initial stage which should be based on a new integrated understanding. It was stated that outcome measures used by the EA already took this approach and formed the basis of how resources are allocated in flood risk management work.

The general feeling was that scenario analysis was useful for drawing out the extremes, but that in reality it is likely that 'hybrid', compromise solutions will prevail, comprising a mix of elements of the modelled scenarios. It was thought that such a 'compromise' approach would be worthwhile. This raised the issue that such 'mixed scenarios' increased the challenge for implementation, requiring much more integration of policy and funding mechanisms. The scenario analysis, however, enables the trade-offs and synergies to be explored, informing hybrid options.

Conclusions

Rural lowland floodplains deliver a range of ecosystem goods and services to society, but the priorities of stakeholders for these have varied in time and space. Context is thus very important when discussing integrated floodplain management. The potential contribution of floodwater storage on the floodplain to flood risk management at catchment level is a case in point.

The ecosystem functions and uses framework was considered a useful approach to assess the wide range of ecosystem goods and services delivered by integrated floodplain management. It was recognised that there are challenges with the valuation of non-marketable benefits such as biodiversity. The value placed on floodplain habitats and biodiversity by workshop participants varied according to context and stakeholder perception. There was general agreement, however, on which type of habitats were most valued and which habitat criteria were most pertinent for ranking importance. The workshop participants were not comfortable with valuing biodiversity simply in terms of species diversity or indeed on its current legal designation. There was a strong feeling that the sustainability of a habitat coupled with the cultural heritage of a locality, should be considered.

It was concluded that a cost-benefit analysis at the level of the floodplain is required to take all costs and benefits into account, including capital and maintenance costs and the potential economic values of the range of goods and services provided by the floodplains, such as non-market public goods and catchment-scale effects where possible.

Though models can contribute to integrated floodplain management by estimating ‘best outcomes’ for the public good, models have limited value unless they can inform and lead to practical outcomes. The participants emphasised the need to provide guidance on the design and implementation of strategies to achieve integrated solutions in practice. This required bringing together the range of stakeholder interests and joining up the various elements of policy and funding that currently appear to be fragmented, recognising the range and distribution of benefits that can be obtained.

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List of attendees

1. Trazar Astley-Reid, the Rural Business Centre
2. Richard Belfield, Local Government Association
3. Philip Brewin, Somerset Drainage Boards Consortium
4. Michelle Claxton, Wildlife Trust
5. Rob Cunningham, RSPB
6. David Gowing, Open University
7. Anna Hall, NFU
8. Tim Hess, Cranfield University
9. Derek Holliday, CLA
10. Duncan Huggett, Environment Agency
11. Martin Janes, River Restoration Centre
12. Jenny Mant, River Restoration Centre
13. Joe Morris, Cranfield University
14. Paul Murby, Defra
15. Amy Parrott, Environment Agency
16. Helena Posthumus, Cranfield University
17. Chris Rostron, Wildlife Trust
18. Jim Rouquette, Open University
19. Maya de Souza, Defra
20. Rosie Simpson, Natural England
21. Paul Trawick, Cranfield University
22. Alan Watson, JBA Consulting