Land Use Policy Group

The UK statutory conservation, countryside and environment agencies

Adapting agricultural policy to increased flood risk

Land Use Consultants

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www.lupg.org.uk

Environment Agency | Cyngor Cefn Gwlad Cymru Countryside Council for Wales | Natural England | Joint Nature Conservation Committee | Scottish Natural Heritage All of nature for all of Scotland | NIEA Northern Ireland Environment Agency

The Land Use Policy Group
The Land Use Policy Group (LUPG) of the UK statutory nature conservation, countryside and environment agencies comprises the Countryside Council for Wales, Natural England, Environment Agency, Northern Ireland Environment Agency, Joint Nature Conservation Committee and Scottish Natural Heritage.

The LUPG aims to advise on policy matters of common concern related to agriculture, woodlands and other rural land uses. It seeks to improve understanding of the pros and cons of policy mechanisms related to land use, particularly farming and forestry; to develop a common view of desirable reforms to existing policies; and to promote these views.
www.lupg.org.uk

Countryside Council for Wales
The Countryside Council for Wales champions the environment and landscapes of Wales and its coastal waters as sources of natural and cultural riches, as a foundation for economic and social activity, and as a place for leisure and learning opportunities. It aims to make the environment a valued part of everyone's life in Wales.
www.ccw.gov.uk

Natural England
Natural England is the statutory body working to conserve and enhance England's natural environment, for its intrinsic value, the wellbeing and enjoyment of people and the economic prosperity that it brings. Its role is to ensure that England's unique natural environment, including its land, flora and fauna, freshwater and marine environments, geology and soils, are protected and improved. Natural England also has the responsibility to help people enjoy, understand and access the natural environment.
www.naturalengland.org.uk

Scottish Natural Heritage
Scottish Natural Heritage (SNH) is a government body established to secure conservation and enhancement of Scotland’s unique and valued natural heritage – the wildlife, habitats and landscapes that have evolved in Scotland through long partnership between people and nature. SNH advises on policies and promotes projects that aim to improve the natural heritage and support its sustainable use. It’s aim is to help people to enjoy Scotland’s natural heritage responsibly, understand it more fully and use it wisely so it can be sustained for future generations.
www.snh.org.uk

The Environment Agency
The Environment Agency (EA) is the leading public organisation for protecting and improving the environment in England and Wales. The EA achieves this by regulating industry, waste and water quality; managing flood risk and water resources, and improving wildlife habitats in addition to many other activities. The EA also monitors the environment, and makes the information that it collects widely available.
www.environment-agency.gov.uk

Northern Ireland Environment Agency
Northern Ireland Environment Agency takes the lead in advising on, and in implementing, the Government's environmental policy and strategy in Northern Ireland. The Agency carries out a range of activities, which promote the Government's key themes of sustainable development, biodiversity and climate change. Our overall aims are to protect and conserve Northern Ireland's natural heritage and built environment, to control pollution and to promote the wider appreciation of the environment and best environmental practices.
www.ni-environment.gov.uk

The Joint Nature Conservation Committee
The Joint Nature Conservation Committee **(**JNCC) is the statutory adviser to Government on UK and international nature conservation. Its work contributes to maintaining and enriching biological diversity, conserving geological features and sustaining natural systems.

JNCC delivers the UK and international responsibilities of the four country nature conservation agencies - Council for Nature Conservation and the Countryside, the Countryside Council for Wales, Natural England and Scottish Natural Heritage.
www.jncc.gov.uk

Disclaimer
This report was produced by the authors on behalf of the Land Use Policy Group (LUPG). The views expressed within the report are those of the contractors and do not necessarily reflect the views of the agencies within LUPG.

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Introduction

Increased flooding from higher and more intense rainfall and from the incursion of high tides is likely to be the most immediate of all the impacts that will be felt from the changing global climate. Across the UK over the next 60 years, the number of people at risk of flooding could rise from 1.5 million to 3.5 million and the annual cost of flood damage could increase by a factor of up to nine times[1].

Agriculture will be both highly affected by increased flooding, but will also have an important role to play in mitigating the negative impacts that flooding can bring. The Common Agricultural Policy (CAP) will continue to be a major influence on land use practices. The ongoing reforms of the CAP provide an opportunity to encourage improved flood risk management by farmers and to better integrate agricultural and rural development policy with flood defence and management.

It is against this background that this study has been conducted by Land Use Consultants for the Land Use Policy Group of GB countryside agencies. It has investigated potential changes to the Common Agricultural Policy (CAP) that will enable agriculture to adapt to changes in flood risk likely to occur as a result of climate change.

Specifically, the study has categorised the likely causes and impacts of increased flooding on agricultural businesses (Chapters 2 and 3) and described the types of adaptation strategies that can be adopted by farmers (Chapter 4). It has examined how the different components of the CAP currently influence farmers' ability to adapt to flood risk and the changes that can be adopted to increase this (Chapters 5-7) and has briefly examined a range of measures that lie outside the CAP (Chapter 8), before drawing overall conclusions and making recommendations (Chapter 9).

The increasing risk of flood damage on farmland

The evidence of recent floods shows that the financial impact of flooding on agriculture can be significant, with costs of the summer 2007 floods that affected parts of England estimated at £50 million.

The impacts of flooding are generally most severe in floodplains and low-lying coasts which also contain a high proportion of the most agriculturally productive areas. However, the impact of high rainfall and flood run-off also lead to less critical impacts across all agricultural land.

The direct impacts of flooding on agricultural businesses include the loss of crops and reductions in yield; higher variable and management costs where field operations have to be rescheduled; and opportunity costs where land uses become limited by the risk of repeated flooding.

Indirect impacts on business profitability include more volatile agricultural markets; higher fixed costs (such as land drainage and insurance); and reduced flexibility in land use planning (including through statutory regulation). Again, it is the farmers who face the greatest risks that have the fewest options to mitigate them (such as the very limited availability of commercial insurance against flood damage).

The role of land use and management in reducing the impact of flooding

With the notable exception of improvements to land drainage, most of the measures that farmers can take to reduce the risk of flooding to their own businesses will also reduce the risk of flooding to others.

[1] HMSO (2004) Foresight Future Flooding.

However, whilst land use and management can play a role in reducing the risk of smaller scale flooding and 'muddy flood' events, there is currently little hard evidence to demonstrate that they have a significant effect on major flood events at a large catchment scale. This lack of knowledge is a critical factor constraining the potential for farmland to play a more significant role in positive flood risk management.

Nevertheless, if land use and management are to have a role in reducing flood risk at a large scale, they will need to be co-ordinated and based on good knowledge of the flood response characteristics of each catchment.

Within floodplains and on coasts, there are opportunities for changes in land use. These include the use of land for temporary flood storage and the creation of wet woodland or saltmarsh to slow the flow of flood water. Most recent examples of this in the UK have involved land purchase by public bodies or conservation organisations where the land is no longer part of an agricultural system. If larger areas of farmland on floodplains and coasts are to be used for flood management, integrated with continuing agricultural production, ways will need to be found to acknowledge the loss of land value and income to farming landowners.

Delivering multiple benefits from flood risk management

Most land use and management for flood risk management is compatible with the delivery of a wide range of other public benefits or 'ecosystem services', particularly high water quality and biodiversity. However, for these benefits to be realised in practice, the measures must be adopted at a farm and catchment scale in suitable locations.

The impact of Pillar I of the CAP

The report looks separately at Pillar I (market support and direct payments) and Pillar II (rural development) of the CAP.

Pillar I, which accounts for the large majority of CAP spending, provides little direct assistance to farmers to help them adapt to, and mitigate, the risk of flooding.

Market support measures, which have been much diminished in recent years, have proved a blunt and distorting tool. Guaranteeing prices for 'flood friendly' products (for which there would be little political interest) would be a complex and inefficient means of encouraging flood risk management.

The decoupled Single Payment Scheme has the advantage of providing a financial buffer against risk and helps farming businesses remain in place to deliver separately funded public benefits. However, this presupposes that agriculture is needed to deliver flood risk management practices which may not be the case in areas such as on upland peat soils and low-lying coasts.

By requiring land to continue to be available for agricultural production, the Single Payment Scheme is a significant disincentive for land use change to non-agricultural uses such as woodland, wetland and salt marsh.

Cross compliance offers the potential (as yet largely unmet) to deliver baseline and best practice land management measures of the kind that can reduce flood run-off across catchments as a whole. For these measures to be effective, it is essential that farmers use them in appropriate locations at a field and farm scale. This will require positive engagement with, and transfer of knowledge to, farmers beyond the level currently available from farm advisory services.

In the past, direct aid to support specific forms of production under Pillar I have exacerbated flood risk management. The new Article 68 measures offer the opportunity to use direct aid to support more beneficial land use systems. However, decisions by Member States on

whether to use Article 68 are likely to be dictated by their long term visions for the CAP, rather than on the specific benefits that Article 68 might provide for environmental management.

The impact of Pillar II of the CAP

The agri-environment and forestry schemes contained in Axis 2 of Rural Development Programmes (RDP) are the only parts of Pillar II that directly influence the use and management of land. Flood risk management is generally a secondary objective of these schemes. A key constraint has been the lack of spatial data to enable flood risk management to be properly targeted, but this is now being addressed in some countries by regional and sub-regional flood risk and shoreline management plans. Other beneficial changes to agri-environment schemes include making agreements available for 20 years (rather than the usual 10), increasing the flexibility for payments that recognise variations in farming costs, and better co-ordination with non-CAP flood defence spending.

Axis 1 of the RDP provides scope, currently largely unmet in the UK, for training and advice programmes to increase farmers' awareness of the actions they can take to mitigate and adapt to flooding. A suitable model is the England Catchment Sensitive Farming Delivery Initiative.

There is little evidence that Axes 3 and 4, which provide support to rural communities, have any significant influence on flood risk management. There are opportunities for using these Axes, together with the planning system, to encourage engagement at a local level between communities that are at risk of flooding and local landowners who might be able to reduce this flood risk, such as through the provision of flood water storage.

Non-CAP measures

There is little evidence of integration in the UK between CAP measures and nationally directed expenditure on flood defence and strategic policies for flood risk management.

It is in the targeting of rural development Axis 2 and 3 measures (particularly the agri-environment and forestry schemes and the involvement of local communities in land management for flood storage) that there is most potential for this integration to take place. Three benefits could be achieved.

Firstly, strategic flood risk planning documents could be used to target the most effective locations for suitable CAP land use and management measures.

Secondly, rural development initiatives with local communities (such as through Leader Local Action Groups) could provide an interface between regional and local spatial planning and agricultural land use and management that lies outside the planning system but can be influenced through Axis 2 of the CAP.

Thirdly, agri-environment scheme agreements could be used to complement and add value to flood defence investment and maintenance schemes.

Recommendations

The report makes 13 recommendations.

1. Gaps in the evidence. Research should be undertaken at an EU scale to quantify the scale of potential impacts from land management on major flood events and identify the circumstances under which these impacts are most significant (both positive and negative).

2. Applying research to individual catchments. Building on existing work, such as the Pontbren Project in central Wales, this research (Rec 1) should be applied at the scale of individual catchments to model the impact of land use and management on the flood

response of the catchments under different rainfall conditions, enabling targeted interventions through the CAP and other measures, to reduce risk of surface run-off from farmland generating floods.

3. Differential impacts of flooding on farming. Land use and agricultural policy need to recognise more explicitly that the impacts of flood events are borne disproportionately by landowners occupying land at high risk from fluvial or marine flooding (much of which is otherwise highly productive). There is scope for recognising this disadvantage through a designation similar to Less Favoured Areas, enabling suitable policy measures, such as differential rates of land management payments to be targeted to this land. These payments would recognise the productive disadvantage as well as opportunities for providing a range of public benefits on land most at risk of flooding.

4. Adaptation measures available to farmers. Land use and agricultural policy should distinguish between two distinct types of flood risk adaptation measures on farmland.

Firstly the majority of land management practices that can reduce the risk of flood generation without incurring significant agricultural costs should be regarded as 'best practice', requiring no or little financial incentive for their adoption by farmers.

Secondly, the land use changes needed to reduce the higher risks experienced on land in floodplains, which may also, if appropriately designed, significantly reduce localised flood risk, should be regarded as high cost. Where these changes deliver wider public benefit, they will require significant long term financial incentives to encourage their adoption by landowners.

5. Improving the overall influence of the CAP. Flood risk management and mitigation should become a cross-cutting objective of the CAP, along with other objectives designed to address the threat of climate change. All parts of the CAP should be 'flood-proofed' at both an EU and Member State level to ensure that, at the very least, they do not increase flood risk or restrict the opportunities for farmers to adapt to increased flood risk.

6. Reducing the negative impacts of the SPS. The rules of the Single Payment Scheme should be amended to enable continuing payments to be made on land that, although it may no longer be available for agricultural production, is recognised by a competent national body as contributing to flood risk management or mitigation.

7. Support for upland farming. Continuing justification for financial support of farming in the uplands must take account of the potential negative impacts of agricultural management on flood generation in the headwaters of catchments.

8. Increasing the positive impact of cross compliance. To ensure that the full benefits of the new water-based cross compliance rules are realised, Member States should be encouraged to operate advisory programmes (funded through Axis 1 of Pillar II) that increase farmers' awareness of management practices that reduce the risk of flood generation on their own and neighbouring land.

9. Better spatial targeting of Pillar II to deliver flood risk management. The strategic spatial approaches to flood risk assessment and mitigation that are required of Member States by the EU Floods Directive should be used to provide the basis for targeted land use and management interventions through Pillar II of the CAP.

10. Turning research evidence into regular practice: Greater emphasis should be given to the use of Axis 1 to apply research and best practice amongst farmers, focussing on how land use and management can deliver improved flood risk management. This should be done both at a generic scale, highlighting measures which can be adopted in all areas, and also at a catchment scale, ensuring that land use and management are used to address the specific flood risk challenges in that catchment. These programmes should seek to deliver integrated outcomes maximising benefits to other environmental services.

11. Increasing flexibility in agri-environment payments. There needs to be a formal recognition by the EC and Member States that, in order to persuade landowners to convert

productive farmland in floodplains for better flood water storage and coastal realignment, the agreements available under Axis 2 schemes must acknowledge the high costs and long term commitments involved. Higher profit foregone payments and longer agreement periods than is the norm in other areas will often be needed. In addition, high one-off capital costs will need to be made available through national funding priorities within Flood risk Management budgets.

12. Coordinating flood risk management with social and economic opportunities: Member States should be encouraged to use Axis 3 and Leader programmes in areas at high risks of flood generation or propagation to pilot approaches to using land for flood risk management that delivers multiple benefits to local communities.

13. Improving co-ordination of the CAP with other measures. As highlighted in other recommendations, there is potential to improve the way in which CAP measures, particularly those in Axis 2, provide the means to deliver EU and national objectives for flood risk management. This requires greater co-ordination within Rural Development Programmes, and in the targeting of individual rural development measures, with strategic land use policies.

Crynodeb Gweithredol

Cyflwyniad

Mae'n debyg mai cynnydd mewn perygl llifogydd o fwy o law trwm ac o ymchwydd llanw uchel yw'r effaith gyntaf a welir o newid hinsawdd. Ledled y DU gallai nifer y bobl mewn perygl o effaith llifogydd gynyddu o 1.5 miliwn i 3.5 miliwn a chost flynyddol difrod llifogydd gynyddu gymaint â naw gwaith yn ystod y 60 mlynedd nesaf[2].

Effeithir yn drwm ar amaethyddiaeth gan gynnydd mewn llifogydd ond bydd gan amaethyddiaeth hefyd swyddogaeth bwysig wrth liniaru'r drygau a all godi yn sgil llifogydd. Bydd y Polisi Amaeth Cyffredin yn dal i gael effaith fawr ar ymarferion defnydd tir. Mae'r newidiadau i'r Polisi sydd ar y gweill yn gyfle i annog ffermwyr i reoli perygl llifogydd yn well yn ogystal â chyfuno polisi amaethyddol a pholisi datblygu gwledig yn well gydag amddiffyn rhag, a rheoli, llifogydd.

Dyma gefndir yr astudiaeth hon a gynhaliwyd gan Land Use Consultants ar ran Grŵp Polisi Defnydd Tir asiantaethau cefn gwlad gwledydd Prydain. Mae wedi ymchwilio i newidiadau arfaethedig i'r Polisi Amaeth Cyffredin a fydd yn galluogi amaethyddiaeth i addasu i newidiadau mewn perygl llifogydd sy'n debyg o godi o newid hinsawdd.

Yn benodol, mae'r astudiaeth yn categoreiddio achosion ac effeithiau tebygol cynnydd mewn llifogydd ar fusnesau amaethyddol (Penodau 2 a 3) ac mae'n disgrifio'r strategaethau addasu y gall ffermwyr eu defnyddio (Pennod 4). Mae wedi archwilio sut y mae gwahanol rannau o'r Polisi Amaeth Cyffredin yn dylanwadu ar hyn o bryd ar allu ffermwyr i addasu i berygl llifogydd a hefyd y newidiadau y gellir eu cael i gynyddu hyn (Penodau 5 – 7). Mae hefyd wedi ystyried yn fras amrywiaeth o fesurau y tu allan i'r Polisi Amaeth Cyffredin (Pennod 8) cyn dod at gasgliadau cyffredinol a chyflwyno argymhellion.

Perygl cynyddol llifogydd ar dir amaethyddol

Dengys tystiolaeth o lifogydd diweddar y gall llifogydd gael effaith ariannol sylweddol ar amaethyddiaeth ac amcangyfrifir fod costau llifogydd haf 2007 a effeithiodd ar rannau o Loegr yn £50 miliwn.

Gorlifdir ac arfordir isel sy'n cael eu heffeithio'n bennaf gan lifogydd ac yno hefyd mae canran uchel o'r tir amaethyddol gorau. Fodd bynnag, gall glaw trwm a dŵr ffo llifogydd yn effeithio rhywfaint ar bob math o dir amaethyddol.

Mae effaith uniongyrchol llifogydd ar fusnesau amaethyddol yn cynnwys colli cnydau a cynhyrchu llai o gnwd, costau amrywiol a chostau rheoli uwch pan fydd yn rhaid aildrefnu gwaith ar y tir a chostau cyfle pan gyfyngir ar ddefnydd tir gan lifogydd mynych.

Mae effeithiau anuniongyrchol ar broffidioldeb busnesau'n cynnwys marchnadoedd amaethyddol mwy ansefydlog, costau sefydlog uwch (megis draenio tir ac yswiriant) a llai o hyblygrwydd wrth gynllunio defnydd tir (gan gynnwys drwy reoliadau statudol). Unwaith eto, y ffermwyr hynny sydd mewn mwyaf o berygl sydd â'r lleiaf o ddewis sut i'w liniaru (megis prinder gwirioneddol yswiriant masnachol rhag difrod llifogydd).

Swyddogaeth defnydd a rheoli tir mewn lleihau effeithiau llifogydd

Yn amlwg, ac eithrio gwelliannau mewn draenio tir, bydd y rhan fwyaf o'r gwaith y gall ffermwyr ei wneud i leihau perygl llifogydd i'w busnesau eu hunain hefyd yn lleihau perygl llifogydd i eraill.

[2] HMSO (2004) Foresight Future Flooding

Fodd bynnag, er bod gan ddefnydd a rheoli tir eu rhan mewn lleihau peryglon llifogydd bychan a digwyddiadau 'llifogydd mwd' ychydig o dystiolaeth gadarn sydd ar gael ar hyn o bryd i ddangos eu bod yn cael effaith arwyddocaol ar lifogydd mawr ar raddfa dalgylch eang. Mae'r diffyg gwybodaeth hwn yn ffactor allweddol sy'n llesteirio defnyddio tir amaethyddol i chwarae rhan amlycach mewn rheoli llifogydd yn bositif.

Fodd bynnag, os yw defnydd a rheoli tir i fod â rhan mewn lleihau perygl llifogydd ar raddfa fawr, bydd yn rhaid eu cydlynu a'u seilio ar wybodaeth dda o nodweddion ymateb llifogydd ym mhob dalgylch.

Mae cyfle i newid defnydd tir ar orlifdir ac ar yr arfordir. Mae'r rhain yn cynnwys defnyddio tir i gadw llifogydd dros dro a chreu coetiroedd gwlyb neu forfa heli i arafu rhediad dŵr llifogydd. Cafwyd yr enghreifftiau diweddaraf o hyn yn y DU wrth i gyrff cyhoeddus neu sefydliadau cadwraeth brynu tir a'i eithrio o'r system amaethyddol. Os yw darnau mwy o dir amaethyddol ar orlifdiroedd neu ar yr arfordir i'w defnyddio ar gyfer rheoli llifogydd a bod hynny'n cael ei gyfuno gyda defnydd amaethyddol, yna bydd yn rhaid cael ffyrdd o gydnabod gostyngiad yng ngwerth y tir a cholled incwm i ffermwyr.

Darparu aml fuddion o reoli perygl llifogydd

Mae'r rhan fwyaf o ddefnydd a rheolaeth tir ar gyfer rheoli perygl llifogydd yn gydnaws â darparu amrywiaeth eang o fuddion cyhoeddus neu 'wasanaethau ecosystemau', yn enwedig ansawdd dŵr da a bioamrywiaeth. Fodd bynnag, os yw'r buddion hyn i'w gwireddu'n ymarferol byd yn rhaid mabwysiadu'r mesurau mewn mannau addas ar raddfa fferm a dalgylch.

Effaith Colofn 1 y Polisi Amaeth Cyffredin

Mae'r adroddiad yn edrych ar wahân ar Golofn 1 (cynnal y farchnad a thaliadau uniongyrchol) a Cholofn 2 (datblygu gwledig) y Polisi Amaeth Cyffredin.

Ychydig o gymorth a geir o dan Golofn 1, sy'n cyfrif am y rhan fwyaf o ddigon o wariant y Polisi, i ffermwyr i'w helpu i addasu a lliniaru perygl llifogydd.

Roedd mesurau cynnal y farchnad, sydd wedi crebachu gryn dipyn yn ystod y blynyddoedd diwethaf, yn declynnau amrwd a oedd yn gallu ystumio. Byddai gwarantu prisiau ar gyfer cynnyrch 'llifogydd gyfeillgar' (a fyddai ond yn denu ychydig o ddiddordeb gwleidyddol) yn ffordd gymhleth ac aneffeithiol o annog rheoli llifogydd.

Mae gan y Cynllun Taliadau Sengl, sydd wedi datgysylltu taliadau oddi wrth gynnyrch, y fantais o ddarparu clustog ariannol yn erbyn risg ac o helpu busnesau ffermio i barhau a darparu buddion cyhoeddus yn cael eu cyllido ar wahân. Fodd bynnag, mae hyn yn rhagdybio bod angen amaethyddiaeth cyn y gellir cael ymarferion rheoli perygl llifogydd ac efallai nad dyma'r achos yn ardaloedd pridd mawn yr ucheldir ac ar arfordiroedd isel.

Drwy fynnu fod yn rhaid i dir fod yn dal ar gael ar gyfer cynhyrchu amaethyddol, mae'r Cynllun Taliad Sengl yn ddad-anogaeth arwyddocaol i'w newid i ddefnydd an-amaethyddol megis coetir, gwlypdir a morfa heli.

Gallai trawsgydymffurfiad fod yn gyfle (nad yw wedi'i wireddu rhyw lawer hyd yma) i osod llinell sylfaen ar gyfer y math o ymarfer gorau mewn rheoli tir a allai leihau llifogydd dŵr ffo ledled dalgylchoedd cyfan. I'r mesurau hyn fod yn effeithiol, mae'n rhaid i ffermwyr eu defnyddio'n effeithiol mewn mannau priodol ar raddfa caeau a ffermydd. Bydd hyn yn golygu cysylltu'n bositif, a throsglwyddo gwybodaeth, i ffermwyr y tu hwnt i'r lefel sydd ar gael ar hyn o bryd gan y gwasanaethau ymgynghorol amaethyddol.

Yn y gorffennol, mae cymorth uniongyrchol i gefnogi dulliau penodol o gynhyrchu o dan Golofn 1 wedi gwaethygu rheoli perygl llifogydd. Mae'r mesurau Erthygl 68 newydd yn rhoi

cyfle i ddefnyddio cymorth uniongyrchol i gefnogi systemau defnydd tir mwy buddiol. Fodd bynnag, mae penderfyniadau Aelod Wladwriaethau ynghylch defnyddio Erthygl 68 ai peidio yn debyg o gael eu harwain gan eu gweledigaeth tymor hir ynghylch y Polisi Amaeth Cyffredin yn hytrach na gan y buddion penodol y gellid eu cael o dan Erthygl 68 ar gyfer rheoli amgylcheddol.

Effaith Colofn II y Polisi Amaeth Cyffredin

Y cynlluniau amaeth amgylcheddol a choedwigaeth yn Echel 2 y Rhaglen Ddatblygu Gwledig yw'r unig rannau o Golofn II sy'n effeithio'n uniongyrchol ar ddefnyddio a rheoli tir. Fel arfer, amcan eilaidd yn y cynlluniau hyn yw rheoli perygl llifogydd. Un cyfyngiad allweddol oedd diffyg data gofodol i allu targedu rheoli perygl llifogydd yn briodol, ond erbyn hyn mae rhai gwledydd yn talu sylw i hyn drwy baratoi cynlluniau rhanbarthol ac isranbarthol ar gyfer rheoli perygl llifogydd a'r traethlin. Mae newidiadau buddiol eraill i'r cynlluniau amaeth- amgylcheddol yn cynnwys cael cytundebau am 20 mlynedd (yn hytrach na'r 10 mlynedd arferol), cynyddu hyblygrwydd taliadau i gydnabod newidiadau mewn costau ffermio a chydlynu'n well gyda gwariant arall heblaw arian y Polisi Amaeth Cyffredin ar gyfer amddiffynfeydd llifogydd.

Mae darpariaeth yn Echel I y Rhaglen Ddatblygu Gwledig, na fanteisiwyd rhyw lawer arno hyd yma yn y DU, ar gyfer sefydlu rhaglenni hyfforddi a chynghori i gynyddu ymwybyddiaeth o'r hyn y gall ffermwyr ei wneud i liniaru ac addasu ar gyfer llifogydd. Mae Menter Darparu Ffermio Sensitif Dalgylchoedd yn Lloegr yn fodel addas.

Ychydig o dystiolaeth sy'n bodoli bod Echeli 3 a 4, sy'n rhoi cefnogaeth i gymunedau gwledig, yn ddylanwad arwyddocaol ar reoli perygl llifogydd. Gellid defnyddio'r Echelau hyn, yn ogystal â'r system cynllunio, i annog cysylltiad yn lleol rhwng cymunedau sydd mewn perygl llifogydd a thirfeddianwyr a allai leihau'r perygl llifogydd hwnnw, megis drwy ddarparu mannau cadw dŵr llifogydd.

Mesurau heblaw'r Polisi Amaeth Cyffredin

Ychydig o dystiolaeth sydd ar gael fod mesurau'r Polisi Amaeth Cyffredin yn cael eu cyfuno yn y DU gyda gwariant sy'n cael ei gyfeirio'n genedlaethol ar amddiffynfeydd llifogydd a gyda pholisïau strategol ar gyfer rheoli perygl llifogydd.

Drwy dargedu mesurau datblygu gwledig Echel 2 ac Echel 3 (yn enwedig cynlluniau amaeth amgylcheddol a choedwigaeth a chael cymunedau lleol i chwarae rhan mewn rheoli tir ar gyfer cadw dŵr llifogydd) y mae'r gobaith gorau y bydd y cyfuno hwn ddigwydd. Gellir cael tair mantais.

Yn gyntaf, gellid defnyddio dogfennau cynllunio perygl llifogydd i dargedu'r mannau mwyaf effeithiol i weithredu mesurau addas defnydd a rheoli tir y Polisi Amaeth Cyffredin.

Yn ail, gallai mentrau datblygu gwledig mewn cymunedau lleol (megis Grwpiau Gweithredu Lleol Leader) fod yn gysylltiad rhwng cynllunio gofodol rhanbarthol a lleol a defnydd a rheoli tir amaethyddol sydd y tu allan i'r system cynllunio ond y gellir dylanwadu arno drwy Echel 2 y Polisi Amaeth Cyffredin.

Yn drydydd, gellid defnyddio cytundebau cynlluniau amaeth amgylcheddol i gyd-fynd ac ychwanegu gwerth at gynlluniau buddsoddi mewn, a chynnal, amddiffynfeydd llifogydd.

Argymhellion

Mae'r adroddiad yn gwneud 13 o argymhellion.

1. Bylchau yn y dystiolaeth Dylid cynnal ymchwil, ar raddfa'r Undeb Ewropeaidd, i feintioli effeithiau posibl rheoli tir ar ddigwyddiadau mawr o lifogydd a nodi'r amgylchiadau pan fo'r effeithiau hyn ar eu mwyaf arwyddocaol (o blaid ac yn erbyn).

2. Cymhwyso ymchwil i ddalgylchoedd unigol. Gan adeiladu ar waith presennol, megis y Prosiect Pontbren yng nghanolbarth Cymru, dylid cymhwyso'r ymchwil hwn (Rec 1) ar raddfa dalgylchoedd unigol i fodelu effaith defnydd a rheoli tir ar ymateb dalgylchoedd i lifogydd o dan wahanol amodau o law gan alluogi targedu ymyriadau drwy'r Polisi Amaeth Cyffredin a mesurau eraill i leihau effaith dŵr ffo oddi ar dir amaethyddol sy'n achosi llifogydd.

3. Gwahanol effeithiau llifogydd ar ffermio Dylai polisi defnydd tir a pholisi amaethyddol gydnabod yn fwy penodol fod perchnogion tir sy'n debygol o ddioddef fwyaf o lifogydd afon neu lanw (tir sydd fel arall yn hynod gynhyrchiol) yn ysgwyddo'n anghymesur effeithiau llifogydd. Mae cyfle i gydnabod yr anfantais hwn drwy ddynodiad tebyg i Ardaloedd Llai Ffafriol a fyddai'n gallu arwain at fesurau polisi addas, megis targedu gwahanol gyfraddau o daliadau rheoli tir ar y tir hwn. Byddai'r taliadau'n cydnabod yr anfantais o ran cynhyrchedd yn ogystal â'r cyfleoedd o ddarparu amrywiaeth o fuddion cyhoeddus ar dir sydd yn y perygl mwyaf o lifogydd.

4. Addasu mesurau sydd ar gael i ffermwyr. Dylai polisi defnydd tir a pholisi amaethyddol wahaniaethu rhwng dau wahanol fath o fesurau addasu perygl llifogydd ar dir amaethyddol.

Yn gyntaf, dylid ystyried y rhan fwyaf o ymarferion rheoli tir sy'n gallu lleihau perygl llifogydd yn gymharol rhad yn amaethyddol, fel 'ymarfer gorau' nad oes angen dim neu ond ychydig o anogaeth ariannol i ffermwyr eu mabwysiadu.

Yn ail, dylid ystyried y newidiadau mewn defnydd tir sydd eu hangen i leihau'r peryglon ychwanegol ar orlifdir, a allai, o'u dylunio'n briodol, leihau peryglon llifogydd lleol yn sylweddol, fel rhai yn costio llawer. Pe byddai'r newidiadau hynny yn arwain at fuddion cyhoeddus ehangach, bydd angen anogaeth ariannol yn y tymor hir i annog tirfeddianwyr i'w mabwysiadu.

5. Gwella dylanwad cyffredinol y Polisi Amaeth Cyffredin Dylai rheoli a lliniaru perygl llifogydd ddod yn amcan trawsbynciol y Polisi Amaeth Cyffredin ynghyd ag amcanion eraill i dalu sylw i fygythiad newid hinsawdd. Dylai pob rhan o'r Polisi gael ei ystyried ar lefel yr Undeb Ewropeaidd ac Aelod Wladwriaeth i sicrhau nad yw, ar y lleiaf un, yn cynyddu perygl llifogydd nac yn cyfyngu ar gyfleoedd i ffermwyr addasu i gynnydd mewn perygl llifogydd.

6. Lleihau effeithiau negyddol y Cynllun Taliad Sengl Dylid newid rheolau'r Cynllun Taliad Sengl i alluogi dal i dalu ar dir sydd, er efallai nad yw bellach ar gael ar gyfer amaethyddiaeth, yn cael ei gydnabod gan gorff cenedlaethol cymwys yn dir sy'n cyfrannu at reoli neu liniaru perygl llifogydd.

7. Cefnogaeth i ffermio'r ucheldir Wrth barhau i gyfiawnhau cefnogaeth ariannol i ffermio'r ucheldir, dylid ystyried y gallai rheolaeth amaethyddol gynyddu llifogydd ym mlaenddyfroedd dalgylchoedd.

8. Cynyddu effeithiau positif trawsgydymffurfiad. Er mwyn sicrhau y manteisir i'r eithaf ar y rheolau trawsgydymffurfio newydd ynghylch dyfroedd, dylid annog Aelod Wladwriaethau i weithredu rhaglenni cynghori (yn cael eu cyllido drwy Echel 1 o Golofn II) i gynyddu ymwybyddiaeth ffermwyr o ymarferion rheoli sy'n lleihau'r perygl o gynhyrchu llifogydd ar eu tir eu hunain ac ar dir eu cymdogion.

9. Targedu gofodol gwell o Golofn II i gael gwell rheolaeth ar lifogydd Dylid defnyddio'r agweddau gofodol strategol ar gyfer asesu perygl a lliniaru llifogydd y mae Cyfarwyddeb Llifogydd yr Undeb Ewropeaidd yn gofyn i Aelod Wladwriaethau eu defnyddio fel sail i dargedu defnydd a rheolaeth tir ac ymyriadau rheoli drwy Golofn II y Polisi Amaeth Cyffredin.

10. Troi tystiolaeth ymchwil yn ymarfer cyffredin Dylid rhoi rhagor o bwyslais ar ddefnyddio Echel 1 i gymhwyso ymchwil ac ymarfer gorau ffermwyr gan ganolbwyntio ar sut y gall defnyddio a rheoli tir arwain at reoli llifogydd yn well. Dylid gwneud hyn ar raddfa gyffredinol, gan amlygu mesurau y gellir eu mabwysiadu ym mhob ardal, a hefyd ar raddfa dalgylch er mwyn sicrhau y telir sylw i ddefnydd a rheoli tir wrth ystyried heriau peryglon penodol llifogydd y dalgylch hwnnw. Dylai'r rhaglenni hyn geisio sicrhau canlyniadau cyfun sy'n rhoi'r manteision mwyaf i wasanaethau amgylcheddol eraill.

11. Cynyddu hyblygrwydd taliadau amaeth amgylcheddol. Dylai'r Comisiwn Ewropeaidd ac Aelod Wladwriaethau gydnabod yn ffurfiol, er mwyn argyhoeddi tirfeddianwyr i newid tir amaethyddol cynhyrchiol ar orlifdir, ac ail-alinio'r arfordir, er mwyn cadw dŵr llifogydd yn well, fod yn rhaid i'r cytundebau sydd at gael o dan gynlluniau Echel 2 gydnabod fod hyn yn costio llawer a'u bod yn ymrwymiadau hir dymor. Yn aml, bydd angen talu mwy na'r elw a gollir a bydd yn rhaid i'r cytundebau fod am gyfnodau hirach na'r arfer. Ar ben hynny, bydd yn rhaid i daliadau costau cyfalaf unwaith ac am byth fod ar gael drwy flaenoriaethau cyllido cenedlaethol mewn cyllidebau rheoli perygl llifogydd.

12. Cydlynu rheoli perygl llifogydd gyda chyfleoedd cymdeithasol ac economaidd: Dylid annog Aelod Wladwriaethau i ddefnyddio rhaglenni Echel 3 a Leader mewn ardaloedd lle mae mwy o berygl llifogydd neu ddatblygu cynlluniau peilot ar gyfer defnyddio tir ar gyfer rheoli perygl llifogydd sy'n arwain at lawer o fanteision i gymunedau lleol.

13. Cydlynu'r Polisi Amaeth Cyffredin yn well gyda mesurau eraill Fel y dangosir mewn argymhellion eraill, gellir gwella'r ffordd y mae mesurau'r Polisi Amaeth Cyffredin, yn enwedig rhai Echel 2, yn darparu'r moddion i wireddu amcanion yr Undeb Ewropeaidd a rhai cenedlaethol ar gyfer rheoli perygl llifogydd. Mae hyn yn gofyn am fwy o gydlynu mewn Rhaglenni Datblygu Gwledig ac o ran targedu mesurau datblygu gwledig unigol, gyda pholisïau defnydd tir strategol.

1. Introduction

This is the final report prepared for the Land Use Policy Group (LUPG) by Land Use Consultants in relation to contract number 064 EPG 08 (CCW).

1.1 Purpose and aims

The purpose of this study is to investigate the potential changes that need to be made to the Common Agricultural Policy (CAP) to allow agriculture to adapt to changes in flood risk likely to occur as a result of climate change. The results of the study will help to inform the LUPG position on how best to implement the changes likely to arise from the CAP Health Check as well as helping to develop the long-term vision for the future of the CAP.

The aims of this study are as follows:

- To identify and categorise the types of adaptation strategies that may be necessary for agriculture. This includes how land owners can adapt to increasing flood risk on their land irrespective of whether this is part of a strategic approach (including adapting to raised water levels, standing water on land for longer periods of time, more frequent inundation events).
- To examine how land owners and their holdings can be used as part of a positive flood risk management strategy, including flood storage, wash-lands, managed realignments or other soft engineering techniques such as regulated tidal exchange, landscape scale land use change e.g. woodland creation or wetlands creation.
- To examine how land owners can be incentivised to deliver positive land management practices to reduce flood risk, illustrated with case studies from within the UK and other Member States that demonstrate the changes required to the CAP.
- To identify the current arrangements in CAP that may allow the items above to be paid for, and identify shortcomings and limitations of these arrangements. Provision of advice should also be considered in this section.
- To identify and recommend changes that could be made to the current arrangements in CAP, either on an individual payments level, the Rural Development Regulation or through strategic changes to CAP priorities.

In particular, this report seeks to identify those changes to the CAP that:

- are needed to allow land managers to adapt to more frequent and extensive flooding
- will incentivise land managers to allow their land to be used as part of a wider flood risk management strategy
- will target adaptation land management practices that impact on flood control e.g. promote land uses that can reduce the risk of runoff leading to greater frequency of flooding
- can allow multiple land managers to change land use on a landscape scale e.g. create woodland or wetlands, and
- will help to address the objectives of other EU and national policies such as the Water Framework Directive, Biodiversity and Soils.

1.2 Background

Of all the impacts that will be felt from the anticipated change in climate, increased flooding arising from higher and more intense rainfall and the incursion of high tides would appear to be the most immediate, particularly in northern Europe. Inundation of floodplain and coastal communities, landscapes and habitats, will become increasingly regular and damaging.

Governments are taking these threats seriously, particularly in countries where large populations live in areas at increased risk of flooding such as the Netherlands and England. The UK Government's Foresight programme has produced a major study anticipating the impact of future flooding over the period to 2030 and beyond[3]. The lessons of recent flooding in England are being adopted following a Government commissioned report[4].

Agriculture will be both highly affected by increased flooding, but also has an important role to play in mitigating the negative impacts that flooding can bring. Significantly, there will be opportunities for changes in the way that land is managed in the headwaters and upper catchments, as well as in floodplains, that will help farmers adapt their businesses to the risk of flooding and may help to reduce peak flows and significantly reduce flood events at a local scale as well as, potentially, at a catchment scale.

The Common Agricultural Policy continues to be a major driver of land use practices in the EU. The various measures contained in the CAP have the potential to encourage agriculture to contribute positively to the threat of flooding. Equally, the experience of the last forty years shows that the CAP can be extremely damaging to the natural environment. The CAP is undergoing a gradual process of major reform, moving from the post war objectives of guaranteeing food security and farming incomes to one of broader rural development. The recent 'CAP Health Check', which concluded at the end of 2008, is a small step along this process and debate is now underway across the EU over the shape and size of the CAP after 2013.

The current CAP arrangements contain a number of measures that address flood risk management by farmers, particularly the agri-environment schemes. However, in general terms, there is little integration between the CAP and the EU's policies towards flood risk management (such as the Floods Directive), nor is there much integration of the CAP at a national level with strategic approaches adopted by Member States for flood defence and land use planning for flood management.

It is against this background that this report seeks to identify the ways in which the CAP can better assist farmers to adapt their businesses to the impacts of flooding, and encourage them to adopt land use and management practices that reduce and mitigate the impact of flooding on society.

1.3 Methodology

This study has been conducted as a desk review of existing research reports, policies and programmes, with valuable inputs from a Steering Group of staff from LUPG members and from a workshop attended by a range of stakeholders on 14 January 2009.

[3] HMSO (2004)
[4] Pitt, M (2008)

1.4 Acknowledgements

The authors are grateful to the support provided by Chris Uttley of the Countryside Council for Wales (CCW) and Amy Parrott of the Environment Agency (EA) who managed this contract, and to other members of the Steering Group, Sarah Hetherington (CCW), Sarah Hutcheon (Scottish Natural Heritage), Fiona Mulholland (Northern Ireland Environment Agency), Lindsey Stewart (Natural England) and Victoria Sturt (EA).

The workshop on 14 January 2009 was attended by Rob Cathcart (Natural England), Gareth Davies (Welsh Assembly Government), Harry Gracey (DARDNI), Jenna Hegarty (RSPB), David Jenkins (Coed Cymru), Ceris Jones and Dianne Mitchell (NFU), Simon Neale (Environment Agency Wales), Tim Pagella (Bangor University), Christine Reid (Natural England), Steven Smith (East of England Development Agency), Victoria Sturt (Environment Agency), Chris Uttley (CCW), Mark Walsingham (National Trust), Howard Wheater (Imperial College London) and Helen Wakeham (Environment Agency), all of whom contributed valuable information and comments.

Additional assistance has been provided by the Association of Drainage Authorities and the National Farmers Union of England and Wales.

1.5 Structure of the report

This report is split into nine chapters as follows.

- The **second chapter** provides a short overview of the evidence on how patterns of precipitation and sea level over the next 50 years are likely to alter through the influence of climate change.
- The **third chapter** reviews the impacts that the increased risk of flooding will have on agriculture, distinguishing between the direct impacts on agricultural land use and management, and the broader impacts on agricultural businesses.
- The **fourth chapter** draws on the results of research to describe the adaptation strategies open to farmers to reduce the impacts of flooding on their own businesses. It reviews the different ways in which agricultural land can be used as part of positive flood risk management strategies and how land owners can be incentivised to deliver these.
- The **fifth chapter** provides a short introduction to the Common Agricultural Policy as a whole, leading into the following three chapters.
- The **sixth chapter** looks at the current Pillar I interventions and how these affect farmers' ability to adapt to increased risk of flooding.
- The **seventh chapter** does the same for the current Pillar II (rural development) interventions.
- The **eighth chapter** covers the range of policy instruments that lie outside the CAP that are, or could be, used to plan for and deliver flood risk management.
- The **final chapter** draws out the main conclusions from the study and makes recommendations on the priorities for further reform of the CAP that will enable farmers to respond positively to the challenges posed by the increased risk of flooding.

2 Climate change and other factors affecting flood risk

This chapter provides an assessment of the likely impacts of climate change on flood risk in the UK. It considers how changing patterns of precipitation and rising sea levels will affect the frequency, timing and severity of flood events, particularly in low-lying coastal regions and floodplains. The ways in which we use land, as well as society's priorities for flood protection, are also changing the way that flood risk is perceived. These issues are also considered briefly in this chapter.

2.1 Forecasts of climate impacts on flooding

2.1.1 Effects of Precipitation

Forecasting studies have produced a range of likely outcomes of the patterns of rainfall in the UK over the next 50 years. While the precise levels of rainfall are difficult to predict, there is a strong scientific consensus that changes in weather patterns are already occurring, consistent with the observed increase in carbon dioxide levels in the world's atmosphere. **Figure 2.1** shows how, during the period 1961 to 2006, there was an average fall in rainfall in many parts of the UK during the summer, but an increase in the winter months.

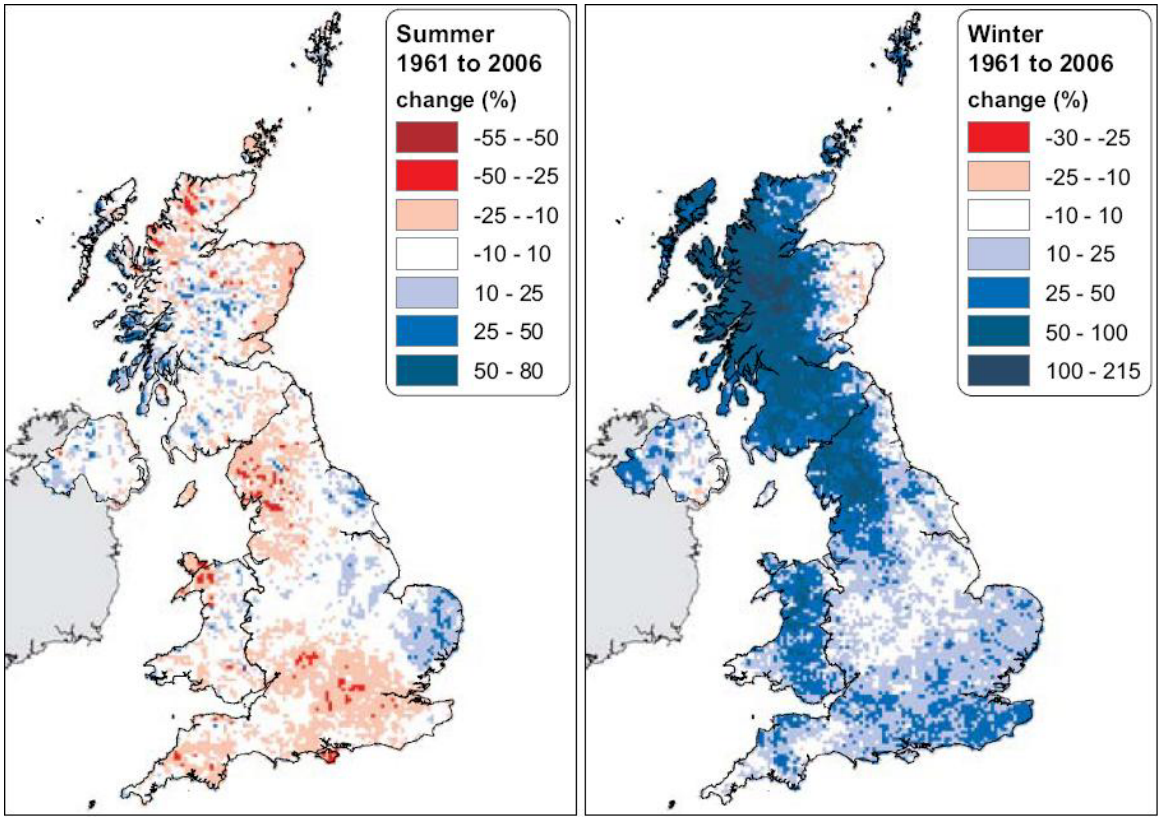

Figure 2.1. Percentage change in total precipitation from 1961 to 2006 for the summer and winter months based on a linear trend

Source: UKCIP09 (2008). The Climate of the United Kingdom and Recent Trends. Online at www.ukcip.org.uk/scenarios/. Maps for spring and autumn not shown here.

Looking to the future, scientific confidence in long term trends is improving and predictions are being made about the spatial differences across the EU as well as seasonal differences. The diverging trends between summer and winter precipitation that have been observed in

the last forty years is predicted to continue. The European Environment Agency's (EEA) 2008 report, 'Impacts of Europe's Changing Climate' identifies increasing winter rainfall as one of the main effects of climate change on North Western Europe. In the UK, the United Kingdom Climate Impacts Programme (UKCIP) suggests increases of winter precipitation in some areas of up to 40% by the 2080s, increasing the risk of severe flood events.[5] The independent report into the summer 2007 floods in England[6] highlighted how the most up-to-date estimates of future winter rainfall anticipated far greater increases than those made previously, even as recently as 2004. In Scotland, it has been estimated that winter precipitation will increase by over 30% in the east of the country and by up to 20% in the west. However, despite these predictions of heavier winter precipitation, levels of snowfall are expected to decline, with Defra estimating a reduction of 60-90% nationally by the 2080s.[7]

In contrast to the predicted increases in winter precipitation levels, the European Environment Agency anticipates increasing incidences of summer drought across Europe. Although summer rainfall levels are expected to decrease overall, continuing the trend that the UKCIP has identified since the 1960s, the rainfall that does occur is likely to be heavier, highlighting the greater variability in conditions that is expected during the summer months.[8] Parched soils will be less able to absorb sudden and heavy summer rain, resulting in an increased risk of localised flash flooding.[9]

The largest relative changes in UK precipitation levels are expected in the south and east of England and in the south of Ireland, where summer precipitation rates may fall by around 50% by the 2080s. In Scotland, a decrease of around 40% is expected, most notably in the south and east of the country.[10]

2.1.2 Effects of Sea Level Rise

Sea levels across Europe are rising and will continue to do so according to EEA predictions. Current estimates of the rises expected by the 2080s vary between 0-60cm in Scotland and 15-85cm in England. One of the most extreme forecasts is that sea levels in the South East of England could rise by as much as 86cm by 2080 as a result of northern polar ice cap melting.[11] Current sea level rises due to isostatic changes are already affecting sea defences in the south and eastern coasts of England, and further rises resulting from climate change will compound this pressure, increasing the risk of flooding and salt intrusion. Storm surges around Scotland's coastline could increase by up to 0.7m, increasing the risk of coastal flooding.[12]

The Foresight Future Flooding report (2008) analysed the risks of flooding and coastal erosion in the UK in the context of four future climate scenarios. This concluded that sea-level rises could increase the risk of coastal flooding by four to ten times, although certain locations may experience changes well outside of this range. The report also assessed which parts of the UK will face the greatest threat from flooding. The conclusions varied between the four scenarios, but certain areas including the Lancashire/Humber corridor,

[5] Environment Agency (2008a)
[6] Pitt, M (2008)
[7] Defra (2005)
[8] Pitt, M (2008)
[9] Environment Agency (2005)
[10] SEPA (2008)
[11] Environment Agency (2008a)
[12] SEPA (2008)

parts of the south east coastline and major estuaries such as the Thames and Severn were consistently shown to be at significant risk.[13]

2.2 Other causes of increased flood risk

The impacts of climate change summarised above are likely to be the most significant cause of increased flooding across the UK as a whole. However, it is important to recognise that other factors also have a role to play.

2.2.1 Soils and land use

The relationship between land use and flooding is covered in greater detail in the following Chapter. However, it should be noted here that the state of soils, particularly their capacity to absorb rainfall (which in turn depends on soil type, slope, degree of compaction and saturation) affects the extent to which water runs off land rather than infiltrating into soils and the groundwater. A study for the Environment Agency covering England and Wales[14] mapped the sensitivity of land to generate surface water and showed that the most sensitive catchments lie in Wales and the west of England where rainfall is greatest and the topography is often steep. The dominance of intensively managed grassland where high densities of livestock increase soil compaction and runoff is also a significant factor in the high levels of flood generation in these areas. Arable cropping, which tends to dominate on the eastern side of the UK is also associated with fast rainfall runoff, particularly where soils lose their structure or become compacted and where land is left unvegetated during peak rainfall periods (such as the winter).

Another key factor that determines whether increasing precipitation leads to flooding is the size and shape of river channels and the morphology of flood and coastal plains. In the past, many river channels have been straightened and their banks kept clear of rough vegetation to increase their efficiency in removing water. Land in floodplains and on low lying coasts has been drained and flood defences have been erected to limit the size of the functional flood and coastal plain. As a result, water now travels faster down catchments resulting in greater peak flows. River channels are more quickly overtopped and floodplains more quickly filled. Rising tides are funnelled up narrower estuaries. The result of these changes is that floodplains and coasts are now less well able to absorb periods of high rainfall and rising sea levels, and will be less well equipped to deal with the impacts of climate change outlined above.

2.2.2 Changing assessments of, and perceptions towards, risk

Finally, it is important to recognise that the way that policy makers and markets value flood risk has an effect on how this risk is perceived and acted upon. Decisions to invest public funding in flood protection are now taken on the basis of rigorous cost benefit analysis that takes into account the value to society of the assets that are at risk (including private property) and the cost of different levels of flood protection. Similarly, the insurance industry calculates the level of cover it is prepared to offer, and the level of premiums it requires, using detailed spatial assessments of flood risk.

The value placed on agricultural land in these decisions has changed over the last 40 years. Until recently agricultural land (particularly the most agriculturally productive land that tends to be concentrated on floodplains and low-lying coasts) was considered to be a nationally important strategic resource, and it benefited from significant public funding of flood defence structures and the work of Internal Drainage Boards. However, a number of factors have changed the emphasis of flood defence investment decisions, including:

[13] Foresight Future Flooding (2008)
[14] Environment Agency (2008d)

- tight constraints on public funding for flood defence
- the growth in the area and value of developed land in floodplains
- the declining importance of agriculture to the economy (notwithstanding the attention now being given to the strategic importance of food production in a time of increasingly volatile world markets)
- increasing priority given to the management of wetland sites of high biodiversity value
- growing interest in using agricultural land as part of strategic plans for flood storage and coastal realignment
- a more integrated approach to flood risk management that takes into account the range of costs and benefits

As a result, the costs of protecting agricultural land for its own sake have been subject to close scrutiny. At the same time as the risk of flooding is increasing as a result of climate change, there is a perception amongst many farmers that the priority given to protecting agricultural land is falling.

The issue of food security is increasingly rising up the policy agenda. A high proportion of the most productive agricultural land lies on (and was created by) the rich soils of floodplains and the value of this land for food (and also energy) production is gaining increasing attention. In England and Wales, 45% of grade 1 and 2 land lies on land at the highest flood risk – the land classified in the Environment Agency's Flood Map as Flood Zone 3[15], and in Scotland, there is also a strong confluence between the most productive lands and low-lying areas more prone to flooding.

As the next chapter will show, there is also increasing attention being paid by policy makers to the role of land use and management as an additional or alternative to hard flood defence engineering (flood banks and channels), particularly where use of these offer multiple benefits. For these reasons, it is likely that farmed land will have a more significant role to play in future strategic flood risk planning.

[15] Based on GIS analysis by this study.

3 Impacts of flooding

This Chapter briefly considers the impacts that increased flooding and flood risk will bring to the UK and then looks in more detail at how agricultural land use and farmers' businesses will be affected.

3.1 Overall impacts

In the UK, the Association of British Insurers estimates that there are more than 2 million homes at risk from coastal or inland flooding (10 % of total homes in the UK), and around 400,000 homes at very high risk of flooding (greater than 1.3 % annual probability or 1 in 75 chance).[16] Across the EU, many of the major cities, particularly those on the coast, face threats from fluvial or marine flooding, particularly in countries such as the Netherlands, Baltic States and many Mediterranean countries.

The UK Foresight Project examined future flood risk under four different scenarios, working on the basis of today's policies and expenditure. Substantial increases in flooding were expected by the 2080s under all scenarios, but with the costs associated varying significantly from £1 billion to £27 billion. The financial cost of flooding and flood risk management is currently around £2.2 billion annually in the UK. £800 million is invested in flood and coastal defence (2003-2004), but the average annual cost of damage from flooding is estimated to be £1.4 billion.[17]

The Foresight report concluded that as a result of the increasing flood risk, the number of people at high risk of flooding could rise to 3.5 million from the present levels of 1.5 million in the UK. However, the risk varies geographically with certain parts of the country facing a greater threat, such as the Lancashire Humber corridor, the south and east coasts and areas around major estuaries. In addition to potential flooding from overtopped river channels, towns and cities will be at greater risk of localised flooding resulting from overwhelmed drainage systems. Currently there is a lack of research evidence in this area, but the potential impacts could be extensive.

Under all four scenarios used by the Foresight report, coastal erosion is predicted to increase significantly, with annual damage costs to the UK increasing by as much as three to nine times by the 2080s.

Despite the many threats and risks that are faced as a result of the increasing flood risk, there are also possible opportunities and benefits. The Foresight report gives the example of saltmarshes potentially benefiting under some scenarios as a result of the abandonment of coastal farmland which is no longer economically viable. However, under every scenario habitats like coastal grazing marsh face threat.

3.2 Direct impacts on agricultural land use and management

This section considers the likely effects of increased flooding on agricultural production in the UK. It needs to be recognised that the heterogeneity of land means that no two areas will be affected in the same way. Factors such as the local geology, soils, land use and floodplain morphology determine how rainfall and snowmelt flow over land, how flood waters move along rivers and spread out over floodplains. The impacts of the increased flood risk

[16] Association of British Insurers website: http://www.abi.org.uk
[17] HMSO (2004). Foresight Future Flooding – See Table 2.1 in the executive summary

described in the previous chapter will vary, with farmers in floodplains and on low-lying coasts being the most severely disadvantaged whilst others will see some benefit.

Flooding, whether from rivers or the sea, occurs most on low lying ground in floodplains, estuaries and coastal plains. It is no coincidence that a high proportion of the land in these areas is of high agricultural quality. Floodplains are an accumulation of many centuries of deposition of silts eroded from higher in the catchment and, as a result, tend to be highly productive. As noted earlier (Section 2.2.2), a high proportion (45%) of the most productive agricultural land in England and Wales lies in areas at the highest risk of flooding. Some 38% of vegetables grown in England come from the Fens of Cambridgeshire and Lincolnshire.[18]

While the impacts of flood run-off will generally be less dramatic out of the floodplains, the impact of saturated soils, soil erosion and the damage caused by heavy rain will nevertheless be significant for most farmland and agricultural businesses.

3.2.1 Effects of Precipitation

Before considering the impact of flooding, it is worth noting that periods of low rainfall will also have significant effects. The agricultural industry will need to adapt to droughts of increasing frequency and intensity and farmers will have to give greater consideration to water availability and irrigation, as well as monitoring changes in soil moisture content and considering the implications for crop growth. Although an extended growing season is predicted as a result of generally warmer temperatures, lower levels of soil moisture resulting from reduced summer rainfall may affect crop growth, counteracting some of the beneficial effects of this longer season on crop yields.[19] Higher levels of irrigation are expected to become necessary to ensure that crops do not suffer as a result of increased drought. Defra has predicted a growth in irrigation of around 20% by the 2020s and 30% by the 2050s. Clearly this will have implications in terms of water demand versus availability, and higher levels of financial investment into irrigation systems may become necessary.

While dryer summers may be the norm, increased intensity of summer rainfall will bring specific problems. Where arable crops face prolonged inundation, financial losses from summer flooding will usually be much greater than where it occurs in winter since crops can be redrilled after winter flooding (resulting in higher costs and a yield penalty) but the entire year's income is at risk from summer flooding. Heavy summer rainfall has a range of impacts, including increased soil wash and erosion, lodging (flattening) of crops, sprouting of the grain in the ear, delayed harvesting, lower yields and quality and higher costs of drying grain. Following the flooding in late June and early July of 2007 that inundated around 42,000 ha in England, a study by ADAS for Defra[20] estimated the direct losses in the value of crops to be £11.2 Million, half of which arose from loss of wheat and potatoes. A subsequent report by Cranfield University for the Environment Agency[21] based on a survey of affected farms put the loss at a much higher £50 Million, taking account of the broader impacts on losses of animal fodder; movement of animals; impacts on livestock growth rates; costs of land reinstatement; and damage to buildings and contents. This report emphasised the severity of impacts from summer flooding compared to those that occur in winter.

Summer flooding also has specific impacts on grassland. Where grassland is inundated in summer, the lush growth starts to decompose more quickly in the higher water temperatures and the high Biological Oxygen Demand can quickly turn the water anoxic, creating highly polluting water. In spring, summer and autumn, sheep and most cattle will be grazing

[18] *Pers. comm*. National Farmers' Union
[19] Farming Futures (2008)
[20] ADAS (2007)
[21] EA (unpublished)

outside rather than being housed as they are in winter, and there is a danger that they will be trapped by rising flood water. The precise way in which rising temperatures and carbon dioxide levels will contribute to increased grass growth, and the ability of soils to absorb and bind pollutants and increase water-holding capacity in the summer is currently unclear.

The immediate agricultural impacts of winter flooding are usually less severe than those of summer flooding. Nevertheless, where newly established arable crops are damaged, they may have to be redrilled. Additional costs will recur throughout the year, especially where different varieties (for instance spring rather than autumn sown) have to be used, requiring separate crop treatments and harvesting and potentially reduced yields. Intense rainfall when fields contain bare soil can cause significant soil erosion and periods of prolonged inundation can damage soil structure.

Flooding at any time of year can create additional demand for contract services, either by condensing the period over which operations such as crop spraying need to take place, or by creating demand for additional work such as the redrilling of crops. Localised shortages of contractors to meet this demand can make problems worse and is likely to increase farming costs.

On land where flooding becomes a regular occurrence and where flood water stays for prolonged periods a change of land use may be necessary, whether this is because of decisions taken by policy makers about flood protection and flood water management, or by the farmer due to changes in weather patterns. For instance land that is otherwise suitable for growing highly productive crops such as potatoes or wheat may need to be converted to less productive permanent pasture.

Such changes in land use for flood risk management may have wider environmental benefits such as reduced soil erosion and increase water infiltration, as well as creating space for flood water storage. However, this is likely to reduce the long term economic value of the land, as well as reducing short term profitability. Falls in land values that occur as a result of strategic policy decisions over the downgrading of flood protection and the zoning of land for flood storage are likely to be challenged by farming and landowning trade associations.

It would be wrong to paint an entirely negative picture of the impact of increased rainfall on farming practices. The rich silt soil present in many floodplains have been deposited by flood water, adding to soil fertility; and deposition of eroded sediments in coastal mudflats and saltmarshes provides natural resilience to erosion from the sea. High levels of winter rainfall can be retained in winter storage reservoirs for irrigation in dry periods in the summer. In previous centuries, water meadow systems where established to deliberately cover pasture with a thin layer of moving water in spring to encourage an ‘early bite’ of grass growth.

3.2.2 Effects of Sea Level Rise

The impact of high tides and marine storm surges will clearly impact on low lying land at the coast itself. Coastal defence structures (banks and sluices) have to be raised, at large cost, in order to maintain the same level of flood protection. High sea levels prevent rivers discharging to the sea and will increase the risk of flooding further upstream. It may be necessary to pump water ‘uphill’ from drainage channels near the coast when they cannot flow to the sea by gravity.

At the coast itself, inundation by sea water, which tends to occur for shorter periods than river flooding, can leave salt deposits in soils that can be initially toxic to crops and can reduce yields for several years. Longer term changes to soil chemistry (which are often irreversible) occur where rising average sea levels causes salination of the groundwater and

water in ditches and dykes. When this salination persists, it is likely to require a change in land use from arable or horticultural crops to grassland that is more tolerant of salinity.

Around parts of the UK's coast (such as the Lincolnshire and Cambridgeshire Fens, Norfolk Broads and Somerset Levels), as well as large parts of the Netherlands, agricultural land which was reclaimed in earlier centuries is below sea level. The land, properties and people living in these areas rely on flood defences (banks, sluices and pumps) to keep the land dry. As sea levels rise, these defences are becoming increasingly expensive to maintain. Should these defences be breached at the coast, the agricultural impact of prolonged periods of inundation by sea water would be severe.

The most severe impact of storms and high tides is the erosion of soft rocks on low lying coasts, such as on the north eastern coast of Norfolk where, in extreme cases, the coastline is retreating at a rate of up to 8 metres a year.[22]

As noted earlier, strategic decisions taken to reduce the level of protection to low lying agricultural land, where there are no other assets requiring protection (for instance by adopting an approach of managed realignment that allows natural processes of coastal erosion and deposition greater freedom), will have major impacts on farmers and landowners in these areas.

3.3 Indirect impacts on business management

The direct impacts of flooding described above, particularly the most severe impacts from major flood events, are concentrated on a relatively small proportion of agricultural land. For instance, the ADAS study into the summer floods of 2007[23] calculated that the inundated land accounted for around 0.5% of agricultural land in England. However, the increased risk of flooding brings impacts that are felt much more widely across the farming industry.

High rainfall that does not lead to flooding brings sub-critical impacts that are widely felt, particularly from increased soil erosion and reduced efficiency of land drainage (reducing crop yields and requiring more maintenance and replacement). Farmers may experience opportunity costs because land becomes less suitable for profitable uses. The risk of flooding adds management constraints to the way that farming operations are carried out. **For the majority of farmers, these impacts will be much more significant than direct losses from flooding.**

Examples of these sub-critical impacts include:

- There is a greater need to create good seed beds and get crops established before soils become saturated, condensing the period over which field operations must take place.
- The risk of pests such as slugs and fungal diseases such as septoria are greater on saturated ground and damp crops that are under stress, leading to higher spraying costs and/or lower yields.
- The inability to harvest crops at their peak condition results in reductions in crop quality and potentially yield.

[22] North Norfolk District Council (2001)
[23] ADAS (2007)

- Grassland with saturated soils is at greater risk of poaching (damage by livestock feet) and is likely to lead to lameness (especially in sheep), requiring livestock to be taken off wet grassland for periods.

The increased risk of flooding also increases the costs of complying with environmental legislation. For instance, land that is frequently saturated or liable to flood is less suitable for spreading farmyard manure and slurry because of the risk of runoff and pollution. This requires farmers (particularly those in Nitrate Vulnerable Zones who must comply with specific limits) to increase the storage capacity for manures and slurries, reduce the overall stocking of the farm, or take on more land that is suitable for spreading.

The unpredictability of extreme weather means that all farmers need to invest more heavily in business planning and risk management. Insurance costs increase with more frequent claims and in areas considered to be at higher risk. There needs to be greater attention paid to flood warning systems, with procedures in place on the farm to evacuate livestock to higher ground if needed.

Most agricultural products are globally traded commodities. Climate change is already leading to more volatile agricultural markets (the absence of Australian wheat exports in the last two years has been one of the reasons for the significant increase in world wheat prices). This volatility in prices brings opportunities for farmers to anticipate movements in prices, moving into commodities at a time of scarcity, but it also brings financial risk and requires well-informed management decisions on the choice of which crops to plant and when to market them.

3.4 Key findings

The following conclusions emerge from this chapter:

- Across the UK as a whole over the period to 2080, the number of people at risk of flooding could rise from 1.5 million to 3.5 million and the annual cost of flood damage (currently estimated at £1.4 billion) could increase between three and nine times.
- The evidence of recent floods shows that the financial impact of flooding on agriculture can be significant, with costs of the summer 2007 floods that affected parts of England estimated at £50 million.
- The effects of flooding will vary depending on factors such as geographic location, soil type, ground slope and systems of land use. Impacts of flooding are generally most severe in floodplains and low-lying coasts but the impact of high rainfall and flood run-off can be felt in all areas.
- Flood and coastal plains contain a high proportion of the most agriculturally productive areas but they occupy a relatively small proportion of the total agricultural area. The impacts of flooding are therefore felt most acutely in small areas of high agricultural productivity, but sub-critical impacts occur across all agricultural land.
- Although it occurs less frequently, the direct impacts of summer flooding on agricultural land and businesses tend to be greater than those that occur from winter flooding.
- The direct impacts of flooding on agricultural businesses include:
  - Loss of crops and forage, and reductions in yields
  - Higher variable (for example, seed, fertiliser, pesticides and feed) and management costs where field operations have to be repeated, often in a

compressed period
    - Opportunity costs where land uses become limited by the risk of repeated flooding
- Indirect impacts on business profitability include:
    - More volatile agricultural markets
    - Higher fixed costs (e.g. land drainage, insurance)
    - Reduced flexibility in land use planning (including through new regulations)

4 Agricultural Adaptation Strategies

This Chapter reviews the actions that farmers and policy makers can take to adapt agricultural practices so that the impacts of flooding on farmers themselves are reduced, and also so that the risk of flooding is reduced across catchments as a whole. The Chapter is split into three main sections covering:

- **Land management practices**, describing the activities that take place on agricultural land such as land drainage, soil cultivation, production of crops and the grazing of livestock.
- **Land use choices,** distinguishing between main types of land cover on farmed land such as arable and horticultural crops, ley grassland, permanent grassland, rough grazing and woodland.
- **Business management practices**, that determine how decisions on farms are made and how businesses can plan for and react to risk.

However, before embarking on this analysis, it is helpful to understand the physical circumstances under which flooding occurs. This can be thought of as a combination of four separate processes.

- Firstly, flood water is generated throughout catchments when rainfall (and all forms of precipitation) exceeds the capacity of soils to infiltrate water. Factors influencing flood generation include the amount and intensity of rainfall, soil type, slope, land use and efficiency of land drainage.
- Secondly, the permeability and capacity of rock strata to hold water determine the movement of water down to, and through, the groundwater. Prolonged periods of rainfall can lead to the water table rising up towards the land surface (as can, at the coast, a rise in sea level).
- Thirdly, as large amounts of water flowing down rivers exceed the capacity of their channels, flooding occurs as water extends over the floodplain. Factors influencing flood propagation include the capacity of rivers and drainage channels, the size and shape of the floodplain and the presence of structures and vegetation that change the movement of water (all of which are heavily influenced by use and management of the land and river channels).
- Finally, the height of sea level affects the ability of rivers to discharge water to the sea and can directly flood low-lying land. The height of the sea relative to the land is influenced by natural tidal cycles, atmospheric pressure and wind (low pressure and high winds can combine to create 'storm surges'), long term movements in the land surface and global changes in sea levels.

4.1 Land management practices

There have been several major research studies in recent years that have reviewed the land management practices that contribute to flood generation and flood propagation.[24] The following section summarises the findings of these studies.

[24] For instance, LUPG (2004), Defra and Environment Agency (2004) and Environment Agency (2008c).

4.1.1 Land drainage

Maintaining and improving agricultural drainage to remove flood water through the use of sub-soiling, in-field drains, ditches and, where land is below sea or river level, pumps, is the most effective way of removing flood water quickly from land. However, at a catchment level, land drainage increases the speed at which rainfall runs-off land, leading to faster and higher peaks in river levels and increasing the risk of flooding downstream, particularly where flood peaks from two tributaries meet.

The corollary of this action is to reduce the efficiency of land drainage by blocking drains or increasing the surface roughness of streams and ditches. In the uplands, blocking the 'grips' cut into peat soils to improve drainage can improve the ability of the soils to hold back water, releasing it over a longer period. Allowing riparian vegetation to grow across streams and ditches and creating meanders can also slow the passage of water. Practical guidance on the management of drainage channels is contained in a manual produced jointly by the Association of Drainage Authorities and Natural England.[25] These actions can reduce downstream flood peaks, particularly where co-ordinated action leads to peak flows of water from tributaries passing down the catchment at different times (as shown in **Figure 4.1**). However, the impact of many of these actions at a local scale means that fields where drainage is impeded lie wetter for longer and are less productive.

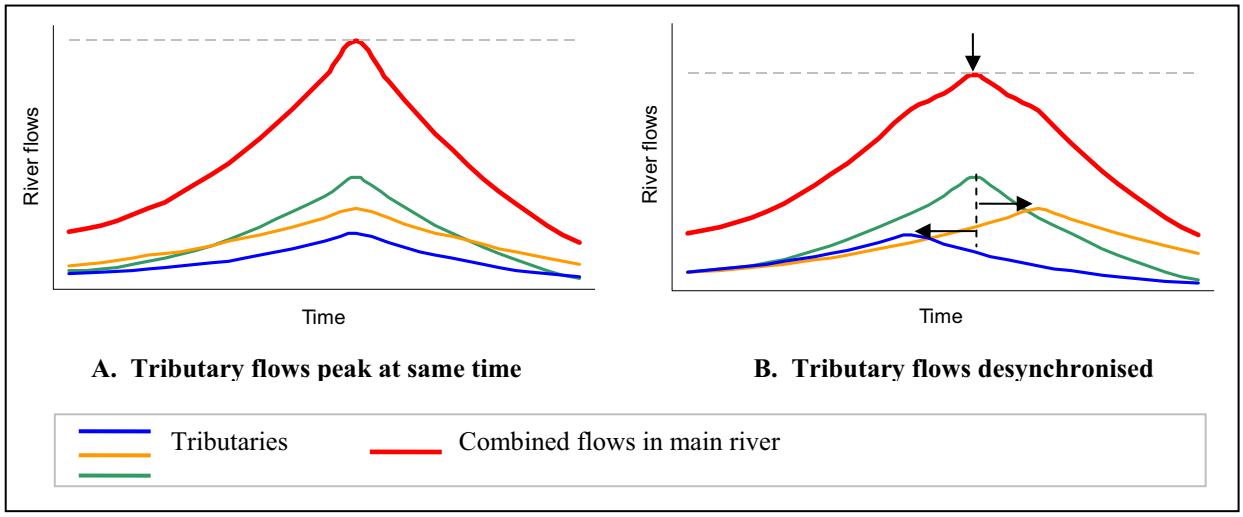

Figure 4.1. The impact of desynchronising peak flows in tributaries on the downstream flow in the main river

4.1.2 Management of soils

Techniques to maximise the infiltration of water into soils and reduce the risk of over-land flow will increase the proportion of rainfall that is fed slowly into groundwater rather than moving quickly into rivers, thus reducing the risk of flooding. Reducing the soil runoff also significantly reduces erosion.

The way in which soils are cultivated can improve soil structure and reduce compaction. Minimum tillage and single pass techniques, the incorporation of organic matter, cross-contour ploughing and leaving uncropped soil surfaces 'rough' over winter are practices that increase infiltration and reduce erosion. These practices are relatively inexpensive and, if

[25] Buisson et al. (2008)

used appropriately (relative to the characteristics of individual soils), have few agricultural disadvantages, being considered part of good practice[26].

4.1.3 Management of crops and vegetation

Where land is at risk of surface runoff (for instance on steep fields or impervious soils), establishing cover crops on bare soils, undersowing open crops such as maize, and maintaining buffers of rough vegetation such as grassland, hedgerows or woodland strips across slopes (particularly beside ditches and rivers), can slow the passage of water and encourage infiltration. The main benefit of narrow strips is in catching eroding soil (thereby reducing siltation in ditches and streams and cutting flood risk) but there may be other benefits such as increased populations of pest predators (from 'beetle banks'[27]) or shelter to livestock (from hedgerows and woodland belts). Experience from the Pontbren project in central Wales, suggests that a reduction of around 40% in the peak flow from surface run-off, at a field and small catchment (around 12km^2) scale may be achievable from optimal planting of tree shelter belts and/or hedgerows.[28]

There is increasing interest from farmers in using GPS (global positioning satellite) technology in farm machinery to target crop inputs as efficiently as possible, particularly where field surveys have mapped differences in soil fertility, structure and weed burdens. These 'Precision Farming' techniques allow farmers to closely match crop varieties and husbandry to the capability and needs of soils. At a field scale, it enables land that is at risk of runoff and erosion to be treated differently (for instance planting cover crops in these areas).

4.1.4 Management of livestock

The majority of the actions identified above apply mainly to arable land. However, one important issue that is specific to pasture is the compaction of soils from grazing livestock. A range of research studies[29] have shown that infiltration rates on grassland with very low densities of livestock are many times (up to 12 times in extreme cases) higher than on intensively grazed grassland as a result of the larger pore spaces in less compacted soils. The density of roots and better soil structure in permanent grassland means that it tends to have higher levels of infiltration than short term ley grassland and arable land.

There has been recent interest from livestock farmers, particularly dairy farmers, in areas where grass grows throughout the year such as Northern Ireland, Wales and the western part of England, in 'New Zealand' grazing systems where animals are kept outside all year and are moved in strips around fields to optimise grazing. [30] This practice may increase with the trend towards milder winters (although higher rainfall may mitigate against this on heavy soils). Any trend to towards year-round grazing is likely to increase the use and compaction of short term grassland leys during winter, increasing the risk of flood runoff.

It is also worth noting that, in Nitrate Vulnerable Zones (NVZs), limits on the production of livestock manure apply a cap on the density of livestock. Outside NVZs, cross compliance measures may in future have a similar impact.

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[26] Environment Agency (2008b)

[27] See the Game Conservancy Trust explanation of beetle banks at www.gct.org.uk/text01.asp?PageId=220

[28] Wheater et al (2008)

[29] As reported in Defra (2007a) Appendix 3: The Impacts of soil compaction on grassland systems on water resource and flood risk.

[30] It is also the case that, as herds get larger, dairy farmers are constrained by the area of grazing land close enough to their dairy parlour, leading to an opposing trend in large dairy herds for 'zero-grazing' where cows are housed all year.

It should be noted that increasing soil infiltration rates by reducing the grazing density of livestock clearly has significant agricultural costs and is unlikely to bring significant management benefits to the individual farmer[31]. This is another example of a potential conflict between the farm and catchment scale interests, and between farmers in the upper part of catchments and property owners in lower catchments. The extent to which this conflict is fully realised in terms of increased flood risk depends on the extent to which increasing water infiltration into soil has a measurable impact on flood water generation. As noted further below, the case for this is currently unproven.

4.2 Land use practices

4.2.1 Land cover types

The role of different crops in the level of rainwater infiltration into soils has already been introduced above. Different types of vegetation use up different amounts of water in their growth (through evapotranspiration) and lose different amounts of water through evaporation from their leaves (known as interception). Tall plants with a large surface area of foliage produce highest levels of interception while dense and actively growing crops have the highest levels of evapotranspiration. A review of research evidence by Forest Research[32] shows that uptake is greatest from conifer crops (which can take up between 25 and 45% of annual rainfall by interception compared) and that uptake from broadleaved woodland is significantly higher than that from grassland and arable crops. On a catchment basis in the wetter uplands, the additional water use by a complete cover of mature conifer forest can result in a 15 - 20% reduction in the annual volume of streamflow.

However, it should be noted that interception and evapotranspiration rates are highest when crops are in full foliage and actively growing. In winter this is not the case (although the high interception rates of conifers will be maintained). However, the extent to which the evapotranspiration and interception rates of different vegetation type have a measurable impact on extreme flood events is unproven (see below).

In comparison, the influence of land cover on flood propagation in river channels, flood and coastal plains is potentially more significant, although again research evidence is not conclusive. There is growing emphasis in the design of urban areas and transport infrastructure on the use of Sustainable Drainage Systems (SuDS). These seek to minimise the use of impermeable surfaces and make use of vegetated drainage ways ('swales'), filter strips and temporary flood storage areas to reduce the speed with which flood water runs-off developed land. The same techniques can be applied to river channels and whole flood and coastal plains to increase the roughness of the vegetation surface, slowing the passage of water out of river channels and estuaries and across land. There has been growing interest in the use of 'wet woodland' such as alder and willow carr, and wetlands to filter and hold back flood water.

4.2.2 Flood storage

The zoning of land for temporary flood storage offers the opportunity to hold back flood water for later release. These areas can carry on being used for agricultural or other purposes until they are needed, but the potential loss of crops makes them more suitable for low value uses such as rough grassland or over-wintered stubbles. If these areas are to hold water for any length of time, they must be capable of being hydrologically isolated (i.e. retained by a bank) which is likely to involve capital investment in suitable structure to fill and then isolate the area.

[31] Although benefits may arise from a lower worm (parasite) burden and increased weight gain.
[32] www.forestresearch.gov.uk/website/forestresearch.nsf/ByUnique/INFD-6MVJ8B

The potential loss of use and damage to land cover (and also, potentially the resulting loss of area-based CAP payments – see Section 6.3.1) are likely to make this action unattractive to farmers unless it delivers significant benefits to their own holding. One way of adding to the benefits of flood storage areas is to use them as winter storage reservoirs to supply crop irrigation in the summer, or to use them as fishing lakes. However these uses are not particularly compatible with flood storage which requires the maximum volume of space to be available without water in already.

4.2.3 Managed coastal or river realignment

The final example of a change in land use bringing benefits for flood risk management is managed realignment on the coast or inland. There are a number of well known examples where decisions have been taken at a strategic level to allow natural processes of river erosion or coastal roll-back to take place in ways that give added protection to other areas. All are on the east coast of England and all involve the deliberate breaching of coastal flood defences to allow high tides to flood arable land. In the second and third examples described below, gains to biodiversity have been a major objective (equal to or greater than, flood defence). With the exception of Alkborough Flats, the small amount of additional flood storage capacity provided by these sites, relative to the very large volumes of water involved in coastal flood events, means that their benefits to flood risk management tend to be highly localised. In all these examples, the large majority of the land involved has been purchased by the public sector or by environmental bodies from private landowners. These examples are:

- Alkborough Flats on the Humber Estuary where sea defences were deliberately breached in 2006. It reduces extreme water levels by 150mm and provides 370 hectares of new wetland habitat. The majority of the site is owned by the Environment Agency and Natural England

- Freiston Shore on the Wash where 66 ha of saltmarsh and 15 ha of saline lagoons have been created by breaching the sea wall in 2002. Site owned by the RSPB.

- Abbots Hall Farm on the Blackwater Estuary in Essex where 80 ha of saltmarsh and mudflats have been created after the sea wall was breached in 2002. Site owned by the Essex Wildlife Trust.

4.3 Business practices

This final section describes changes that can be made in the way farm businesses operate to protect them from the risks of flooding or to reduce the risks to others. Whereas the previous section was largely based on analysis of scientific evidence of the activities that can take place in the field, the following section describes ways of working and running businesses that take place in the farm office.

4.3.1 Flood warning and action planning

Improving the information available to farmers on the likelihood of flooding occurring on their land (both in terms of short term weather events and long term climate trends) enables them to plan cropping patterns and farming operations. Providing just a few hours warning of flood peaks moving down catchments and inland from the sea, such as is available in the England and Wales from the Environment Agency's Flood Warning system, allows livestock and machinery to be moved from at risk land. In practice, flood warning systems have to take account of the regular transfer in the management of land between farmers (such as under grazing licences and farm business tenancies). This places an onus on the land occupier to make sure the database held by the authority issuing the warnings is kept up to date.

Long term indications of flood risk are available in England and Wales from the Environment Agency's Flood Map. Systematic mapping of flood risk is a requirement of the EU Floods Directive (see Section 5.3.2) and will therefore be undertaken by all Member States.

Long term modelling of increased risk of river and coastal flooding, such as that included in the United Kingdom Climate Change Impacts Programme and Foresight Future Flooding study, is not precise enough to give the level of spatial detail that would enable farmers to make informed decisions on flood risks management over 20 year time horizons.

There is currently no single source of detailed practical information on the adaptation and mitigation measures that farmers can take to address flooding (of the kind outlined in this Chapter). However, the Environment Agency's 2008 edition of its guidance booklet "Best Farming Practice"[33] contains much valuable information on reducing soil erosion and the Farming Futures website[34] hosted by Forum for the Future and supported by farming and landowning trade bodies and Defra, contains a range of practical fact sheets on climate change topics and farming sectors. On the East Anglian coast of England, the Managing Coastal Change Project[35] works with farmers to explore their needs and opportunities arising from rising sea levels and moving coastlines.

4.3.2 Spreading financial risk

In a time of volatile prices and uncertain production, all businesses need to carefully monitor their costs and cash flow and to maintain sufficient capital reserves. Farmers who are owner occupiers tend to have high capital reserves tied up in land that they can borrow against, but cash flow is often extremely tight.

Arable and horticultural producers rely heavily on crop harvests that can be badly hit by weather events. Many larger arable farmers have become used to spreading their exposure to the market by dealing in commodities futures (either directly or through grain co-operatives). However, this also carries risk.

Whereas livestock farmers tend to receive their income over a longer period (for instance sales of milk over the whole year or sales of stock over seasons), they can also be affected by extreme weather at key times in the production cycle (for instance during spring lambing). The unpredictability of these events makes it difficult to offset the risk.

Acquiring alternative sources of income that are not derived from land at risk of flooding is another way of reducing exposure to weather events. The Single Payment that farmers receive from the Common Agricultural Policy is a significant source of income for most farmers (for some hill farmers it accounts for more than half of their income). Other traditional forms of diversified income on farms are tourism (such as farmhouse bed and breakfasts), agricultural contracting and use of farm buildings for business lets and warehouse storage. Major land use change projects, such as those cited at Section 4.2.3, emphasise the opportunities for landowners to replace income that is lost from basic production of agricultural commodities with income from value added production and tourism. But at a larger landscape scale finding viable alternatives to losses of agricultural production is likely to be more difficult.

Insurance against some agricultural losses from flooding (for instance buildings, machinery, store crops and livestock – but not standing crops or land) is available from specialist

[33] EA (2008b)
[34] www.farmingfutures.org.uk/
[35] This project is run by the Country Land and Business Association (CLA), Farming and Wildlife Advisory Group (FWAG) and the National Farmers Union (NFU) and funded by Defra's Flood and Coastal Erosion Risk Management Innovation Fund.

insurers such the NFU Mutual. However, premiums and excesses in policies vary greatly to reflect past claims and future risks (based on the Environment Agency's Flood Map and the insurance industries own models). As part of an agreement with Government[36], the Association of British Insurers has committed the insurance industry to continuing to make flood insurance available to homes where the flood risk is no worse than a 1 in 75 annual risk and, in areas with a higher flood risk, to offer insurance providing there are plans to reduce the risk to an acceptable level within five years. But this agreement does not apply to businesses. Where risks of flooding are high, as is the case on undefended flood and low-lying coastal plains, it is common for applications to be declined by insurers, or for premiums and excesses to be prohibitively expensive.

4.3.3 Collective action to manage water levels

Collaborative action to share the burden of flood defence or flood water storage amongst different holdings within flood or coastal plains has been practiced by Internal Drainage Boards (IDB) in areas such as the Fens, and the Humberhead, Somerset and Gwent Levels for many decades. IDBs have proved effective at organising drainage schemes and maintaining low water levels. In some areas they have also become closely involved in delivering raised water levels through agri-environment schemes such as the Somerset Levels Environmentally Sensitive Area Scheme.

Research for CCW[37] has examined the steps needed to involve landowners collectively in management of water levels on low lying land, based on a review of case studies. The study concluded the following 'best practices':

- The appointment of a facilitator with strong local knowledge is key to bringing groups of farmers together.
- Involving IDBs is often a valuable way of gaining support for collective action. There may be benefits in paying the IDB to adopt a co-ordinating role.
- Effective participation by individual farmers depends on them recognising the problems that need addressing. Visits to other areas facing similar problems where solutions have been adopted successfully can be a powerful way of achieving this.
- Payments to farmers need to be sufficient to overcome their resistance to 'losing' land to raised water level regimes.

For co-operation to work effectively, there has to be a way of sharing levels of risk and benefit between farmers and others such as property owners. This can be difficult where one group of farmers or landowners are expected to receive higher water levels or to store flood water on their land to relieve flooding on other land. The ability of IDBs to collect levies from landowners under the Land Drainage Act (1994) to fund collective action on water level management offers a potential mechanism for this (although this does not apply in Scotland). This leads on to the subject of compensating farmers for adopting practices that reduce flood risk to others.

4.3.4 Mechanisms for recognising the costs of changing land use or management

As already noted, an increase in flood risk to farmland is likely to reduce the capital value of land and increase the liabilities, representing a fundamental financial risk to the landowner. Where land in flood or coastal plains can be used positively for flood storage or to contribute to flood defence in other ways, the Land Drainage Act (1994) gives drainage authorities powers to take on all or part of this financial risk in three ways. These are outright purchase

[36] ABI (2008)
[37] CCW (2006)

of the land (using compulsory purchase powers if needed), one-off payment of compensation, or payments of compensation when flooding occurs[38]. The same range of options is available to other public and private bodies that wish to commission changes in land use or management that reduce their flood risk.

As noted in the examples of coastal realignment schemes above (Section 4.2.3), outright purchase of land from farmers by public or conservation bodies seems to be the favoured route for schemes that seek to deliver multiple benefits including flood risk management and biodiversity. This may in part be due to the occupier no longer being eligible to receive payments from the CAP Single Payment Scheme (see Section 6.3.1).

However, for schemes where the objective is simply temporary flood storage and the land continues to be used for mainstream agriculture when not flooded, drainage authorities and public bodies usually do not wish to take on the responsibility of managing agricultural land. An option, which has been adopted in the Great Fen Project in Cambridgeshire[39], is for land to be purchased by a public body and then leased or tenanted back to the farmer.

This study is aware of very few examples in the UK where drainage authorities have paid compensation to private landowners, either as an advance payment to 'purchase' future flood storage, or as a retrospective payment after flooding occurs. This is likely to be because, where flooding is seen as naturally occurring or where the use of certain areas for flood storage has been seen as part of historic custom and practice, it has been perceived that there has been no need to pay compensation. However, a more deliberate approach to actively placing or holding back water in certain areas is likely to require a financial acknowledgement, through compensation, of the costs on the landowner of doing so.

It is suggested that drainage authorities will be less willing to accept responsibility for retrospective compensation since this is both difficult to budget for and also implies their liability for the all impacts of flooding[40]. An efficient and equitable way in which future flood storage capacity might be 'purchased' is through a tender process where landowners with suitable land (that can receive flood water and be hydrologically isolated) are invited to submit bids to store water over set periods. Open market tender processes to deliver public benefits of this kind have been effective at gaining willing participating by farmers in schemes such as the National Forest Tender Scheme in England.

As will be described in Chapter 7, annual 'profit foregone' payments to farmers are the basis for agri-environment schemes funded through the CAP's Rural Development Programme. These schemes deliver a wide range of benefits of which flood risk management is rarely a significant element. There is little evidence of profit foregone payments being used by drainage authorities or others to purchase changes in land use or management that deliver flood management benefits.

An option that could be explored is for communities or businesses threatened by flooding to directly commission and pay for changes in upstream management of land or rivers that reduces their flood risk. Such arrangements would need to take place in the context of, and as an addition to, regional flood defence strategies. They are likely to be most appropriate where the changes in land use provide a range of benefits to the community or business such as the creation of a flood storage area using grassland and wet woodland that also provides green space for recreation and biodiversity.

[38] An example of the latter option can be found on farmland around Lincoln where the Environment Agency purchased the right to flood agricultural land, on occasion, to project the city of Lincoln (Source: NFU).
[39] This project aims to restore 3,700 hectare of wetland between Huntingdon and Peterborough on land that is predominantly privately owned arable farmland. See www.greatfen.org.uk.
[40] Pers. comm. land drainage engineer of an Internal Drainage Board.

A hybrid option between outright land purchase and the payment of compensation that might be pursued is where a public body takes on a share of the equity of land in return for control of water levels to manage floods. This study is not aware of any such arrangements in existence. Defining the circumstances under which control over water levels transfers from one party to the other, and the land and water management obligations of the parties when they have this control, would be complex. There could be irreconcilable tensions where the objectives of the parties are significantly different.

4.4 Discussion and conclusions on agricultural adaptation strategies

This Chapter has described a wide range of measures that farmers can adopt to reduce the risks of flooding to their own business and to others and also the actions they can take to reduce the impact of flooding on others.

While these measures are effective at reducing runoff generation at a local field or farm scale, their impact on flooding at a landscape or large catchment scale is not proven. It must be remembered that extreme rainfall or tidal events involve very large quantities of water that are far in excess of normal levels. Once ground has become saturated, surface runoff is inevitable and the response of rivers to further rainfall is magnified (a tipping point or threshold is exceeded in which hydrological behaviour changes dramatically).

4.4.1 Measures that can be effective at delivering farm and local scale benefits

At a field and farm scale, the most effective measures that farmers can take to protect their own businesses from the impacts of flooding are as follows:

- Maintain field drains and ditches so that water is quickly evacuated from their land
- Maintain good soil structure, particularly avoiding soil compaction from machinery and livestock, and maintain soil organic matter content, to maximise water infiltration into soil and minimise runoff.
- Avoid using land that is most at risk of flooding and surface runoff for land uses that carry higher risks of erosion or flood damage. These include high value horticultural crops (particularly row crops such as potatoes where erosion is a major risk).
- Where runoff is likely to occur, use cross-contour grass buffers, hedgerows and other breaks in cropping, and establish cover crops on bare soils to reduce soil erosion.
- Make use of flood warning systems and have an action plan in place to reduce losses when flooding is likely.
- Use forward financial planning to spread risks and maintain a diverse income stream to reduce exposure to losses from flooding.

Almost all these farm-scale measures involve using appropriate land management practices. For most farmers there is unlikely to be a need for radical changes of land use (i.e. the conversion of arable land to woodland). Such dramatic changes are only likely to be needed on the minority of land that lies on exposed coasts and on low-lying land (below mean sea level) where current land uses have relied on flood and coastal defences that may no longer be sustainable or affordable. In areas such as the Wash in eastern England, land use change will have significant localised effects.

One land use change that is directed at overcoming shortages of rainfall in summer, but may have flood management benefits in winter, is the creation of on-farm winter storage

reservoirs for crop irrigation during the drier growing season. As noted earlier (Section 4.2.2), these will only provide flood storage capacity if they are not already full when flooding occurs.

4.4.2 Measures that may be effective at a larger scale

As noted above, there is much less evidence that the changes in land use and management described in this Chapter will have a significant impact on mitigating major flood events. One of the key conclusion of the major Defra and Environment Agency study into land use and flood generation[41] is "*analysis of peak runoff records has so far produced very little firm evidence of catchment scale impacts of land use management*". The best that can be hoped for is that changes in land use and management will flatten flood peaks, slowing the passage of water from parts of catchments ('desynchronising peak flows) sufficiently that flood heights are reduced. Changes in the management of farmland are clearly not capable of preventing major flood events from occurring.

The most effective large catchment-scale measures that farmers could adopt to reduce flood generation and propagation are likely to be:

- Reducing the efficiency of land drainage and field ditches, particularly on soils that have large water holding capacity, such as deep peat and loamy soils
- Creating areas for temporary storage of flood water
- Using targeted creation of cross-contour grass buffers, hedgerows and other breaks in cropping to increase soil infiltration in areas most at risk of surface runoff.
- Reducing soil erosion that leads to reductions in the capacity of ditches, streams and rivers to carry water.
- On flood and coastal plains, using targeted changes in land use to change the morphology of vegetation cover and topography to reduce the speed with which water moves down stream.

For these to be effective, they need to be carefully targeted to those areas that will deliver optimum benefit. They also need to be adopted across large areas and will need to involve the majority of farmers. They require a co-ordinated strategic approach at a large catchment scale, based on accurate rainfall-runoff or tidal surge models. Without this evidence-based and co-ordinated approach, changes adopted by farmers will either have no significant impact at a catchment scale, or could even exacerbate downstream flooding by bringing the peak in flood run-off from one tributary catchment in line with another.

4.4.3 Conflict and synergy between measures that deliver farm scale and broader benefits

There are some inherent conflicts between the actions that farmers may wish to take to reduce the impact of heavy rainfall and flooding on their own land, and the changes that would reduce flood generation at a larger scale. Improving the efficiency of field drainage is one obvious example that evacuates water efficiently from land but, on many soils, will increase the speed and the peak flows of water downstream. However, many of the actions that directly benefit farmers have the potential to deliver broader benefits, even if their impacts on major flood events at a large catchment scale are currently unclear. Actions to improve soil quality and reduce soil erosion and to create winter storage reservoirs have the potential to benefit both the farmer and the wider catchment.

As discussed further below, temporary or permanent changes in land use to provide short term flood storage or to change floodplain and coastal morphology carry significant costs to

[41] Defra and Environment Agency (2004)

farmers and landowners in terms of loss of capital value of land, higher costs and lower income.

4.4.4 Gaining active engagement by farmers in flood risk management

It is important to recognise that the benefit of individual measures may not be obvious to the farmers delivering them. For instance, holding back flood water by changing land use or management in the upper catchment may have no obvious benefit to the farmers undertaking these actions, nor to the immediate vicinity. The benefit to downstream landowners and communities will only be achieved by the combined impacts across the whole catchment and may only be evident in a modest reduction in flood peak.

For farmers to be actively engaged in delivering these changes there needs to be leadership and a consensus from the farming community themselves, as well as a long term commitment from Government and its agencies to see through programmes and projects. There needs to be greater understanding of how land use and management affects flooding at both a local and large catchment scale, requiring evidence from research and the transfer of knowledge to farmers as well as policy makers. The Managing Coastal Change Project taking place on the East Anglian coast of England (Section 4.3.1) is seeking to encourage informed dialogue of this kind.

If a more active approach to using agricultural land for flood risk management is to be pursued (such as through the temporary storage of flood water), ways have to be found of acknowledging the financial losers and winners. There are a number of examples where land has been purchased from farmers by public or conservation bodies to enable changes in land use from agriculture to wetland and coastal habitats. But there is little experience, in the UK at least, of payments to farmers to change the use or management of their land to deliver flood management benefits. As will be shown later in Chapter 7, agri-environment schemes include flood risk management as a secondary objective, with benefits tending to be provided on the back of measures addressing the primary objectives which include biodiversity and landscape.

4.4.5 Gaining multiple benefits

Finally, it is worth pointing out that some measures which have limited benefits for flood risk management nevertheless deserve attention because they deliver other benefits to the farmer and/or the public interest. The growing policy attention on multi-purpose land use and the delivery of a range of 'ecosystem services', means that integrated outcomes (for instance improving water quality, the recharge of aquifers, biodiversity and climate change mitigation) are now a priority for land use policy. [42]

The land use and management practices that deliver improved flood risk management at a local or catchment scale are capable of delivering a range of other benefits. As an example, the re-wetting of peat soils by blocking land drains and reintroducing dwarf shrub heath vegetation is capable of reducing the speed of flood run-off, improving water quality, enhancing biodiversity, protecting archaeological sites and reducing losses of soil carbon.

However, it is important to stress that the land use or management practices have to be located in the right place at both farm and catchment scale for each of these multiple benefits to be realised. Thus the optimal location of a hedgerow or strip of rough grassland for flood risk management may not be the optimal location for biodiversity, provision of recreation or improvement in water quality. It cannot be assumed that encouraging farmers to adopt measures that can in principle deliver a range of benefits will lead to these benefits

[42] Defra (2007b)

being delivered in practice. Care must be taken to ensure that the measures are spatially targeted in ways that maximise these benefits.

4.5 Key findings

The following conclusions emerge from this chapter:

- Most of the activities that farmers can adopt to reduce the risk of flooding to their own businesses have the potential to deliver broader benefits at a local or larger scale (albeit the extent of the benefits at large catchment scales is currently unproven). An activity that risks negative impacts off the farm is the improvement of land drainage which, on many soils, increases the speed and peak flows of water downstream.
- Whilst land use and management can play a role in reducing the risk of smaller scale flooding and muddy flood events, there is currently little hard evidence to demonstrate that changes in land use and management have a significant effect on reducing the impact of major flood events at a large catchment scale. It is likely that these changes need to be co-ordinated, and based on good knowledge of the flood response characteristics of each catchment, if they are to have any impact on reducing the severity of downstream flooding.
- This lack of knowledge about how land use and management contributes to flood generation is a critical factor constraining the potential for farmland to play a more positive role in flood risk management. Further research, followed by the dissemination of knowledge through long term contact with individual farmers will be needed before this potential can be realised.
- The growing risk of flooding will increase the exposure of all farm businesses to volatile markets and to financial risk. Farmers can prepare for this risk by adapting and diversifying their businesses but those in areas at greatest flood risk have fewest options. The very limited availability of commercial insurance against flood damage for people living in areas of greatest risk will have an increasing influence on their businesses.
- Action to adapt to, or mitigate, increasing flood risk can be more effective if it involves collective action by groups of landowners. This is particularly the case in floodplains where it is difficult to 'engineer out' individual land holdings from high water level regimes. Previous work has identified the need for good local facilitation and engagement with farmers, and the positive role of IDBs where they exist, in achieving this.
- Within floodplains and on coasts, there are opportunities (sometimes forced by the un-sustainability of existing land uses) for changes in land use such as the use of land for temporary flood storage areas or the creation of wet woodland or saltmarsh to slow the flow of flood water. These changes can result in a significant loss of land value and income. Land purchase by public bodies and conservation organisations has been the most common means of achieving this change, particularly where agricultural production is no longer a major objective for this land.
- If in future larger areas of farmland on floodplains and coasts are to be used for flood management, with agricultural production on highly fertile land remaining a strategic objective, ways will need to be found to acknowledge the loss of value and income and overcome owners' resistance to lower productive capacity, while keeping the ownership of the land with private landowners.
- Most land use and management for flood risk management is compatible with the

delivery of a wide range of other public benefits or ‘ecosystem services’. However, for each of these benefits to be realised in practice, it is important that the measures are located in the right place at a farm and catchment scale.

5 Overview of EU policies and programmes

This chapter provides a brief introduction to the key EU policies and programmes that influence land use and the management of flood risk. It introduces the Common Agricultural Policy (the implications of which for flood risk management are examined in greater detail in the following two chapters) and provides a short introduction to EU structural funding and to EU Directives relevant to land use and flood risk management.

5.1 The Common Agricultural Policy

5.1.1 Origins of the CAP and the path of reform

The CAP was first created in 1962, with the aims of increasing European food production and underpinning the income of farmers. The CAP was introduced to the UK in 1973 when the country joined the European Economic Community. The CAP has gone through various reforms during its lifetime, most recently in 1993 (the 'MacSharry Reforms'), 2000 (Agenda 2000), and 2003 (the Mid-Term Review which is something of a misnomer since, in many respects, it introduced the most radical changes to date).

These reforms responded to international pressure for increased trade liberalisation in agricultural commodities (with the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) requiring the EU to adopt significant changes to its support of agriculture), as well as to internal pressures prompted by the high cost of the CAP, the accession of southern and eastern European states and not least, the desire to refocus the CAP onto rural development rather than on support of agricultural commodities and farm incomes.

The 2008 CAP budget was €54 billion, which represents almost half of the entire EU budget. The cost of the CAP to the UK alone is around £7 billion per year. Around two-thirds of the cost of the CAP is directed towards crops, with the remainder being spent on the livestock sector. Approximately 87% of the EU's agricultural output is covered by the CAP, with the remaining 13% being products such as potatoes and some fruit, which are currently not covered.

5.1.2 The twin pillars of the CAP

There are two main areas ('pillars') of agricultural expenditure under CAP. The first, comprising market income and support, is known as Pillar 1. This covers direct payments made to farmers and ongoing market-related subsidies. Pillar 2 comprises rural development measures, which are an increasingly important component of CAP.

The following figure summarises the measures existing under each Pillar of the CAP.

Pillar I	Pillar II
▪ Maintenance of the internal market, including o Intervention Pricing o Export Subsidies and Import Tariffs ▪ Direct Aid ▪ Production Controls	Rural Development Programmes, including ▪ Agri-Environment Schemes ▪ Support for Less Favoured Areas ▪ Measures to increase the competitiveness of agriculture ▪ Support for rural communities
▪ Cross Compliance	

As the following two chapters explain in more detail, flood risk management is present as a potential objective within the CAP only within agri-environment schemes and, to a lesser extent, through the Good Agricultural and Environmental Conditions of cross-compliance. In

both cases, it is left to Member States to develop these measures and decide the extent to which they address issues such as flood risk management. The impacts of the other measures on flood risk management, particularly those under Pillar I which account for the majority of expenditure, can be considered as unintended and, to a large extent arise from the extent that they distort agricultural markets and land use patterns and practices.

5.1.3 Future directions for the CAP

A process of formal appraisal, the CAP Health Check, was built into the Mid Term Review reforms agreed in 2004. This Health Check recognised the need for the CAP to confront new challenges which specifically included climate change and water management[43]. It took place during 2008 and a series of changes, which seek to streamline existing arrangements rather than introduce significant new reforms, were agreed on 20 November 2008. The changes will be implemented by Member States from 2009. The main themes of the Health Check have been to extend the 'decoupling'[44] of direct aid schemes in those Member States that chose not to do this fully in 2004, to further reduce the role of market intervention, to increase the 'modulation'[45] of funds from Pillar I to Pillar II programmes and to simplify some of the reforms introduced in 2004. The most significant 'new' element of the Health Check, which is referred to as 'Article 68', permits Member States to use the Pillar 1 budget to support certain economically vulnerable types of farming, environmental practices or risk management measures. Further detail of these changes is provided in the following Chapter.

The UK Government has made plain its desire to see further substantial reforms to make the EU's agricultural sector more market orientated and to increase its responsiveness to public objectives[46]. No timetable for further reform has been agreed amongst EU Member States and the European Commission. However, change is likely to be driven by world trade talks (lack of consensus on agricultural support was a key reason for the failure of the Doha round of talks in 2008) and by pressure on the EU budget, as well as the political desire to continue the movement of funding from support of agricultural businesses and land use to the achievement of broader public objectives.

5.2 Structural funding

Structural Funds have formed a central plank of European Union activity since the origin of the European Economic Community with the Treaty of Rome in 1957. The Funds aim to enhance economic and social cohesion and to reduce structural imbalances across the EU by supporting projects which create investment and jobs, improve infrastructure and enhance economic and social development. Structural Funding is the EU's most significant funding mechanism after the CAP, accounting for around a third of the total EU budget.

There are four structural funds, the European Social Fund (ESF), the European Agricultural Guidance and Guarantee Fund (EAGGF), European Regional Development Fund (ERDF), and the Financial Instrument for Fisheries Guidance (FIFG). These are administered by the European Commission at an EU level, with Member States bidding to the EC to run programmes of activity funded by one or more of the structural funds. In almost all cases, Structural Funds must be matched with national public funding (i.e. from government

[43] European Commission communication 20 November 2007. http://ec.europa.eu/agriculture/healthcheck/index2_en.htm

[44] 'Decoupling' means breaking the link between agricultural support schemes and the production of specific commodities.

[45] 'Modulation' means reducing the funding allocated to direct agricultural support schemes (the Single Payment Scheme) and making this money available through targeted rural development schemes.

[46] Defra and UK Treasury 2005. *The Vision for the Common Agricultural Policy*. December 2005.

departments, their agencies or local authorities) and often then matched again by private sector funds from individual beneficiaries of the funding.

The distribution of structural funds to Member States has developed from a relatively *ad hoc* allocation for individual projects prior to 1987, to progressively more integrated and territorially specific programmes. The current Structural Funding Programme runs from 2007 to 2013. In the UK, areas that were judged to be performing poorly in the last programme period (such as West Wales and the South Wales Valleys, Cornwall and Merseyside) are in receipt of Convergence Funding, while other areas have bid to national pots to address competitiveness and skills issues. Spending from EU Structural Funds in the UK in the current period is much less than that in the preceding periods.

During previous Structural Fund programmes, major public infrastructure projects have received ERDF funding and these have included investment in flood defence structures. The EAGGF has funded environmental advice and capital grants schemes through Objective 5b during 1994 to 1999 and Objective 1 during 2000 to 2006, in areas where these applied. Investment in flood defence is continuing under current Structural Fund programmes (for instance in Wales, £17 Million of Convergence Funding is being allocated to 12 coastal defence schemes)

5.2.1 Interreg

The EU's Interreg programmes form the co-operation strand of the Structural Funds programmes, funded by the ERDF, encouraging Member States to work together in different zones of the EU. The current programme, Interreg IV, covers the period 2007 to 2013 and involves three strands covering cross border co-operation (Interreg IVA); transnational co-operation in a number of discrete zones (Interreg IVB) and interregional co-operation which is open to all national regions (Interreg IVC). There are annual calls for funding bids, with approved projects operating over a number of years. Interreg projects are expected to demonstrate co-operation in the fields of innovative implementation, experimentation (strands A and B) and improving understanding between areas (Strand C). In other respects, projects can cover a wide range of social, economic and environmental objectives.

5.3 Other EU policies and programmes

Several EU directives and programmes have a bearing on the water environment, flood risk planning and flood and coastal defence.

5.3.1 Water Framework Directive

This major piece of European legislation (Directive 2000/06/EC) came into force in December 2000 and became part of UK law in December 2003. It requires Member States to monitor the status of surface freshwater, groundwater, and coastal waters to one mile from low water and, where the ecological or chemical quality of these resources is below set limits, to adopt measures to bring them above the limits. Member States are currently consulting on draft River Basin Management Plans (RBMPs) for each of the River Basin Districts (RBD). By 22 December 2009, the Management Plans will be published, setting out the programmes of measures to be used (and operational by the end of 2012) in each RBD. There is a target date of the end of 2015 for the main environmental objectives set for each RBD to be met. Thereafter there is a six year cycle of monitoring, reviewing plans and updating the programme of measures.

No additional EU funding is available to fund the programmes of measures and Member States are expected to make use of existing programmes such as the agri-environment schemes funded through the CAP.

5.3.2 Floods Directive

The EU Directive on the Assessment and Management of Flood Risk (Directive 2007/60/EC) aims to help Member States limit the damage caused by flooding to land, property and human health by requiring them to assess if water courses and coastlines are at risk from flooding and to map the extent of the hazard and the location of those assets and humans at risk. Appropriate action must be taken in order to reduce the flood risk and the severity of the consequences. All information gathered must be made accessible to the public and neighbouring states must co-ordinate their activities within a shared river basin. In the UK, Defra is responsible for transferring the terms of the Directive into UK law. In Scotland, the Flood Risk Management (Scotland) Bill, which is currently going through the Scottish Parliament, will transpose the Floods Directive and sets up production of flood risk management plans which will be statutory and will be used to target flood risk management measures.

The Flood Risk Management Plans that the Floods Directive requires Member States to produce by 2015 will build upon Catchment Flood Management Plans, Shoreline Management Plans and River Basin Management Plans. CFMPs have been prepared for England and Wales, having completed a consultation period in the first half of 2009. They are non-statutory documents which aim to understand the factors that contribute to flood risk within a catchment, and to recommend the best ways of managing the flood risk. Shoreline Management Plans in England and Wales provide a large-scale assessment of the risks associated with coastal processes and provide a long-term policy framework to reduce the risks to people and the environment in a sustainable way. A second generation of Shoreline Management Plans are currently being prepared in England and Wales, to be completed by 2010.

5.3.3 EU Soils Action Plan

At EU level, the protection of soils has historically received less attention than that of other natural resources such as water, but an increasing emphasis is being placed on the subject, as reflected by the introduction of the EU Soils Directive which is currently under consultation. It will set out common principles for protecting soils across the EU, and within this framework, Member States will decide how best to protect and use soil within their own territory. The Soils Directive is part of the wider EU Soil Thematic Strategy, which seeks to encourage the sustainable use and protection of soils.

There are national Soils Action Plans in England and Wales, which encourage co-operation between a range of stakeholders in order to achieve the protection and appropriate management of soils and to optimise their function. In England, Defra is consulting on a Soils Strategy that will update the Soils Action Plan for England. The Environment Agency's Soil Strategy for England and Wales[47] includes actions to tackle the impacts of agriculture on soils, including better delivery of advice and knowledge. The Scottish Government's Scottish Soils Framework aims to promote the sustainable management and protection of soils in Scotland.

5.3.4 Sixth EU Environment Action Programme

The sixth Environment Action Programme (6th EAP) sets out the framework for environmental policy-making and action in the European Union for the period 2002-2012. It promotes full integration of environmental protection requirements into all Community policies and actions. The 6th EAP identifies four priority areas of climate change; nature and biodiversity; environment and health; and natural resources and waste. Seven thematic strategies are being developed to deliver actions at an EU level. The 6th EAP is concerned primarily with the causes of climate change, rather than the impacts (such as increased

[47] EA (2007)b

flooding) and while it includes thematic strategies on soils and the marine environment these are concerned primarily with their contribution to biodiversity and less with flooding risk management. The thematic strategies are due to be reviewed by the European Commission in 2010.

5.3.5 LIFE Funding

LIFE is the EU's financial instrument supporting environmental and nature conservation projects throughout the EU. It has operated since 1992 and has co-financed around 2,750 projects worth a total of €1.35 billion. The current funding programme, LIFE+, runs from 2007 to 2013 and has budget of €2.14 billion. It is strongly directed to delivering the objectives of the 6th EAP and its thematic strategies (and thus does not have a strong emphasis flood risk management). Member States have the opportunity to bid annually for funding to three separate funding streams of LIFE+ Nature & Biodiversity (which receives half of the total budget), LIFE+ Environment Policy & Governance and LIFE+ Information & Communication. It is likely that a number of funded projects at a national level, particularly those involving coastal realignment and wetland projects, will have either direct or indirect benefits for flood risk management. But the emphasis on biodiversity outcomes is likely to mean that few such projects will take place on farmland.

6 Pillar 1 of the CAP

This chapter outlines the measures available under Pillar 1 and considers the ways in which they affect farmers' ability to manage flood risk. It is split into six sections covering:

- Market support
- Production controls
- Direct aid
- Cross compliance
- Article 68
- Key findings on the impact of Pillar I measures

6.1 Market support

Supporting the internal market for agricultural commodities formed the mainstay of the CAP, accounting for the large majority of spending until 2000. This was achieved through guaranteeing prices to farmers for a range of agricultural products and restricting imports, and subsidising exports with countries outside the EU.

6.1.1 Guaranteed prices

Under the intervention pricing mechanisms, the EU historically set a minimum price that a farmer will be paid for certain commodities. If the world market price of a commodity fell below the set price, the intervention purchaser would receive a subsidy to make up the shortfall between the price paid to the farmer and the current market value. If the world price rose higher than the intervention price, the farmer would still keep the full price that they were paid for that produce. The purpose of this strategy was to guarantee a minimum income for farmers, but it has stimulated extreme over-production in the past. The main commodities covered by intervention pricing are durum wheat, common wheat, barley, rye, maize, white sugar, butter and skimmed milk powder.[48]

Following the Uruguay Round of the GATT, the EU has progressively reduced intervention prices for most supported commodities since 2000. The intervention price for butter was reduced by 25% and that of milk powder by 15%. In 2006 a reform of the EU sugar regime was adopted, cutting the guaranteed sugar price by 36%. The European Commission's intention is to use intervention pricing as a 'safety net' or price stabilising mechanism when world prices fall to low levels, rather than to provide a permanently raised internal market.

6.1.2 Export subsidies and import tariffs

Without restrictions on the trade of supported commodities with the rest of the world, the EU's intervention market would effectively end up subsidising prices across the globe. A system of export subsidies, to enable sales to third countries with lower prices, and import tariffs, to limit imports from third countries to the EU's high prices, are therefore necessary to maintain the internal market. Compensation is paid to traders who export agricultural goods such as sugar and milk to foreign buyers for less than the intervention price that is paid to European farmers. Conversely, a levy is imposed on importers wishing to sell goods produced in third countries into the EU. As with intervention pricing, following the Uruguay Round of the GATT, the EU has reduced the level of export subsidies, offering to cut all them all from 2013 on the condition that other nations reciprocate by lowering their tariffs on industrial goods. This has occurred during a period in which food retailers and the food

[48] EC (2008)

service sector have increased third country imports to provide greater choice and lower prices for consumers.

Export subsidies and import tariffs have been amongst the most criticised components of the CAP, seen as an unfair barrier to trade, resulting in the 'dumping' of EU commodities onto developing countries, undermining the value of those produced in those countries, and discouraging farmers in developing countries from processing their raw materials for sale in the EU's affluent market place.

6.1.3 Influence of market support on farmers' ability to manage flood risk

Prior to the MacSharry and Agenda 2000 reforms, the high level of intervention prices were responsible for burgeoning production of the supported commodities (such as, in the UK, wheat, milk and beef). The resulting intensification of agricultural land use (such as the draining of land and increased stocking densities) and the removal or agricultural improvement of semi-natural habitats (such as species rich grassland and hedgerows) is likely to have had a significant impact in increasing the speed with which rainfall was discharged from farm land to rivers, particularly where these changes occurred on steep land and in high rainfall areas.

The reduction of price support over the last eight years, coupled with the removal of production-related direct payments in 2007 (see Section 6.3), has reduced the incentives for over-production. This coincided, during the years to 2007, with a period of low world and domestic prices in the supported commodities and, as a result, there was a modest decline in the number of livestock kept and the area of arable crops. For example, the number of cattle and calves kept in the UK decreased by 12% and the area of crops fell by 11% during the nine years to 2006-7.[49] However this reduction in the intensity of agricultural land use has not reversed the previous drainage of land or the removal of semi-natural habitats capable of holding back flood water.

The reduction in agricultural profitability, and increased exposure to more volatile commodity prices, has made it more difficult for farmers to plan ahead to accommodate the increased risk of flooding. With uncertainty over the relative profitability of different crops and livestock, farmers are less likely to commit land to flood storage, habitat restoration schemes, new woodland or extensive land management. It is less easy to justify long term investment in new equipment or systems that would improve their flood risk management and mitigation.

The use of price support and trade barriers should therefore be considered as a blunt tool with more scope for harm (albeit unintended) than good in relation to flood risk management. These mechanisms were responsible for increasing the risk of flooding from farmland and their dismantling will do little, on its own, to reverse this.

Nevertheless, the potential for 'green coupling' of market support to encourage commodities that deliver public benefits might be considered. For such coupling to work, it is necessary to identify traded commodities that, as a direct result of their production, provided net benefits for flood risk management. In practice, there are few such products. Alder wood (from wet woodland) and marsh samphire (from salt marshes) might be considered to offer this potential in relatively limited circumstances. Neither are major timber or food commodities but it would, in theory, be possible to establish systems to maintain market prices high enough to favour the establishment and management of alder woodland and saltmarsh. This on its own would not guarantee flood risk benefits since the location and means of management of these habitats are important factors. Other controls would be needed to ensure that these were delivered.

[49] Defra (2007c)

The past experience of manipulating the internal market for agricultural products through the CAP suggests the 'green coupling' of market support would be an inefficient and potentially distorting means of delivering flood management benefits. The European Commission is unlikely to favour a form of coupled support, having only recently started the decoupling process. Furthermore it is unlikely to get political support and would fall foul of World Trade Organisation rules.

6.2 Production Controls

During the 1980s and 1990s, the EU brought in a number of measures under the CAP with the aim of reducing the over-production that had resulted from intervention pricing. The two most relevant to the UK are milk quotas (which are being dismantled) and set-aside (which was removed in the CAP Health Check in 2008).

Fixed quotas for milk production were introduced in 1984, along with a levy on producers who exceed the limit set. The aim was to reduce over-production in the dairy sector but although this has been fairly effective, the quota that was set still exceeded consumption levels within the EU by around 10%.[50] Arrangements for allocating and exchanging quota between producers are different in each Member State.

The recent agreement on the CAP Health Check confirmed that milk individual producers' quotas will be raised by 1% per year from 2009, before being abolished completely in 2015. The gradually rising quotas are designed to lessen the eventual impact of their removal.

Set aside was introduced as a market-management tool to reduce overproduction of cereals, oilseed and protein crops. Farmers were required to remove a specified proportion of their arable land from production, although exemptions were made in certain situations such as where energy crops are grown. Farmers were compensated financially for their reduced crop yields. In 2004, payments for set aside relating to per-hectare aid totalled €1.8 billion[51]. The European Commission retained the ability to alter the proportion of land that farmers must set-aside on an annual basis in response to changing market conditions - for example, following a poor harvest in 2003, rates were reduced from 10% to 5% set-aside for the following year and in 2008, when world markets were at an all time high, the rate was dropped to zero. The CAP Health Check confirmed the removal of set-aside as a supply control measure on a permanent basis. However, in England, the Government is committed to finding ways to retain the environmental benefits provided by set-aside land.[52]

It is worth noting that there was considerable debate during the early 1990s about the merits of introducing nitrogen quotas as a supply control. These had the potential to limit production and deliver environmental benefits (both by reducing use of artificial nitrogen fertilisers and also increasing the value – and hence improving the use – of animal manures) but would have been complex to administer.

6.2.1 Influence of set-aside on farmers' ability to manage flood risk

Milk quotas have had no direct impact on farmers' flood management planning and this section focuses on the role of set-aside.

Although introduced purely to reduce the production of arable crops, it is likely that set-aside, as an unintended benefit, provided two potential benefits for flood management. Firstly, it could provide a 'sacrificial' area of land for flood storage free from the risk of damage to crops (although the land still had to meet basic requirements of availability for agriculture

[50] IATP (2007)
[51] Defra (2005)
[52] A consultation on options takes place during April and May 2009.

use) and secondly it can reduce overland runoff by providing a buffer beside streams and ditches. Both of these rely on set-aside land being sited where it would provide most benefit and on the land being allowed to develop a cover of rough vegetation (rather than bare soil). Since this use of land is not related to production control, but rather to the provision of direct environmental benefits, it is more relevant to consider it under the heading of cross-compliance, below.

6.3 Direct Aid

The bulk of the CAP budget is spent on direct payments – over €30 billion per year.[53] Payments started to be introduced in the early 1990s to compensate farmers for cuts in some intervention prices as well as for tariff reductions that had been introduced following the GATT negotiations. Initially, direct payments were linked to levels of production of certain crops and numbers of livestock kept, and were set at levels designed to compensate proportionally for the losses incurred by the changes to intervention prices and tariffs. These payments are subject to the 'Blue Box' rules of the World Trade Organisation (meaning that support that is potentially distorting to trade can continue providing measures are put in place to ensure the levels of distortion do not increase).

As noted in Chapter 5, the Mid Term Review of the CAP in 2003 involved the substantial 'decoupling' of support, with Member States encouraged to replace direct aid schemes with the new Single Payment Scheme (Single Area Payment Scheme in new Member States). Under Article 69 of the 2003 reforms, Member States were able to retain direct aid schemes under certain circumstances. In England, Wales and Northern Ireland, all Pillar I direct aid payments to farmers have now been incorporated into the Single Payment Scheme. The Scottish Government chose to retain a small level of direct aid payments for beef cattle and many countries (including France, Portugal and Austria) have retained schemes to support the keeping of beef suckler cows. As part of the CAP Health Check changes agreed in 2008, the scope of Article 69 support has been further constrained and is now part of Article 68 (see below).

Under the Single Payment Scheme (SPS), which was introduced in 2005, farmers receive payments based on their land area as long as they meet certain standards (known as cross compliance – see below) relating to environmental quality, food quality and animal welfare. The main aims of the SPS are to allow farmers the freedom to produce to market demand, to promote environmentally and economically sustainable farming and to simplify the CAP.[54] Farmers can decide how to use their land (subject to the minimum standards required by cross compliance) in the knowledge that they will receive the same amount of aid, allowing them to adjust production to suit demand.

6.3.1 Influence of direct aid and the Single Payment Scheme on farmers' ability to manage flood risk

The same issues described above for support for market prices also apply to decoupled direct aid schemes. Flood risk management is primarily about land use and management and decoupled direct aid schemes only influence how land is used indirectly. These schemes can apply conditions that affect how land is managed, or can vary payments according to intensities of production systems (for instance the Livestock Extensification Premium that operated until 2005 made payments to farmers with low stocking rates), but they are still fundamentally about payment for forms of production, not environmental management.

[53] Defra (2005)
[54] European Commission (undated)

Compared to market support schemes, there is less evidence that the direct payment schemes that operated in the CAP until 2005 led to a worsening impact on flood generation and management. Nevertheless, these schemes still presided over a period when high stocking levels in many upland areas damaged vegetation and compacted soils, exacerbating flood run-off.

There are more positive comments to be made about the Single Payment Scheme, at least in terms of helping farmers overcome the financial risks to their business from flooding. The payment itself provides no direct encouragement for farmers to adopt positive land management measures, but it does provide a source of income that is relatively risk free, providing a financial buffer against volatile markets and risks of flood losses. The Single Payment therefore avoids the main distorting elements of market support and direct payments, but provides an element of financial stability from which farmers can plan and adapt their businesses to overcome the impact of flooding.

The Single Payment also helps ensure that land remains under active management, with farmers in place to adopt targeted measures under rural development schemes (although the payment, on its own, does not guarantee the standards of land management – this is the role of cross compliance, covered below). This potential benefit of the Single Payment presupposes that agricultural management is necessary to deliver improved flood risk management and that agricultural abandonment of land would be a bad thing. It is generally accepted that, for services such as biodiversity and landscape conservation, active land management is important, but this may not necessarily be the case for flood risk management. Habitats such as regenerated woodland and coastal saltmarsh, neither of which requires active management, can be effective at slowing and holding flood water and associated sediments, while ungrazed dwarf shrub heath generates lower levels of flood run-off.

Despite being decoupled from specific systems of production, the Single Payment still requires that land remains available for minimum levels of agricultural production. This requirement is a strong disincentive for farmland to be converted to non-agricultural uses such as saltmarsh and mudflats. It means that schemes to encourage this conversion of land (usually involving either the purchase of land or profit foregone payments to the landowner) have to take account of the loss of Single Payment, and require higher funding than if the Single Payment could continue to be paid after the land use change has taken place.

6.4 Cross Compliance

There have been widespread accusations that the CAP has in the past prioritised high commodity yields over environmental protection. It is argued that extensive market price support in the EU encouraged intensification of agriculture at the expense of environmental considerations.[55] Cross-compliance goes some way towards addressing this issue, encouraging farmers to respect basic environmental, food safety, phytosanitary and animal welfare standards. Where they fail to do so, the payments received may be reduced.

However, the enforcement of environmental management requirements on farmers as a condition of receiving support has actually been present within the CAP since the early 1990s. Initially, limited conditions were introduced to set-aside and to beef and sheep subsidies under the 'MacSharry' reforms of 1993, with the Agenda 2000 Reforms extending cross compliance to agri-environment schemes and LFA support. Prior to 2005, agri-environment schemes were conditional on agreement holders abiding by Good Farming

[55] Defra (2005)

Practice. The Mid-Term Review in 2003 replaced these requirements with a set of cross compliance conditions that apply to all Pillar I direct aid schemes and to the Pillar II land-based schemes.

All beneficiaries of these schemes are required to abide by two separate elements of cross compliance. These are firstly Statutory Management Requirements (SMRs), obliging recipients of the schemes to adhere to specific pieces of European legislation, and secondly Good Agricultural and Environmental Conditions (GAEC) which are defined by Member States, taking account of the characteristics of their own territories.

6.4.1 The Statutory Management Requirements

Annex III of the 2004 CAP reform 'Horizontal Regulation' (EC 1782/2003) lists 18 pieces of EC legislation (Directives and Regulations), of which the first five are environmental and the ninth concerns human health but also has environmental impacts. These are summarised in **Table 6.1** below.

Table 6.1 Statutory Management Requirements with significant environmental impacts

SMR	Summary
1	Conservation of wild birds – Member States are required to protect certain species of bird and to secure or re-establish their habitats. Killing/disturbance of wild birds is prohibited, as is destroying/damaging their nests. Hunting wild birds remains permitted under certain conditions.
2	Protection of groundwater against pollution caused by dangerous substances – land managers are required to obtain authorisation before disposing of certain substances to land, including spent sheep dip and pesticide washings.
3	Protection of the environment where sewage sludge is used in agriculture – only sludge treated in accordance with the Directive may be used. Specified harvesting intervals and other regulations must be observed in order to prevent contaminants from reaching the human food chain.
4	Protection of water against pollution caused by nitrates from agricultural sources – farmers with land in Nitrate Vulnerable Zones (NVZ) should comply with the mandatory measures set out in the Action Programme for NVZs.
5	Conservation of natural habitats and of wild flora and fauna – Special Areas of Conservation (SACs) should be designated for habitats and species to be protected from damage, deterioration and disturbance. The effects of plans or projects that may cause adverse effects must be considered.
9	Plant protection products – These may only be used for approved uses and in accordance with specified requirements and the principles of good plant protection practice.

None of the SMRs have a direct influence on flood risk management (but SMRs 2, 3, 4 and 9 are concerned with water quality and SMRs 1 and 5 have an influence of water level management for biodiversity). This is because there is currently no European legislation that could easily be applied in this way. During the CAP Health Check conducted in 2008 there was discussion about whether the Water Framework Directive or Floods Directive could form the basis of new SMRs. However, both Directives place requirements on Member States to maintain systems of legal scrutiny and monitoring as a prelude to adopting appropriate measures, and they do not specify requirements that farmers could be expected to abide by through an SMR.

6.4.2 The Good Agricultural and Environmental Conditions

Under Good Agricultural and Environmental Conditions (GAEC), Member States are required to adopt and enforce standards based around the framework specified in Annex IV of the Horizontal Regulation (EC 1782/2003). This framework was amended in the recent CAP Health Check, adding several criteria and specifying which aspects of the framework

are mandatory and which are at the discretion of Member States, allowing for their individual environmental and agricultural characteristics. The framework for the GAEC is set out in Table 6.2.

Table 6.2. The framework of Good Agricultural and Environmental Conditions
Measures with the greatest positive impact on flood risk management highlighted in **bold**

Minimum soil cover; **Soil erosion (baseline practices in relation to risk assessment), Soil organic matter and Soil structure**
Minimum level of maintenance • *Retention of landscape features (these now specified)* • *No encroachment of scrub on land not in agricultural production* • *Protection of permanent pasture*
Protection and management of water (new Dec 08) • ***Establishment of buffer strips along watercourses (requirement in England pre Dec 08, now proposal to widen strips for introduction 2010)***
Protect water against pollution and runoff, and manage the use of water (new Dec 08) • ***Compliance with irrigation procedures (new Dec 08)***

Source: Annex IV of EC 1782/2003, as amended by the CAP Health Check in November 2008

Each of the UK administrations have defined slightly different cross compliance conditions. These differences are summarised in **Table 6.3.**

Table 6.3 Comparison of the GAEC requirements across the UK

England	In England there are 17 GAECs covering a range of environmental issues, the main ones being soil protection, overgrazing, field boundaries (hedgerows and stone walls), tree felling, burning, EIA and SSSI.
Scotland	Scotland has 18 GAECs, within which there is a significant level of crossover with those set out in England. However, there is a particular focus on issues surrounding arable farming, with two separate conditions covering arable crop rotations and stud management. In Scotland, the Condition covering the burning of heather and grass is stipulated as complying with the Muirburn Code.
Wales:	Wales' 11 GAECs again cover similar issues to those specified in England's guidelines. However, they tend to be slightly broader in their scope, hence the existence of fewer individual Conditions. Soil and post-harvest management, over and undergrazing, protection of sites of historical and environmental value and field boundaries are again the main issues covered.
Northern Ireland	There are six GAECs set out for Northern Ireland, covering soil management, supplementary feeding, over and under grazing, field boundaries and the protection of habitats, archaeological sites and permanent pasture.

6.4.3 Advice and guidance on cross compliance

The 2004 CAP reforms that introduced cross compliance also brought in a requirement for Member States to provide a Farm Advisory Service to give farmers advice on how to abide by the SRM and GAEC. Different arrangements have been developed in each country. For instance, in England, Defra has contracted the company Momenta to provide this advice, whereas in Wales the service is provided as part of the Farming Connect service operated by the Welsh Assembly Government's Agricultural Department and in Scotland, the Farm Advisory Service is provided by the Scottish Agricultural College. These services are a mixture of reactive advice responding to individual requests from farmers, to proactive events such as workshops and farm walks on topical issues.

6.4.4 Influence of cross compliance on farmers' ability to manage flood risk

Although there is little firm evidence, the consensus from stakeholders at the workshop held during this study is that the influence of cross compliance on flood risk management since it

was introduced has been negligible. This is mainly because of the lack of priority to date given to flood risk management in the SMR and GAEC. There is also a perception that the complexity of the requirements and the relatively low levels of enforcement do not provide a strong incentive for farmers to abide by cross compliance.

However, the addition of new measures to the GAEC in 2010 (following the new measures set out in the CAP Health Check), particularly the requirement for wider buffer zones beside watercourses, could bring a more significant impact. It remains to be seen how this measure, and the measure on the protection of water from pollution and runoff, will be adopted by Member States. As noted earlier, Defra is keen that the environmental benefits that have developed from set-aside should be retained in England through cross compliance.

In England, Defra has issued a consultation document[56] on the changes needed to cross compliance following the CAP Health Check. The consultation document acknowledges two important requirements that must be achieved if cross compliance is to deliver significant benefits. Firstly it is important that measures such as 6m buffer zones are located in places at a field and farm scale where they are likely provide most benefit in reducing soil erosion and runoff. Secondly it acknowledges the importance of engaging positively with farmers in understanding and addressing issues such as soil quality and water run-off.

One of the main conclusions from Chapter 4 was that many of the practical measures that address the impact of flooding on farms, and could potentially deliver broader flood risk management benefits, involve small but closely targeted changes in land management. On the one-hand cross compliance is a suitable mechanism to draw farmers' attention to the relevant baseline and best practice land management measures. On the other hand, the optimal siting of buffer zones and other measures are unlikely to be addressed solely by compulsory measures. Although the farm advisory services make advice available to farmers, it would appear that the 'reach' of these into the farming community has been light and they are unlikely to have had a significant impact on the flood risk management benefits accruing from cross compliance. Ways need to be found to impart best practice knowledge to farmers in ways that they regard as relevant and valuable to their businesses. Cross compliance could provide the necessary level of incentive to draw attention to baseline practices, but additional extension advice is necessary to help farmers make best use of these.

6.5 Article 68

The CAP Health Check sought to address the issue of the future of the production specific direct aid schemes that were retained by some Member States in 2005 (see Section 6.3). The outcome of the complex negotiations meant that an expanded role has been given to production-coupled schemes, although this does not seem part of a planned strategic development of the CAP. The Health Check agreement allows Member States (with EC approval) to divert up to 10% of total Pillar I national ceilings to direct payments that support specific sectors or measures[57]. These payments require no national co-financing.

For countries whose co-financed Pillar II programmes are small compared to their Pillar I national ceilings, such as the UK, it should be noted that the value of Article 68 measures (if taken up by these Member States) could exceed their current Pillar II budgets. This is significant since most of the Article 68 criteria (below) duplicate objectives that are already present in Pillar II which requires co-financing by Member States.

[56] Defra (2009)
[57] The limit for some criteria of payment is 3.5% of national ceilings.

While many of the Article 68 criteria and Pillar II measures may be similar, they are different in one fundamental respect. Most payments to farmers under Pillar II are calculated on the basis of a proportion of the costs incurred for delivering the outputs of the measure. With the exception of payments to farmers in the Less Favoured Areas, Pillar II measures are not intended to subsidise the core agricultural business (although in practice this distinction may not be perceived by farmers receiving the payments). There is no such restriction on Article 68. As noted below, this difference is likely to influence Member State's use of Article 68.

The criteria stated in the Health Check agreement are open to broad interpretation and it remains to be seen whether and how these will be adopted by Member States and approved by the Commission. The criteria include several that could be directed to flood risk management, either directly or indirectly (annoted comments in *italics*), as follows:

- protecting the environment (*this could include payments for low input systems on semi-natural habitats such as upland moorland, lowland heathland and unimproved grassland, all of which have relatively low impacts on flood generation and propagation*);
- payments for disadvantages faced by specific sectors in economically vulnerable or environmentally sensitive areas as well as for economically vulnerable types of farming (*this could include payments to retain farmers in area subject to frequent flooding such as low-lying flood plains and coastal areas*);
- top-ups to existing entitlements in areas where land abandonment is a threat (*again, could include areas subject to frequent fluvial or marine flooding –in the UK, most likely to be in areas such as the Fens or Somerset and Gwent Levels or in estuaries in the south east of England*);
- support for risk assurance in the form of contributions to crop insurance premia (*a criteria which directly addresses the impact of climate change and the lack of availability of commercial insurance in areas of greatest risk. It is notable that, compared to most of the other Article 68 criteria, this support is not available under Pillar II*).

6.5.1 Influence of Article 68 on farmers' ability to manage flood risk

Article 68 includes substantial opportunities for Member States to use Pillar I money to address flooding impacts, both in terms of the budget available and the criteria under which money can be directed. This means that, potentially, measures could be adopted at a landscape scale (for instance across sensitive catchments, floodplains or coastal zones) to support particular forms of land use. As an example, money could be used to favour extensive livestock production on wet grassland in floodplains and on low-lying areas that are currently dominated by flood-pumped arable farming. Such land use would be less exposed to financial losses from flood events and could provide wider flood storage benefits helping to reduce impacts on towns and other assets.

Calls for Article 68 money to be directed to flood risk management will face competition from other demands. These include the need to support marginal agricultural systems and the provision of other ecosystem services such as protection of soil carbon and enhancement of biodiversity. Approaches that have multiple objectives (for instance the enhancement of upland habitats) and can deliver a range of economic, environmental and social benefits are likely to find most favour.

As with other Pillar I measures, there is a danger that support will have unintended distorting effects. For instance, support for crop insurance premia could result in unsustainable land uses being maintained, contributing to flood water generation or requiring continued high expenditure on flood protection.

Ultimately the decision on whether and how Member States use Article 68 is likely to be down to bigger strategic decisions about the future structure of the CAP and the roles of Pillars I and II. Using Pillar I to launch a new range of coupled income support payments indicates a direction of travel with the CAP that some Member States are likely to resist. Those Member States that wish to restrict the CAP to payments for the delivery of specific public benefits (under what is now Pillar II) are probably unlikely to adopt Article 68 to any great degree.

This poses the question of whether support to help farmers adapt to the impacts of flooding, and provide broader flood risk management services, can be provided solely through profit-foregone agreements and capital grants of the kind available through Pillar II. While this is likely to be the case for small-scale changes in land management to reduce flood run-off and impacts across catchments as a whole, it is unlikely to be sufficient to maintain agricultural management in areas of highest flood risk, where such management is deemed necessary for economic, environmental or social reasons. In these circumstances, Article 68 may provide a mechanism for underpinning the viability of these land management systems. Alternatively, an extension of the LFA support currently included in Pillar II may be appropriate.

6.6 Key findings on the impacts of Pillar I measures

The following conclusions emerge from this chapter:

- In view of the large budget allocated to Pillar I of the CAP, it provides relatively little direct assistance to farmers to help them adapt to and mitigate the risk of flooding. But there are opportunities to use cross compliance and, potentially, Article 68 measures, to better effect.
- Market support measures, which have been much diminished in recent years, have proved a blunt and distorting tool. Although the dismantling of market support has increased farmers' exposure to volatile markets and financial risk, there is no political appetite for reversing this.
- Guaranteeing prices for products that are derived from land use systems that deliver high levels of flood risk management (such as marsh samphire from saltmarsh) may at first sight appear attractive. But in practice such 'green product coupling' is likely to be a complex and inefficient means of achieving this.
- The decoupled Single Payment Scheme provides a financial buffer against risk and helps ensure that farming businesses remain in place to receive other payments for delivering specific public benefits. However, this presupposes that agricultural management is needed to deliver flood risk management practices which may not be the case in areas such as on upland peat soils and low-lying coasts.
- By requiring land to continue to be available for agricultural production, the Single Payment Scheme is a significant disincentive for land use change to non-agricultural uses such as woodland, wetland and salt marsh.
- Cross compliance offers the potential (as yet largely unmet) to deliver baseline and best practice land management measures of the kind that can reduce flood run-off across catchments as a whole. But for these measures to be effective, it is essential that farmers place them in appropriate locations at a field and farm scale – these require positive engagement with, and transfer of knowledge to, farmers beyond the level current being provided by farm advisory services.
- In the past, direct aid to support specific forms of production under Pillar I have

exacerbated flood risk management. The new Article 68 measures offer the opportunity (and a large budget diverted from the Single Payment Scheme) to use direct aid to support more beneficial land use systems. Schemes that support land use systems that deliver multiple objectives, including flood risk management are likely to receive most favour. However, whether and how Member States chose to make use of Article 68 depends on their long term strategic objectives for further reform of the CAP.

7 Pillar II - Rural Development Measures

This Chapter follows a similar structure to the previous one. It starts by introducing the Rural Development Programme and its four Axes, and then describes each of the Axes in turn, describing how they have been implemented in the UK and examining their impact on farmers' ability to manage and mitigate flood risk. This chapter covers the following topics:

- Introduction to the Rural Development Programme
- Axis 1: Improving the Competitiveness of the Agricultural and Forestry sector
- Axis 2: Improving the Environment and the Countryside
- Axis 3: Quality of life and economic diversification
- Axis 4: Leader
- Different approaches to regional targeting
- Key findings on the impact of Pillar II measures

7.1 Introduction to the Rural Development Programme

The Rural Development Programme was a major new element in the Agenda 2000 CAP reforms. It encourages rural initiatives whilst also helping farmers to restructure their farms, diversify and improve their product marketing. The first rural development programme ran from 2000-2006 and the second runs from 2007-2013. Separate programmes are prepared and implemented within each Member State. Around €7 billion of the annual EU budget is spent on rural development measures. Assistance can be given to farmers and others in rural areas for activities such as:

- Training – farming techniques and rural crafts
- Helping young farmers to set up and older ones to retire
- Modernising farm buildings and machinery
- Protecting and conserving the natural environment and rural heritage
- Encouraging rural tourism

The way in which the current Rural Development Programme must be delivered by Member States is set out in Commission Regulation 1698/2005. It sets out four main objectives (known as the Axes), as follows:

- Increasing the competitiveness of the agricultural sector through support for restructuring (Axis 1);
- Enhancing the environment and countryside through support for land management (including rural development actions related to Natura 2000 sites) (Axis 2);
- Enhancing quality of life in rural areas and promoting diversification of economic activities through measures targeting the farm sector and other rural actors (Axis 3);
- Enhancing the use of the Leader approach which provides a bottom-up, community driven method using local partnerships to inform the implementation of the other three axes (Axis 4).

Member States choose which national or regional authorities are responsible for administering each Axis. In England, Axes 1, 3 and 4 are co-ordinated by the Regional Development Agencies, and Axis 2 is co-ordinated by Natural England. In Wales, Axes 1 and 2 are co-ordinated by the Welsh Assembly Government, whilst Axes 3 and 4 are

managed by local partnerships, led by the County Councils. In Northern Ireland, Axes 1 and 2 are co-ordinated via the Department of Agriculture and Rural Development (DARD), whilst Axis 3 is delivered via local council clusters using the Leader approach (Axis 4). In Scotland Axes 1, 2 and 3 are co-ordinated at government level but delivered by Scotland's Environmental and Rural Service (SEARS), which involves a number of government organisations working together. Axis 4 is delivered by local partnerships comprised of representatives from local councils, other agencies and local businesses. **Table 7.1** summarises the areas covered under each Axis.

Table 7.1 Measures and Objectives under the Four Axes of the Rural Development Programme 2007-13

Axis 1 – Improving the Competitiveness of the Agricultural and Forestry Sector
Promoting knowledge and improving human potential: • Vocational training and information actions, including diffusion of scientific knowledge and innovative practices, for persons engaged in the agricultural, food and forestry sectors • Use of farm and forestry advisory services Restructuring and developing physical potential and promoting innovation: • Adding value to agricultural and forestry products • Cooperation for development of new products, processes and technologies in the agriculture and food sector and in the forestry sector Improving the quality of agricultural production and products: • Participation of farmers in food quality schemes • Information and promotion activities
Axis 2 – Improving the Environment and the Countryside
The sustainable use of agricultural land: • Natural handicap payments to farmers in areas with handicaps other than mountain areas • Agri-environment payments • Support for non productive investments The sustainable use of forestry land: • First afforestation of agricultural land • First afforestation of non-agricultural land • Restoring forestry potential and introducing prevention actions • Support for non productive investments
Axis 3 – The Quality of Life in Rural Areas and Diversification of the Rural Economy
Diversifying the rural economy: • Support for the creation and development of micro-enterprises • Encouragement of tourism activities Improving the quality of life in rural areas: • Basic services for the economy and rural population • Village renewal and development • Conservation and upgrading of the rural heritage • Training and information • Skill acquisition, animation and implementation
Axis 4 – LEADER
Measures as follows: • Local development strategies • Inter-territorial and trans-national cooperation • Running the local action group, acquiring skills and animating the territory

7.2 Axis 1: Improving the competitiveness of the agricultural and forestry sector

The first Axis of the RDP enables Member States to offer support for training and advice, restructuring of agricultural and forestry businesses and investments to improve the quality of agricultural production.

7.2.1 Training and advice

In England, funding is available to raise the level of skills in the farming, food and forestry sectors through training, with the aim of improving their competitiveness and increasing their contribution to the environment and to sustainable communities. The activities funded vary regionally, but in principle any training or information that is directly relevant to the needs of the sector concerned will be considered. Eligible costs include the provision of trainers, venues and materials, as well as project-management costs for training organisations and small-scale capital costs. Under EU regulations, support may also be granted to help farmers and foresters meet the costs of using advisory services, but in England these activities are not supported, as it is considered that adequate advice is received by all farmers claiming under the Single Payment scheme. However, advisory services are still provided to woodland owners.

In Wales, the Farming Connect programme provides a range of services including one-to-one support; sector specific knowledge transfer and development programmes which includes discussion groups demonstration farms and open days; individual training tailored to the needs of farmers; diversification; and awareness training. The Farm Advisory Service, which is part of Farming Connect, helps eligible farm businesses to meet cross compliance and environmental regulations.

In Northern Ireland, training and advice are delivered through four schemes. The Focus Farms scheme aims to make the agricultural industry more competitive through the provision of training for farmers led by other farmers. Focus Farms are selected as examples of good practice and receive financial assistance towards establishing their farm as a training facility which can be visited by other farmers. Training and advice are also delivered through the Benchmarking Scheme, and through Farm Family Options which assists farming families to assess their present situation and their future options. In addition to these three schemes, training and advice are also provided as a mechanism through which to encourage Supply Chain Partnerships between farmers and growers.

In Scotland, training and advice are delivered through Rural Development Contracts (Land Managers Options). Farmers can select LMOs up to the value of an allowance which is calculated on the basis of the size of their holding. Under Axis 1, the LMO options available include training and the use of farming and forestry advisory services. Training must cover a specified range of topics such as business skills, marketing and managing people. Options relating to advisory services include business auditing and nutrient management planning.

7.2.2 Restructuring and developing physical potential

In England, support is available under Axis 1 to aid with the processing and marketing of primary agricultural and forestry products by means of investment aimed at improving efficiency. Investments are expected to deliver specific outcomes such as the development of new products and opening up of new markets or improvements in quality standards. The measure is generally targeted at micro, small and medium-sized enterprises, but for forestry products eligibility is limited to micro-enterprises.

In Wales, support is provided through the Processing and Marketing Grant Scheme for capital expenditure on buildings and new equipment, the cost of a business plan/feasibility

study for the project, and for related costs such as consultants' fees. Examples of investments that might be supported under the scheme are investment in new egg or horticulture processing facilities, or the development of higher value dairy products aimed at the growing market for speciality cheese.

In Northern Ireland, grants are administered through the Agricultural and Forestry Processing and Marketing Grant Scheme and through the Agricultural and Forestry Marketing and Development Grant Scheme. The first provides support towards the cost of buildings, equipment, business plans/feasibility studies and for related costs such as consultants' fees, whilst the second scheme supports businesses engaged in marketing the produce of agriculture and forestry.

In Scotland, a grant is available through one of the Land Managers Options which supports seed stand registration and improvement, helping to stimulate supply of both genetically selected and locally native seed origins. The use of this genetically appropriate planting stock will improve the yield of good quality timber and provide economic opportunities, especially in remote rural areas.

7.2.3 Improving the quality of agricultural production

In Scotland, an annual one-off payment is granted to farmers and crofters who are members of one or more of a specified range of schemes, such as Lion Eggs, Freedom Foods and the Scottish Organic Producers Certification Scheme. Grants are made through the Land Managers Options scheme and cover 50% of the joining fee or membership subscription, up to a maximum of £150.

In England, participation in food quality schemes is not covered under the Rural Development Programme. It is considered that producers who participate generally do so with the aim of achieving a market premium for their products, in which case the financial cost of subscribing is adequately returned without additional support from the RDP. However, as already described, support is granted for work that will add value to agricultural and forestry products as a result of improvements in quality. Likewise in Wales and Northern Ireland, there are no specific measures included under the RDPs which encourage producers to participate in food quality assurance schemes.

7.2.4 Influence of Axis 1 on farmers' ability to manage flood risk

The Axis 1 measures have no direct impact on land use or management. Nevertheless they can have a significant indirect impact through information and advice that influences farmers' land management decisions and through support for particular forms of production. In the previous chapter, the role of the farm advisory services was described (Section 6.4.3), and it was concluded that these currently have a limited impact on flood management (Section 6.4.4).

Although not currently funded through the CAP, it is worth noting how the England Catchment Sensitive Farming Delivery Initiative (ECSFDI) is seeking to address long term (and usually diffuse) water pollution issues in fifty priority catchments (covering approximately 40% of agricultural land in England and over 50,000 farmers). This initiative uses locally-based project officers who have access to relatively small capital grant budgets (with a total budget of £5 Million in the first phase of the initiative) to raise awareness of farmers in the steps they can take to reduce pollution and improve water quality. The project officers organise demonstration events and workshops and can make individual farm visits when invited by the farmer. The monitoring and evaluation undertaken to date[58] suggests that the initiative has increased farmers' knowledge of diffuse pollution issues and is increasingly seen by them as a useful source of advice. Flood management has recently

[58] See www.defra.gov.uk/farm/environment/water/csf/pdf/ecsfdi-phase1-report.pdf

been added to the initiative as a secondary objective although it is notable that many of the topics that were already addressed (such as land drainage and soil erosion) are equally relevant to the control of flood run-off as to water quality. There have been two pilot catchment sensitive farming projects in Wales (at a much smaller scale to that operating in England), trials in Scotland and there are plans for an initiative in Northern Ireland (which may receive funding from Axis 2).

To be effective at engaging with farmers and changing their behaviour, training and advisory schemes need good technical information to impart, based on sound scientific evidence. The lack of certainty about how individual actions by farmers can best reduce water run-off and flood generation at a catchment scale limits what training and advice schemes could achieve in this respect (accepting that good scientific evidence is only one of the factors needed to change an individual's behaviour).

The support for restructuring farm businesses and improving their quality of production provides a means of strengthening the core viability of the businesses, reducing their exposure to uncertain commodity markets. While it is the case that only those businesses with spare income to invest will be able to take advantage of the matching capital grants, these schemes should have a long term indirect benefit to these businesses. One way in which these schemes could be made more attractive and accessible to businesses facing greater financial risk as a result of flooding would be to offer a high rate of grant aid (on condition that the investment did not increase the exposure of the business to flooding).

7.3 Axis 2: Improving the environment and the countryside

The second Axis of the RDP receives the greatest proportion of funding, with agri-environment schemes being the main delivery mechanisms in the UK. Support for Less Favoured Areas, afforestation, woodland management and capital grants for environmental investments also fall under this Axis.

7.3.1 Agri-environment schemes

Agri-environment schemes consist of term agreements (usually over ten years) with landowners and managers who receive annual revenue payments in return for delivering a range of land use and management measures. These revenue payments, which are normally set at standard levels, are based on the typical profit foregone and costs of adopting the prescribed measures. The EC regulations state that Member States can compensate farmers for 100% of their loss of income and direct costs attributable to the adoption of the measures, and can include an additional 20% for 'transaction costs' (an incentive that recognises the costs of applying to the scheme and changing management systems).[59] Additional payments can also be made towards the cost of necessary capital investments (see 'non-productive investments' below).

The UK was one of the first EU countries to introduce agri-environment schemes in the form of the Environmentally Sensitive Area (ESA) schemes which started in 1987 in England, Wales and Scotland and in 1988 in Northern Ireland. **Table 7.2** summarises the schemes in place across the UK.

[59] These are based on limits agreed by the World Trade Organisation.

Table 7.2 Agri-Environment Schemes in the UK

Country	Agr-Environment Schemes
England	Environmental Stewardship Scheme (replaced the Environmentally Sensitive Area (ESA) and Countryside Stewardship Schemes in 2005).
Wales	Tir Gofal (developed from Tir Cymen) and Tir Cynnal. Due to be replaced in 2012 by the two tier Glastir scheme
Scotland	Rural Priorities and Land Managers' Options (replaced the Rural Stewardship Scheme (RSS) in 2008).
Northern Ireland	Countryside Management Scheme New Environmentally Sensitive Areas Scheme

In England, the Environmental Stewardship scheme provides funding to farmers and land managers who deliver effective environmental management on their land. The main objectives are to conserve biodiversity, maintain and enhance landscape quality and character, protect the historic environment and natural resources, promote public access and understanding of the countryside, and to ensure the protection of natural resources. Secondary objectives include genetic conservation and flood management. An additional emerging focus for the scheme is climate change adaptation, under which there are opportunities to link delivery of carbon management (in soils and vegetation) with flood risk management. There are three levels to the scheme, with a fourth to be added in 2010:

- Entry Level Stewardship (ELS) – is available to all farmers (i.e. without competition) for the delivery of baseline management practices. Operates as a whole farm scheme.
- Organic Entry Level Stewardship (OELS) – equivalent to the ELS, but for organically-registered holdings.
- Higher Level Stewardship (HLS) – concentrates on more complex types of management where agreements will be tailored to local circumstances. A part farm scheme.
- In 2010, Uplands ELS will replace the Hill Farm Allowance (Section 7.3.5), operating like ELS, but offering a higher payment in return for a greater commitment to upland land management prescriptions to all farmers in England's Severely Disadvantaged Areas.

Under ELS farmers can choose from a range of over 50 management options, each of which has an assigned points value. Farmers must reach a total points target for their land, which is calculated on the basis of total land area. Management options cover a range of areas including boundary features, crop types, management plans and the protection of historic features.

The obligations set under the ES scheme are additional to the regulations of GAECs and SMRs and do not replace the conditions of cross compliance.

In Wales, the way in which Axis 2 is delivered was reviewed during 2008 and an announcement was made by the Assembly Government's Rural Affairs Minister on the new Glastir scheme in May 2009. New applications to the previous schemes, Tir Cynnal (the entry level agri-environment scheme) and Tir Gofal (the higher level scheme) were closed and, subject to agreement with the European Commission, the new two tier Glastir scheme will be open for applications in 2012, with transition arrangements until 2014.

Glastir will have two elements. The first will be open to all farmers in Wales, and the second will be targeted at those areas that can deliver the environmental outcomes that are most important to Wales. Responding to the challenges set out in the CAP Health Check Agenda

(Section 5.1.3), these outcomes will include climate change, carbon capture, water management and biodiversity.

In Scotland, the Rural Stewardship Scheme was replaced by Rural Priorities and Land Managers Options under the SRDP in 2008.

There are two agri-environment schemes in place in Northern Ireland, both of which operate as whole farm schemes: the New Environmentally Sensitive Areas Scheme (NESA) which is now closed to new applicants, and the Countryside Management Scheme (CMS) which was re-launched in 2008. The new CMS has multiple objectives of improving biodiversity, addressing water quality, mitigating climate change, improving soil quality and avoiding marginalisation and land abandonment. It includes a Special Environmental Project option which includes the facility to support co-operative action to enable specific lands to be earmarked as floodplains.

Figure 6.1 shows uptake levels of higher level agri-environment schemes throughout the UK between 1992 and 2007.

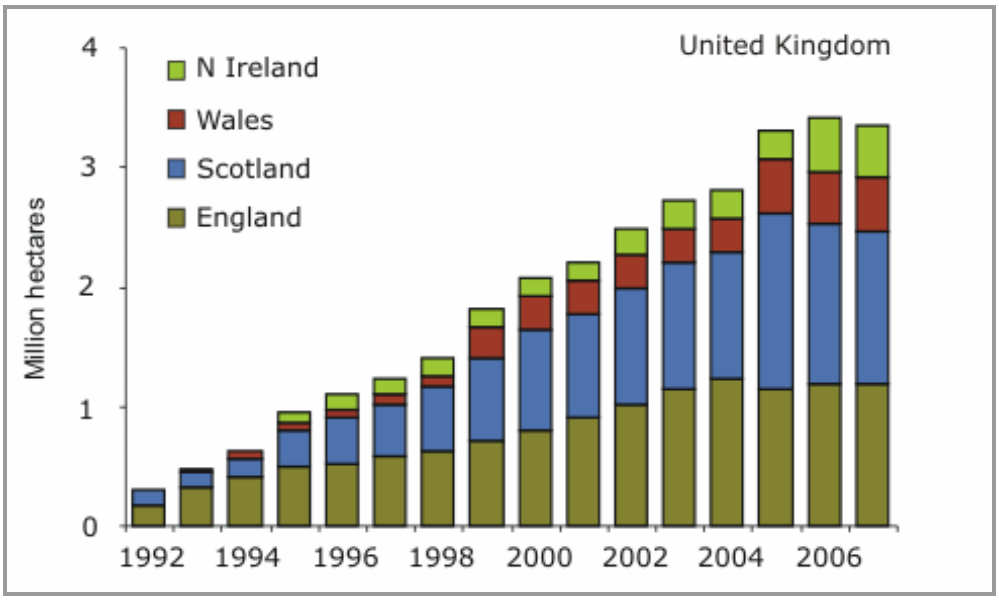

Figure 6.1 Uptake levels of higher level agri-environment schemes in the UK up to 2007

Source: Defra

7.3.2 Influence of agri-environment schemes on farmers' ability to manage flood risk

Agri-environment schemes have multiple environmental objectives, with biodiversity and landscape conservation being particularly important. Flood risk management is generally perceived as a secondary objective.

- In England, flood management is given as a secondary objective of the Higher Level Scheme, with options for soil management, field boundaries, wet grassland, moorland re-wetting and intertidal habitats (saltmarsh and mudflats) all highlighted as providing opportunities for improved flood risk management, but only where they also contribute to a primary objective. In addition, the Entry Level Scheme specifies flood management as one of the potential outcomes from the soil management options.
- In Wales, flood management was not given as a specific objective of either Tir Cynnal or Tir Gofal, although certain measures included within the schemes

provided opportunities in this area, such as the protection of field boundaries, wetland and habitat management, raising water levels, woodland planting and establishment of streamside corridors. Water management (including both water quality and flood risk management) will be one of the targeted outcomes of the Glastir scheme when it is introduced in 2012.

- In Scotland, Sustainable Flood Management is one of the Regional Priorities in the SRDP and there is a package of options available. This package is expected to be revised and Flood Risk Management Plans are likely to be used as a means to target measures in future[60]. In addition, flood management is a stated aim of certain options available under Rural Priorities, including the creation, restoration and management of wetlands, and will be an indirect benefit of others.
- In Northern Ireland, one of the stated aims of the CMS is to develop actions for the mitigation of, and adaptation to, the impacts of climate change. For example, there is support for wetlands with the explicit aim of helping manage flood situations. Other habitat enhancement options such as field boundary enhancement can also assist with flood risk management, although not as a stated aim.

As noted in Chapter 4 (Section 4.54), there is strong synergy between land management practices that deliver improved flood risk management and other environmental objectives such as biodiversity, the historic environment and water quality. To realise these benefits careful targeting is needed at both a field and farm scale. In Chapter 6 (Section 6.4.4), it was noted that farmers and their advisers need technical information to get the best out of changes in land management. Whereas there is increasingly detailed information being used to target activity for primary objectives such as biodiversity (for instance through Biodiversity Action Plans and related initiatives used to delivery Public Service Agreement targets for the condition of Sites of Special Scientific Interest and farmland birds) and water quality (through the draft River Basin District Management Plans), there is much less consensus and clarity over how and where agri-environment scheme options should be directed to reduce flood generation and make space for water in flood and coastal plains.

Strategic approaches such as the Catchment Flood Management Plans in England and Wales provide a good start, but they are currently not statutory and are tentative in relation to changes in land use and management. Critically, these strategic approaches do not currently set out what land use change or management is needed, and at what scale, to provide improved flood risk management.

There is both a lack of good scientific evidence on the land use changes needed to produce flood risk management benefits and also a lack of clarity of the public policy priorities, that will be needed to target agri-environment measures to deliver these benefits.

Agri-environment scheme agreements typically run for relatively short periods and ten year agreements are the norm. Where farmers are required to change the land use in ways that are difficult and costly to reverse, as is the case where land drainage is substantially reduced and water tables rise, a ten year commitment may not be regarded as sufficient. This has been recognised in England where High Level Scheme agreements reverting land to saltmarsh (and other intertidal and fluvial inundation options) run for 20 years. It is likely that applying this same longer period to other land use change options in flood plains (such as the planting of wet woodland or rewetting of arable land on peat) would make them more attractive to farmers and landowners.

The calculation of agri-environment scheme annual payment on the basis of the profit foregone by agreement holders recognises the costs incurred from the adoption of modest

[60] *Pers. comm*. Sarah Hutcheon, SNH.

changes in land management and small-scale changes in land use. These can be supplemented by relatively small matching grants towards necessary capital investment. However, as noted under the discussion of Article 68 measures in the previous chapter (Section 6.5.1) this way of calculating payments is not sufficient to recognise the core costs of maintaining agricultural businesses in areas of high flood risk. Furthermore, where changes in land use require substantial capital investment in new water level management or flood defence structures, these costs are unlikely to be met from the agri-environment scheme budget.

Water Level Management Plans (WLMPs) in England provide a good example of how a strategic approach can be taken to combining revenue funding from agri-environment schemes with capital funding for water level management structures directed through Internal Drainage Boards. WLMPs are intended to deliver biodiversity objectives (being prioritised to designated sites) but the same principal could be used to deliver land use change for flood risk management, in particular to enable land to be used for flood storage.

Changing land use in flood plains and on low-lying coasts frequently affects large blocks of land under different ownership, requiring co-ordinated approaches in which all affected holdings are involved. As noted earlier (Section 4.3.3), previous research has identified the approaches that can be adopted to encourage collective water level management by farmers, including the importance of locally-based facilitation and the involvement of Internal Drainage Boards, where they exist. Agri-environment schemes are voluntary approaches and do not allow for individual holdings to be forced to enter agreements. There have been examples (such as from the Somerset Levels in south west England) where more intensive businesses (for instance dairy farms) have been unwilling to join schemes where payment rates are based on profit-foregone from more extensive (beef and sheep) businesses, and where schemes have therefore not gone ahead. Higher tier agri-environment schemes often provide supplementary payments to encourage collaborative applications, but with generally limited success in the UK.

It may be that the supplementary payments are currently insufficient to overcome resistance by farmers to enter binding commitments with their neighbours or it may there are more fundamental practical reasons (such as the basic incompatibility of enterprises with the proposed agri-environment measures). Whatever the reasons, it is clear that agri-environment schemes are not currently equipped to ensure the necessary 100% involvement in large scale water level management schemes. Varying the rate of payment between different farmers in the same agreement (as occurs in many upland commons agreements in England) and even, in exceptional circumstances, the use of compulsory purchase (where this is provided for by the Land Drainage Act or other legislation) can be used to overcome this.

It is also worth noting that tenancy agreements can be a constraint on the adoption of agri-environment agreements. In Wales, CCW have experience of tenant farmers who are interested in participating in water level management options but have not being able to because of the landlords concern about the loss of land value. Ensuring that payments are available both to tenants and to landlords to cover long term ‘opportunity costs’ and reduced land value should address this. But the situation is inevitably complicated by the difference in the interests of the landlord and tenant, both of whom need to be party to the agreement.

In summary, the influence of agri-environment schemes on flood risk management is currently modest. This impact could be increased provided:

- The priority of flood risk management is raised as an objective, putting it on a par with other objectives such as biodiversity and water quality;

- There is better information available on the spatial targeting of measures that enables flood risk management to be addressed (such as from the Catchment Flood Management Plans being prepared in England and Wales);

- Agreements running over a longer period (20 years) are available where land use changes are difficult and costly to reverse;

- Revenue funding for profits-foregone can be combined with more substantial capital investments in water level management structures; and

- Flexibility can be used in the way payments are calculated to recognise the different costs incurred by businesses and to maximise the opportunity for all holdings in a water level management area to be included in an agreement.

7.3.3 Afforestation and woodland management

A number of woodland establishment and management schemes are in place across the UK. All of these schemes acknowledge the potential role of woodland in flood risk management, as part of the general objective for creating multi-functional woodland cover. Applicants to the schemes are encouraged to demonstrate how the woodland will deliver improved flood risk management (for instance in floodplain wet woodland or stream side shelter belts), amongst the range of other potential benefits that woodland can provide.

English Woodland Grant Scheme: This replaced the Woodland Grant Scheme and the Farm Woodland Premium Scheme, and provides incentives for the creation and management of woodlands and forests in England. It is run by the Forestry Commission and aims to provide jobs and improve the economy of rural areas, and to provide uses for land other than agriculture.

Better Woodlands for Wales: This is a grant scheme run by the Forestry Commission Wales, designed to improve the quality and extent of Wales' woodlands. It was developed in consultation with woodland owners and agents as well as partner organisations of the FCW. Grants are offered on the basis of establishing an approved long-term management plan, which must meet the minimum standards under the UK Woodland Assurance Scheme. This scheme will be replaced by the new agri-environment scheme Glastir when it opens in 2012 (Section 7.3.1).

In Scotland, the ***Scottish Forestry Grants Scheme*** was closed in 2006 and grant support for woodland creation and management is now administered under forestry-specific options within Rural Development Contracts – Rural Priorities.

The ***Northern Ireland Forest Service*** offers grants through the Woodland Grant Scheme, towards the cost of creating and managing woodland, and the Farm Woodland Premium Scheme to help offset the cost of taking land out of agriculture for woodland creation.

Funding for the creation and management of small woodland areas may also be available under agri-environment schemes as part of larger agreements (such as the higher level of Environmental Stewardship in England).

7.3.4 Influence of forestry schemes on farmers' ability to manage flood risk

Schemes such as these provide farmers with the opportunity to take land liable to flooding out of agricultural production. Strategically located woodland can reduce flood risk by slowing flood run-off and providing areas for flood storage.[61] It is particularly important that

[61] Thomas H and Nisbet T (2006)

the location of new woodland is well chosen so that the benefits for flood attenuation or storage can be optimised.

7.3.5 Support for Less Favoured Areas

Less Favoured Areas (LFAs) are defined areas of land within the EU that are difficult to farm as a result of limitations such as high altitude or an unfavourable climate. LFAs were first established in 1975, and in the UK are sub-divided into Disadvantaged Areas (DAs) and Severely Disadvantaged Areas (SDAs).

It is widely accepted that traditional and extensive grazing by beef cattle and sheep have shaped the landscape and biodiversity of the uplands of the UK and contribute greatly to the social fabric of communities in these areas. Until 2001, beef and sheep farmers in the LFAs were entitled to receive headage payment on eligible animals (with higher rates of payment applying in the SDA compared to the DA) through the Hill Livestock Compensatory Allowances (HLCA).

As part of the Agenda 2000 reforms, the HLCA was replaced by separate arrangements in each country. Article 13 of Regulation 1257/1999 stipulated that compensatory payments should be paid based on the land area farmed and must be sufficient to compensate for existing handicaps, whilst avoiding overcompensation. Payments are differentiated to reflect the severity of the natural handicap and are only made to farmers who meet specified criteria relating to the social and environmental objectives of the aid.

LFA support contributes to the achievement of three objectives:

- To ensure continued land use and thereby to contribute to the maintenance of a viable rural community;
- To maintain the countryside; and
- To maintain and promote sustainable farming systems which take into account environmental protection requirements.

In England, LFA measures are currently implemented through the ***Hill Farm Allowance Scheme*** under which area payments are based on the eligible land for sheep breeding and suckler-cow beef production, with enhanced rates available to farmers who have woodland and arable land in the LFA, and reduced rates on large holdings. This scheme will be replaced by the Uplands Entry Level Scheme, part of Environmental Stewardship, in 2010 (Section 7.3.1).

In Wales around 80% of agricultural land is classified as a LFA. Beef and sheep farmers in these areas have been able to received area-based payments through the ***Tir Mynydd*** scheme. From 2012 this will be replaced by a 20% premium on the new ***Glastir*** agri-environment scheme (Section 7.3.1). It will be available to all farmers (including dairy farmers) as a flat rate across the DA and SDA. [62]

In Scotland, approximately 85% of agricultural land is classified as a LFA, of which 98% is Severely Disadvantaged. The ***Less Favoured Area Support Scheme Scotland*** (LFASS) comprises part of the Scottish Rural Development Programme 2007-2013, which is a £1.6 billion programme of economic, environmental and social measures designed to develop rural Scotland.

In Northern Ireland, the LFA covers approximately 70% of agricultural land. Support to beef and sheep farmers in these areas is paid via the ***Less Favoured Areas Compensatory Allowances Scheme***. This Scheme has two components: an area based payment made for

[62] At the time of writing, Glastir is subject to agreement by the European Commission.

eligible Disadvantaged or Severely Disadvantaged Land, and a 'cattle bonus', which increases payments for those producers who have 25% or more of their eligible livestock units as suckler cows or heifers.

Payments made under LFA are dependent on farmers continuing to meet the requirements of GAECs and SMRs.

7.3.6 Influence of LFA support on farmers' ability to manage flood risk

Support schemes for Less Favoured Areas offer no direct incentives for farmers to improve their flood risk management. By supporting the extensive grazing of upland habitats, LFA schemes maintain management of economically marginal areas that might otherwise be abandoned and they ensure farming businesses remain in place so that they may receive more targeted support, through agri-environment schemes or other interventions, that is directed to specific environmental outcomes.

In the recent past (during the 1990s and early 2000s), support in the LFAs probably had a negative impact on flood risk management in many areas by encouraging over-grazing, destruction of peat and the compaction and erosion of soils, leading to increasing flood generation. These negative impacts are likely to have been removed by the changes introduced in each country since 2004. However, in an economic climate where farming is moving 'down the hill', it remains to be seen whether the support now provided in the LFAs is sufficient to prevent land abandonment.

There is uncertainty over whether land abandonment in the uplands, particularly on the highest peat soils, would increase or decrease the speed of flood run-off. Compared to the economic and social benefits from hill farming, and the positive contribution that extensive livestock rearing can bring to biodiversity and cultural landscapes, the arguments for maintaining upland farming in order to provide flood risk management benefits would appear to be weaker.

7.3.7 Non-productive investments

Under Axis 2, capital grants are made available to fund conservation work. In England, these payments are offered only through Environmental Stewardship agreements and cover the cost of activities such as restoring or reinstating traditional boundary features, buildings and ponds. Similarly in Wales, grants to cover a range of specified activities have been administered through Tir Gofal (to be replaced in 2012 by Glastir).

In Northern Ireland, non-productive investments are administered separately from agri-environment schemes. Likewise in Scotland, although non-productive investments are linked to the achievement of agri-environment and afforestation commitments, payments are made independently from the Land Management Options.

7.3.8 Influence of non-productive investments on farmers' ability to manage flood risk

In the main, these capital grants are supporting the multiple objectives of agri-environment schemes, which, as noted above, are principally concerned with providing ten year profit-foregone agreements, and are not available to fund large flood defence or water level management investments. There appears to be unmet potential for capital funding of water level management structures outside the agri-environment schemes in this element of Axis 2.

7.4 Axis 3: Quality of life and economic diversification

Under the third Axis of the Rural Development Programme, measures are included to support economic and social goals as well as environmental ones. The Axis focuses on the quality of life and economic diversification in rural communities, but as it is not always implemented on a national scale, the schemes in place vary between different regions.

7.4.1 Support for rural communities

Within Axis 3 of the UK's Rural Development Programmes, a range of measures are included which aim to support local communities and to improve quality of life in rural areas. In practice, there are strong links between the delivery of this element of Axis 3 and the Leader programmes under Axis 4 (accepting that Axis 3 support is potentially available in all areas whereas Axis 4 support is limited to Leader areas).

Measures included under Axis 3 that cover rural quality of life include the improvement of basic services for the economy and rural population, village renewal and development and the conservation and upgrading of rural heritage. These measures feature in all of the four UK's RDPs; however because Axis 3 is delivered at a local level across the whole of the UK, there will be regional variations in the schemes that are in place.

7.4.2 Influence of support for rural communities on farmers' ability to manage flood risk

There is very little reference in the national Rural Development Programme documents to the potential for rural communities to improve their own flood risk management, such as through flood warning schemes, the use of Sustainable Drainage Systems (SuDs) or improved 'hard' defences or for increased collaboration with landowners to detain flood water.

The main reason for the RDP not being seen as a significant delivery mechanism for flood defence of communities is that the resources available are relatively insignificant compared to the large budgets that are deployed for flood defence. As noted many times in this report, the lack of evidence about how and where changes in land use can make a significant impact on flood risk mean that there will continue to be a preference for hard engineering in flood protection (aside from the prevention of development in floodplains). There may however be a role for using this delivery mechanism in cases where smaller scale or muddy floods affect particular locations or properties.

There are opportunities for Axis 3 (together with the Leader Axis below) to increase engagement between communities and landowners over land management and land use. The benefits of this increased engagement are likely to be two fold.

- Firstly, the dialogue between communities and landowners on flooding issues could do much to increase awareness at a local level of how land use and management can contribute cumulatively to preventing smaller scale floods and local flood generation, providing farmers with a stronger sense of the downstream benefits that can accrue from changes they make.

- Secondly, seeing land close to settlements in floodplains as a potential community resource, could increase the justification for public investment in this land from agri-environment schemes or other sources. The community benefits that can be provided by this land include not only temporary flood storage but also public open space, a nature reserve, education resource and source of biomass for renewable energy. The planning system is taking a more strategic approach to the use of green space (or green infrastructure) in and close to settlements and this element of

the RDP could facilitate greater engagement by communities and landowners in this process.

7.4.3 Economic diversification

A range of measures are in place under the RDPs which aim to aid economic diversification within the rural communities of the UK. These measures involve funding for micro-enterprise, skills training and support for tourism-related activities. Funding in England is administered on a regional scale within the guidance of the national RDP. Similarly in Scotland, each region has identified priority outcomes to aid the delivery of the key outcomes of the national RDP, which include business viability and competitiveness. In Wales, assistance is given to help farming families diversify into non-agricultural activities and similarly in Northern Ireland, the stated aims of this part of the RDP include diversification, business creation, and support for tourism.

7.4.4 Influence of economic diversification on farmers' ability to manage flood risk

The influence of economic diversification schemes is similar to that of the capital grant schemes contained in Axis 1. Although these measures have little direct impact on flood risk mitigation or management, the resulting increased economic diversification improves the understanding and robustness of the rural economy in its ability to deal with the impacts of extreme weather events such as flooding.

7.5 Axis 4: LEADER

As noted above, Axis 4 of the RDP focuses on support for rural communities, based on a locally motivated, 'bottom-up' approach. Leader is not a separate fund or set of objectives; rather it is a delivery mechanism through which funds allocated to the RDPs can be invested. It is implemented through Local Action Groups (LAGs), which are comprised of public and private partners and local interest groups and are intended to cover a broad range of interests. Leader aims to achieve local development objectives and to increase the capacity of rural communities and business networks by building knowledge and skills and by encouraging innovation and co-operation.

In England, Leader support is provided in three areas: implementing local development strategies, implementing co-operation projects involving objectives from the other three axes, and for running LAGs. The approach delivers a minimum of 5% of the EU funds within the RDP, totalling at least £105m across England.

In Scotland, Leader accounts for around £38 million of the total SRDP funds. Additional funding of £19 million has been awarded to seven LAGs in the Highlands and Islands, because of the area's previous status as disadvantaged and remote. As in other territories, LAGs are responsible for awarding funding in their regions, granting support to projects which are community driven and have widely beneficial outcomes.

In Wales, Axes 3 and 4 are delivered together in order to promote closer integration of funding streams and to ensure coherence and co-operation at the local level. Each Local Authority area has a single combined Axis 3 and Axis 4 Partnership, but although the Axis 4 LAG is a full member of the Partnership, it is a separate body and complies fully with EU requirements regarding the implementation of Leader activities.

In Northern Ireland, Axes 3 and 4 are being delivered together at a sub-regional level. Seven local council clusters are working with new LAGs to prepare and implement Axis 3 of the NIRDP at local level. They can choose from its various measures covering diversification into non-agricultural activities; business creation and development;

encouragement of tourism activities; basic services for the economy and rural population; village renewal and development; and conservation and upgrading of the rural heritage.

7.5.1 Influence of Leader on farmers' ability to manage flood risk

The same comments apply to the links between the Leader programmes and flood risk management that were made previously for the support for rural communities under Axis 3. There is unmet potential for initiatives originating with Local Action Groups to engage with farmers and landowners in order to address flood defence and risk management, for example through flood warning schemes or through changes in land use and management. An aim of the LEADER initiative is the sharing of 'best practice' not only locally and nationally but across the EU. This offers the opportunity to exchange information between LAGs over novel flood risk management measures across the EU.

LAGs are facilitated by project officers (usually based within local authorities). Making them aware of the opportunities to address local communities' flood risk issues through changes in land use or management will be a key way of increasing the influence of the Leader Axis on farmers flood risk management practices. The points made under Section 7.4.2 are also relevant.

7.6 Different approaches to regional targeting

Finally, it is worth noting that there are different approaches taken across the UK's national territories towards the matching of RDP measures to regional goals. In England and Wales, Axis 2 measures are delivered nationally, but with more local targeting statements (in England there are separate targeting statements for each National Character Areas – formerly known as Joint Character Areas), while Axes 1, 3 and 4 are delivered at a regional level by Regional Development Agencies in England and by local authorities or groups of local authorities in Wales. In Scotland, the Land Management Contracts are administered nationally by the Scottish Government Rural Payments and Inspection Directorate (SGRPID) but Regional Project Assessment Committees (RPACs), which have broad stakeholder representation, establish Regional Priorities that determine which contracts are supported on a range of topics including water quality, adaptations to mitigate climate change and biodiversity and landscapes. In Northern Ireland, there is a division of responsibility between the Department of Agriculture and Rural Development and clusters of local council (Section 7.1).

The evidence from this study suggests that the natural variation in water management issues between coastal areas, floodplains and the headwaters of catchments means that the regional setting of priorities for RDP spending on flood risk management is likely to result in better targeted and more effective measures.

7.7 Key findings on the impact of Pillar II measures

The following conclusions emerge from this chapter:

- The agri-environment and forestry schemes contained in Axis 2 are the only parts of Pillar II that directly influence the use and management of land. Flood risk management is generally considered a secondary objective of these schemes. It is unlikely that its profile as an objective will be raised until there is clearer spatial targeting information available (such as from the Catchment Flood Management Plans being prepared in England and Wales). Making agreements available over a longer period, increasing the flexibility for annual payments that recognise local variation in farming costs, and better co-ordination with non-CAP flood defence spending would all help to improve the impact of agri-environment and forestry schemes.
- Axis 1 of the Rural Development Programme provides scope for training and advice programmes to increase farmers' awareness of the actions they can take to mitigate and adapt to flooding. It is significant that the largest initiative providing water quality advice (but not flood risk management) in the UK – the England Catchment Sensitive Farming Delivery Initiative) – is not funded by the CAP but from national funds. There are opportunities for using Axis 1 funds to pay for locally delivered schemes of this kind.
- There is little evidence that Axes 3 and 4, which provide support to rural communities, have any significant influence on flood risk management. There are opportunities for using these Axes to encourage engagement at a local level between communities that are at risk of flooding and local landowners who might be able to reduce this flood risk. This could be combined with strategic approaches through the planning system for designing green infrastructure around settlements that is able to provide flood water storage as well as a range of other compatible services.
- Other elements of Pillar II such as the Axis 1 schemes to encourage restructuring and quality production, Axis 2 support for Less Favoured Areas and the Axis 3 schemes assisting economic diversification can bolster the economic viability of farming businesses, putting them in a better position to adapt to the financial risks from a changing climate and increased flooding. Whether it is always necessary for land to be managed by farming businesses for it to delivery flood management benefits is a moot point.

8 Non-CAP measures

Detailed analysis of the range of policies and programmes that exist outside the CAP and have an influence on farmers' adaptation to, and mitigation of, flood risk, lies outside the scope of this report. However, the relationship between these and the measures that existing within the CAP is important. This Chapter is split into five sections covering

- Flood risk management policy and expenditure
- Land use planning
- EU Structural funds
- Financial instruments
- Regulation
- Key findings on links with the CAP

8.1 Flood Defence and risk management

Large sums of money are spent by national authorities on flood protection. Following the 2007 floods, the UK government agreed to spend £1.5 billion on flood defences between 2009 and 2011. In England and Wales in 2006/07, the Environment Agency had a budget of £176 million for maintaining existing flood defences and £162 million building new ones. The Scottish Government is investing £40 million over 3 years from 2007 to reduce the flood risk for 1,850 properties. Although the majority of this money is spent on the maintenance of hard engineering (sea walls and flood banks), there is increasing attention to the use of soft defences or natural realignments, making use of the resistive power of land to slow the progress of, and store, flood water.

In the UK, the flooding that has occurred in recent years and the growing evidence of increase flood risk from climate change are leading to a renewal of national policy. In England this is most evident through Defra's policy, 'Making Space for Water' which is developing a more integrated strategic approach to flood and coastal erosion risk management. This is seeking to develop policy that takes a holistic approach, spatially and sectorally, based on an evidenced-based assessment of risk that assesses environmental and social as well as economic impacts. These objectives are becoming evident in Catchment Flood Management Plans and Shoreline Management Plans.

Catchment Flood Management Plans have been prepared for England and Wales by the Environment Agency. They are non-statutory documents, aiming to understand the factors that contribute to flood risk within a catchment and to recommend the best ways of managing future flood risk within the catchment. Shoreline Management Plans provide an assessment of the risks associated with coastal processes and provide a policy framework to reduce the risks to people and the environment in a sustainable way. The first round of SMPs are technical in their content, but the second (ongoing) round aim to achieve a greater level of engagement with communities and stakeholders.

The Environment Agency in England and Wales operates a flood warning service in areas at risk of flooding from rivers or the sea. Flooding warnings are issued through the media, website and direct to subscribing homes and businesses considered to be at risk of flooding via telephone phone, e-mail, fax or pager. In Scotland, SEPA is the flood warning authority and in Northern Ireland, the Rivers Agency is responsible for flood defence but does not currently operate a flood warning system.

There is currently very little integration between the way that CAP measures are directed to flood risk management and the national spending on flood defence which are guided by the strategic approaches and systems described above. Large sums of money being spent on the maintenance of existing hard engineering defences but there is very little co-ordination with the revenue payments being made to farmers through agri-environment schemes on water level management, which tend to be driven by a range of objectives of which flood risk management is a minor element.

The Catchment Flood Management Plans and Shoreline Management Plans provide the most appropriate link for greater integration. However, since they are not statutory, are under review and provide only partial coverage across the UK, neither currently provide the basis for targeted intervention through the CAP Rural Development Programmes. Nevertheless, over time, these plans could form a similar role to Biodiversity Action Plans and River Basin Management Plans in setting out spatially targeted land use and management objectives for flood risk management, implemented through Rural Development Programmes and other national initiatives.

Although there are clearly opportunities for greater integration between agri-environment schemes and delivery of flood defence priorities, it should be noted that UK Treasury and EU State Aid rules mean that spending has to be carefully accounted to avoid double funding. Agri-environment schemes cannot be used to fund mitigation measures that are required as a condition of the authorisation of flood defence works. However, they can be used to add value to these works for instance providing wetland habitats that provide additional flood protection to that contained in 'engineered' parts of the project.

8.2 Land use planning

Strategic land use and development planning takes place at a 'cascade' of scales from national statements and regional strategies to local plans, with the level of spatial detail increasing at each scale. In the UK, the Government has proposed that a set of new 'National Planning Statements' will identify national priorities, enabling the largest and most important infrastructure developments to pass more quickly through local and regional planning processes. Government is currently consulting on which topics should be covered by the National Planning Statements. Given the size of the challenge facing many coastal communities, including several large urban areas, from fluvial and marine flooding, it is likely that land use change for flood protection (including coastal realignment) will be covered by the National Planning Statements.

National planning authorities issue guidance documents that regional and local planning authorities are expected to abide by. For instance, the national policy statements[63] covering development and flood risk set out how flood risk should be considered at all stages of the planning and development process, in order to reduce damage to property and loss of life. They expect local planning authorities to develop policies that direct development away from areas where the risk of flooding is high. Similarly, there are national policy statements on planning and climate change requiring regional and local planning authorities to take anticipate and seek to mitigate the impact of climate change on development.

In England, Scotland and Wales, there is a sub-national tier of planning which is relatively new. In England these are the Regional Spatial Plans which are shortly to merge with Regional Economic Strategies. The national Wales Spatial Plan is split into six Spatial Plan areas. In Scotland, middle tier Strategic Development Plans are being drawn up for the

[63] In England: Planning Policy Guidance Note 25; in Wales: Technical Advice Note 15; in Scotland: Planning Policy 7 and in Northern Ireland: Planning Policy Statement 15.

major urban areas. The primary focus of these plans is on economic and social development and, outside areas facing the most acute levels of flood risk (such as parts of the coast of the Eastern Region of England), these make little reference to flood risk management in spatial planning.

Local Development Frameworks or Plans, contain the planning policies against which applications for development are judged. In England, local planning authorities are required to develop Strategic Flood Risk Assessments that take an evidence-based approach to identifying those areas where development can take place and what types of development are acceptable (giving greatest priority to areas of lowest flood hazard). In some areas such as Greater London and Greater Manchester, SFRAs have been drawn up at a sub-regional level. In many areas, local authorities have yet to prepare SFRAs.

8.3 EU Structural funds

Chapter 5 described the system of structural funds and programmes. It suggested that in the UK in previous plan periods, the European Regional Development Fund has been used to co-fund large infrastructure projects, including flood defence works, but the lower budgets in most parts of the UK is likely to reduce this impact in the current plan period. These funded projects have been delivered as part of regional flood defence programmes with little co-ordination between them and spending on agri-environment schemes. For the most part, opportunities have been lost to use agri-environment schemes to add value to capital investment projects funded by the European Regional Development Fund.

8.4 Financial instruments

Taxation of individuals and businesses is used by Governments to raise revenue for public spending. However, variable taxation and the use of tax allowances can be used as an instrument of policy to favour certain activities over others. Agricultural land and businesses benefit from relief from many taxes so the scope for offering lower rates of tax to, for instance, farmers willing to store flood water, is less than it might be in other sectors of business. However, the principle of using national taxation to encourage the provision of non-market services is accepted in other areas of policy (for instance businesses providing childcare to employees) and is worthy of consideration in this context.

- Drainage Authorities already have powers to raise a levy on landowners in their area under the Land Drainage Act. This form of positive taxation could be used to reallocate money between landowners who provide improved flood risk management and those who benefit from it. The same principle could be applied to a local precept on tax for households and businesses to fund flood defence services provided on land.
- Chapter 4 noted that businesses in high flood risk areas are finding it increasingly difficult to obtain commercial insurance. A system of redistributing risk (a form of state sponsored flood insurance) could be introduced along similar lines to the way national insurance collected from businesses was set up to provide for unemployment benefit.

While these suggestions could be considered as part of national strategies, there is likely to be resistance from some Member States to introducing tax raising and redistribution powers as part of the CAP. The use of these financial instruments is therefore likely to remain available as a national measure to complement the CAP.

8.5 Regulation

In comparison with other environmental services such as water quality, biodiversity and landscape protection, there is a sparse regulatory 'floor' to flood risk management policy. This is partly down to the historical lack of sound evidence of damaging practices on which to establish binding commitments through regulation. But it is unlikely that an equivalent of the 'polluter pays' principle ('flooder pays') can be easily applied to flood risk management since, unlike pollution, flood water does not originate with any business put passes through them on its way down the catchment or along the coast.

It is also the case that regulation covering topics closely related to flooding, such as water quality take little account of their impact on flood risk management. For instance nitrate action programme evaluations generally conclude that action is not required in areas with high rainfall (because of the dilution effects on leached nutrients) but this may result in higher stocking levels in these areas, increasing the risk of soil compaction and surface run-off.

Chapter 4 identified land management practices that reduce soil infiltration and increase flood run-off and which, across catchments as a whole, may increase flood peaks. There is scope for using cross compliance to discourage these practices (particularly where they may also be responsible for other negative impacts such as soil erosion and poor water quality), but the difficulty of demonstrating a cause and effect relationship between these diffuse activities and downstream flooding means that legislation to bring prosecutions is unlikely to be effective.

The exception to this is that increasingly prescriptive requirements are likely to be applied to development in floodplains that, if they went ahead, would be at risk from flood damage and could become a liability for public investment in flood defence.

8.6 Key findings on the impact of non-CAP measures

The following conclusions emerge from this chapter:

- There is very little evidence of integration between CAP measures and nationally directed expenditure on flood defence and strategic policies for flood risk management in the UK.
- It is in the targeting of rural development Axes 2 and 3 measures (particularly the agri-environment and forestry schemes and the involvement of local communities in land management for flood storage) that there is most potential for this integration to take place. Three benefits could be achieved.
    - Firstly, strategic flood risk planning documents could be used to target the most effective locations for suitable local land use and management options.
    - Secondly, rural development initiatives with local communities (such as through Leader Local Action Groups) could provide an interface between regional and local spatial planning and agricultural land use and management that lies outside the planning system but can be influenced through Axis 2 of the CAP.
    - Thirdly, agri-environment scheme agreements could be used to complement and add value to flood defence investment and maintenance schemes.
- There are several ways in which taxation and other financial instruments might be used to redistribute money from businesses and households benefiting from improved flood protection to landowners providing that benefit, but these arrangements will be organised by national governments and are likely to lie outside the remit of the CAP.

9 Conclusions and recommendations

This final chapter draws together the findings of the previous chapters and sets out the overall conclusions of the study. As required by the brief for the study it "*recommends changes that could be made to the current arrangements in CAP, either on an individual payments level, the Rural Development Regulation or through strategic changes to CAP priorities*". These recommendations are phrased as general requirements for change that LUPG, its members and others can seek to incorporate into public policy, rather than statements of the specific actions that named organisations should adopt.

The chapter is arranged under the following headings:

- Gaps in the evidence
- Threats facing farmers from flooding
- Adaptation measures available to farmers
- The overall influence of the CAP
- Reducing the negative impacts of the CAP
- Increasing the positive impacts of the CAP
- Improving co-ordination of the CAP with other measures

9.1 Gaps in the evidence

Although forecasts of the changing climate and risk of flooding are improving, they are still imprecise at the level of individual landscapes and farming types. The way in which changing patterns of rainfall and rising sea level interact with land use and other factors, leading to the generation of floods, is complex. This means that predicting future flood risk at a fine enough spatial and temporal scale that allows businesses to anticipate particular extreme flood events requires an accuracy of forecasting that we are unlikely to fully achieve. It is therefore inevitable that businesses will have to accept increased uncertainty and this is something that they will need to plan for (covered further below).

However, if policy interventions to mitigate the impacts of flooding are to be correctly targeted and cost effective, it is essential that they are based on sound evidence. One key issue that deserves more attention is the extent to which changes in agricultural land use and management practices change the flood response of catchments and generate flooding. This study has identified that farmers can reduce the impact of higher rainfall on their own businesses by maintaining efficient land drainage and that this may result in faster flood responses in the catchment. We know that land management and use changes can have significant effects on a local scale, for instance generating smaller 'muddy flood' events. However, it is not clear how significant these actions are in increasing downstream flood risk, particularly in relation to extreme flood events at a large catchment scale. Conversely, if farmers are to be encouraged to adopt measures that reduce the risk of surface water run-off, it must be clear that these actions produce significant benefits and, where possible, at the larger landscape scale. Better knowledge of the relationship between farming practices and flood risk, taking account of the diversity of agricultural land use, is needed at two levels. This gives rise to two recommendations:

> **Recommendation 1**: Research should be undertaken at an EU scale to quantify the scale of potential impacts from land management on major flood events and identify the circumstances under which these impacts are most significant (both positive and negative).

Recommendation 2: Building on existing work, such as the Pontbren Project in central Wales, this research should be used at the scale of individual catchments to model the impact of land use and management on the flood response of the catchments under different rainfall conditions, enabling targeted interventions through the CAP and other measures, to reduce the risk of surface run-off from farmland generating floods.

9.2 Threats facing farmers from flooding

Climate change is forecast to increase the severity of extreme weather events to all areas and this will increase the volatility of agricultural markets as a whole and is likely to increase fixed costs such as those incurred from land drainage and insurance. However, apart from these generic impacts, it is important to understand that flood risk and the impacts of flooding will be felt very differently by farmers in different areas and sectors.

Across countries as a whole, the most severe impacts (involving significant damage to land and property) will be felt by the minority of farmers who occupy land in floodplains and low lying coasts. To a large extent, these farmers receive flood water generated from other land over which they have no control.

It is significant that flood and coastal plains tend to have disproportionately large areas of the most productive land, with concomitantly high capital values. It is the past history of flooding that has created the rich soils in floodplains but, in order to take most advantage of this productive capacity, the land needs to be freely drained and defended from lengthy inundation. Flooding therefore creates a disproportionately significant impact for these farmers, and to the country as a whole, in relation to agricultural productivity, food supply and land values.

In comparison, the majority of farmers who occupy land outside these high flood risk areas face sub-critical impacts which increase variable and management costs and depress crop and livestock yields. Land that is most sensitive to high levels of surface water run-off and that may generate floods downstream tends to be steeply sloping, meaning that it usually has lower agricultural productivity and capital value.

The significantly higher levels of impacts experienced by occupiers of land in floodplains is recognised in some areas of policy (such as the provision of flood warning services), but has not been recognised in others. Although not directly equivalent, it should be noted that the physical disadvantage experienced in certain areas (such as mountain and hill land) is recognised through Less Favoured Area status, but that no equivalent status is available to recognise the risk experienced by farmers in floodplains.

Recommendation 3: Land use and agricultural policy should recognise more explicitly that the impacts of flood events are borne disproportionately by landowners occupying land at high risk from fluvial or marine flooding. There is scope for recognising this disadvantage through a designation similar to Less Favoured Areas, enabling suitable policy measures, such as differential rates of land management payments, to be targeted to this land. These payments would recognise the productive disadvantage as well as opportunities for providing a range of public benefits on land most at risk of flooding.

9.3 Adaptation measures available to Farmers

Across catchments as a whole, the majority of farmers are able to take action on their own land that reduces the 'sub-critical' impacts of high rainfall and localised flooding on their own businesses. Most of these actions involve changes in land management and small scale changes in land use (such as the management of soils to improve structure and increase organic matter, and the creation of buffer strips across slopes) that are relatively inexpensive and can be regarded as 'good agricultural practice'. With the exception of improvements to land drainage, measures that benefit the farmer on their own land will also tend to reduce the risk of flood generation to other land, or at the least, will not increase this risk. Despite this, there is currently limited evidence that measures adopted by farmers outside areas of highest flood risk can have a significant catchment-scale impact on flood generation and propagation (although they can help deliver other environmental services such as water quality and biodiversity).

In comparison, occupiers of land at high risk of flooding have more limited options to reduce the harm to their own businesses. They can reduce their liability to losses by choosing land uses that are more compatible with periods of standing water, but these changes usually reduce the agricultural productivity of the land, and are likely to do so over a long period (in other words they may not be easily reversible). There is little that these farmers can do to reduce the risk of flooding from water generated on other land or from the sea.

Nevertheless, changes of land use in floodplains that are compatible with increased flood risk can have significant benefits to other occupiers of the floodplain and can deliver wider environmental benefits. For instance, the use of wet grassland as a flood storage area or wet woodland or saltmarsh to slow the speed of flood water can have significant local benefits on flood propagation, whilst enhancing biodiversity and landscape quality and providing opportunities for recreation.

Recommendation 4: Land use and agricultural policy should distinguish between two distinct types of flood risk adaptation measures on farmland.

- Firstly the majority of land management practices that can reduce the (usually localised) risk of flood generation across all farmland (and also provide other environmental benefits) without incurring significant costs for the farmer should be regarded as 'best practice', requiring no or little financial incentive for their adoption by farmers.
- Secondly, the land use changes needed to reduce the higher risks experienced on land in floodplains, which may also, if appropriately designed, significantly reduce localised flood risk, should be regarded as high cost. Where these changes deliver wider public benefit, they will require significant long term financial incentives to encourage their adoption by landowners.

9.4 Overall influence of the CAP

The CAP is evolving from its origins as an economic and social policy instrument to safeguard domestic food supplies and agricultural incomes. Successive reforms of the CAP since the mid 1990s have increasingly focussed on the delivery of a broad range of environmental, economic and social benefits through support for land use. However, it is still far from providing a coherent land use policy that takes account of the broad range of benefits that land can provide.

In the CAP's current form, it is Axis 2 of Pillar II (particularly the agri-environment and forestry measures) that provides most support for positive flood risk management practices by farmers. Whereas agri-environment entry level options encourage beneficial changes in land management, the higher level options favour land use change. However, flood risk management is seen as secondary amongst many environmental objectives for agri-environment and forestry schemes.

The scale of the threats arising from climate change requires a clearer recognition in the CAP (as in other major instruments of public policy affecting land use) and guidance for the objectives that should be pursued to reduce and adapt to these threats.

In the past, large parts of the CAP have had distorting and largely unforeseen impacts on the environment (such as the conversion of semi-natural habitats to improved farmland which was encouraged by guaranteed prices and unsustainably high stocking levels in the uplands which were encouraged by livestock premia). Action is needed to ensure that current measures and future reforms of the CAP do not have distorting or damaging impacts on flood risk management.

> **Recommendation 5:** Flood risk management and mitigation should become a cross-cutting objective of the CAP, along with other objectives designed to address the threat of climate change. All parts of the CAP should be 'flood-proofed' at both an EU and Member State level to ensure that, at the very least, they do not increase flood risk or restrict the opportunities for farmers to adapt to increased flood risk.

9.5 Reducing the negative impacts of the CAP

Beyond this overall objective, there are a few instances where elements of the CAP are, or may be, hindering opportunities for positive adaptation of land to reduce flood risk.

This study has recognised that the Single Payment Scheme provides farmers with an income stream (at least until 2013) that reduces their exposure to losses from flood damage. It provides a financial 'hedge' of income that is not at risk from flood events. However, land claiming the Single Payment must be available during the year in question for basic levels of agricultural production.

> **Recommendation 6:** The rules of the Single Payment Scheme should be amended to enable continuing payments to be made on land that, although it may no longer be available for agricultural production, is recognised by a competent national body as contributing to flood risk management or mitigation.

Most upland areas are in receipt of funding from the CAP in recognition of the physical handicaps that must be overcome to farm this land, and the environmental services provided by this land. Without continuing financial support from the CAP, it is likely that agricultural management of many upland areas would cease. Extensive grazing by livestock is regarded as compatible with, and often necessary for the delivery of, most public goods provided by the uplands such as the maintenance of remote communities, biodiversity and the provision of public access. However this may not always be the case for flood risk. Even basic levels of agricultural management to make land available for livestock grazing such as the maintenance of tracks across open moorland and land drainage on grassland, as well as the suppression of scrub by livestock themselves, tends to increase surface run-off water and may reduce the water holding capacity of the vegetation and soils. While it would be wrong to suggest that this justifies withdrawal of support for agricultural management in the

uplands, it is important that the benefits to local economies, biodiversity and recreation are balanced with potential negative impacts of increased flood generation.

Recommendation 7: Financial support schemes for farming in the uplands should take account of the potential negative impacts of agricultural land use on flood generation in the headwaters of catchments.

9.6 Increasing the positive impacts of the CAP

For those measures that farmers across catchments as a whole can adopt to reduce the impact of flooding on their own businesses, there is little evidence that current CAP measures are contributing significantly to these. As noted above, these are often cost neutral or low cost and can be regarded as part of 'best practice'. While these measures do not justify significant profit-foregone payments, it seems likely that many farmers are unaware of the measures they can take or are unaware of their benefits.

It is likely that cross compliance measures have had little positive impact on flood risk management to date because of the lack of focus on appropriate practices and the low level of enforcement. New measures introduced as part of the CAP Health Check at the end of 2008 could (depending on how they are delivered by Member States) increase the positive impact of cross compliance in terms of reduced flood generation at a farm and localised scale within catchments. However, the full benefits of any new cross compliance measures are only likely to be met if they are accompanied by a campaign of awareness raising and demonstration to farmers, emphasising the benefits to farmers own businesses of adopting simple land management measures. The England Catchment Sensitive Farming Delivery Initiative demonstrates how a targeted approach (in this case focussed mainly on water quality) can increase farmers' awareness and willingness to adopt favourable practices.

Recommendation 8: To ensure that the full benefits of the new water-based cross compliance rules are realised, Member States should be encouraged to operate advisory programmes (funded through Axis 1 of Pillar II) that increase farmers' awareness of management practices that reduce the risk of flood generation on their own and neighbouring land (see also Recommendation 10).

The new Article 68 measure introduced to Pillar 1 of the CAP at the end of 2008 is still an unknown quantity. It could be used to provide direct support to maintain positive land management in areas at risk of flood and coastal erosion. As such, it could form the basis of a new level of recognition by the CAP of the disadvantages faced by farmers in these areas (Recommendation 3) and the potential for positive land use change in these areas (second bullet of Recommendation 4).

The scope to underwrite crop insurance premia through Article 68 appears to be an attractive option at first sight but would be likely to encourage unsustainable land uses and, under most circumstances, would be counter-productive.

The overall conclusion on Article 68 is that decisions by Member States of whether and how they adopt this measure will depend on their long term strategic objectives for the CAP, particularly on whether they wish to adopt the precedence of coupled direct support returning to Pillar 1 of the CAP

Turning to Pillar II of the CAP, there are clearly opportunities to increase the level of targeted support to achieve defined flood risk management benefits through each of the Axes in Pillar II.

Before examining the opportunities in each of the Axes, it is worth examining the arrangements available to target support through Pillar II measures. In order to have any significant impact on flood risk management at a catchment scale, it is clear that land use and management measures need to be spatially targeted to those areas that will deliver most benefit to reduce flood generation. In order to be adopted in a co-ordinated way across large areas where they are needed requires active involvement by large numbers if not the majority of farmers. Based on the experience of the UK, there is no evidence of Pillar II interventions on flood risk management being directed or co-ordinated by the kind of strategic approaches that are available for biodiversity (such as Biodiversity Action Plans), landscape quality (such as the Management Plans in protected landscapes) and are likely to become available for water quality from River Basin Management Plans.

Strategic flood risk management approaches are starting to be developed in parts of the UK through Catchment Flood Management Plans and Shoreline Management Plans. Although these have no statutory basis, they should start to provide the spatial priorities for land use zoning for flood water storage and coastal realignment that could be used to direct Pillar II measures, whether they involve advice and technology transfer, land-based payments or support for community action.

Recommendation 9: The strategic spatial approaches to flood risk assessment and mitigation that are required of Member States by the EU Floods Directive should be used to provide the basis for targeted land use and management interventions through Pillar II of the CAP.

Axis 1 can indirectly support positive adaptation measures by farmers in two ways. Firstly, in a diffuse manner, by supporting economic diversification it reduces farmers' exposure to losses from flooding. Secondly, and more importantly, it can support the development and transfer of knowledge to farmers on positive land management practices. The lack of good research evidence on which to base technical advice has already been noted (Recommendations 1 and 2), as has the need for knowledge to be transferred successfully to farmers (Recommendation 8). Axis 1 funds could have an important role in facilitating these recommendations.

Recommendation 10: Greater emphasis should be given to the use of Axis 1 to apply research and best practice amongst farmers, focussing on how land use and management can deliver improved flood risk management. This should be done both at a generic scale, highlighting measures which can be adopted in all areas, and also at a catchment scale, ensuring that land use and management are used to address the specific flood risk challenges in that catchment. These programmes should seek to deliver integrated outcomes maximising benefits to other environmental services.

Axis 2 measures already provide scope for targeted land management and land use interventions. As noted in Sectrion 9.2, flood risk management is currently regarded as a secondary objective in many schemes, although there is a high degree of complementarity in most landscapes between measures that support flood risk management and other environmental services such as water quality and biodiversity (notwithstanding the comments at Section 9.5). It is hoped that raising flood risk management as a cross-cutting objective of the CAP (Recommendation 5) and improving evidence to support targeted measures (Recommendations 1, 2 and 10) will address this.

There remains an important constraint on the use of Axis 2 funds to support flood risk management measures, particularly on the most valuable agricultural land in floodplains. The ten year timescale and way in which annual payments are calculated may be insufficient

to persuade farmers to undertake major land use changes that are difficult or costly to reverse (such as conversion of highly productive arable land in floodplains to wetland). The payment formula allows for 100% of profit-foregone (income and additional costs) plus an additional 20% as a transaction payment. However, the profit foregone calculation needs to reflect the high productivity of the land in question, rather than a typical figure for all land of this use. Furthermore, these land use changes often incur high capital costs to achieve the necessary engineering of water levels.

There are useful precedents such as where 20 year agreements are available for the conversion of farmland to salt marsh, and where large capital programmes have created the conditions under which agri-environment schemes can flourish (Section 4.2.3). But there is more than could be done to create a consistent and co-ordinated approach.

Recommendation 11: There needs to be a formal recognition by the EC and Member States that, in order to persuade landowners to convert productive farmland in floodplains for better flood water storage and coastal realignment, the agreements available under Axis 2 schemes must acknowledge the high costs and long term commitments involved. Higher profit foregone payments and longer agreement periods than is the norm in other areas will often be needed. In addition, high one-off capital costs will need to be made available through national funding priorities within Flood risk Management budgets.

Axis 3 and the Leader programmes current have little direct or indirect influence on flood risk management by farmers. This is again likely to be because of the lack of clear research evidence demonstrating how land use and management can minimise flooding and its after effects. However, there is the potential for greater involvement by communities with farmers in determining more local flood risk management strategies involving farmed land, particularly where these deliver wider community benefits such as the production of wood heat for community use. There is scope for pilot projects in at-risk areas, to demonstrate how this could deliver positive outcomes.

Recommendation 12: Member States should be encouraged to use Axis 3 and Leader programmes in areas at high risks of flood generation or propagation to pilot approaches to using land for flood risk management that deliver multiple benefits to local communities.

9.7 Improving co-ordination of the CAP with other measures

In the UK and in many other Member States (encouraged by the Floods Directive), strategic planning of flood and coastal risk management, involving an appreciation of land use planning, is developing. The development of Catchment Flood Management Plans and Shoreline Management Plans in England and Wales are examples of this. As noted above, these currently have no statutory weight but will be used to guide other interventions such as flood defence investment, development control and regulation.

As noted above (Recommendation 9), there is the potential, as yet unrealised, to use CAP measures (such as Axis 1, Axis 2 agri-environment and forestry schemes and potentially Article 68 measures) to support these strategic flood and coastal management plans. This could provide a way of compensating farmers whose land is used as temporary flood storage, for which there is currently no other obvious mechanism.

Large sums of money are allocated for flood defence and coastal protection, most of which is spent on the maintenance of existing hard structures. However, new capital investment is increasingly being used for 'soft' land use and management projects. As noted above (Section 9.6), there is currently little co-ordination at the planning stage, between these projects and the payments that are available from agri-environment schemes. Better co-ordination holds out the potential benefit of adding value to these investments, and also providing a broader range of environmental benefits through the agri-environment scheme multiple objective approach.

Recommendation 13: As highlighted in other recommendations, there is potential to improve the way in which CAP measures, particularly those in Axis 2, provide the means to deliver EU and national objectives for flood risk management. This requires greater co-ordination within Rural Development Programmes, and in the targeting of individual rural development measures, with strategic land use policies.

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