scottish borders pilot regional land use framework

Scottish Borders COUNCIL

TWEED FORUM

FRAMEWORK

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Important Note

The maps included in the document are for illustrative purposes only. Readers are advised to use the online maps **www.scotborders.gov.uk/pilotLUSconsultation/maps** which can be zoomed in to a scale of 1:50,000

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SECTION 1 - INTRODUCTION

1.1. Background:

This document presents a new way of looking at land in the Scottish Borders and the way we use and manage it. In presenting it, we want to raise people's awareness of the many different issues that influence land management and encourage them to think about and respond to the ideas put forward. It is all about providing information in a way and within a framework that we hope will help people make better long-term decisions about land use, at a time of rapid environmental, economic and social change.

Everyone is familiar with the current Borders landscape - the upland moors, sheep farms and forests, the river valleys and rich arable lowlands - and the communities on farms and estates, in villages and in towns that, together sustain and manage the land so as to improve our quality of life. But this is a living and working landscape, one that has changed over time and will continue to do so, as land managers respond to new pressures and challenges that influence the choices they make about the way they manage their land.

Along with local soil and climatic factors, new crop types, new technologies and new markets have all influenced what and how the land is used, but increasingly there are other, wider factors at play that are also shaping the choices land managers and society need to make. New drivers for change - such as falling numbers and rising ages of rural populations, the increasing movement of people to towns, the impact of global trade on prices, the Common Agricultural Policy, concerns about security of food supply, about diseases and pests, and about potential damage to our environment - these and other issues are being reflected in new challenges and opportunities, new laws and policies.

In addition to this web of complex interactions and potential choices, we now have another, potentially overriding challenge – that of climate change. In itself, climate change does not alter any of the previous drivers for change, but it adds a new layer of complexity and uncertainty. We are already beginning to see changes to the way our climate works – warmer winters, longer growing seasons,

more intense rainfall events and flooding - changes that are beginning to have fundamental impacts on the choices we might wish to make about land use in different locations.

Making choices, especially long-term choices, about land use therefore is complex. Subsidies and other financial incentives play a part, as do environmental and economic regulations, but somehow we still need to balance the way we manage land for the long-term and on a large scale, so as to deliver food *and* wildlife, forestry *and* clean water, recreation *and* development, renewable energy *and* beautiful landscapes, flood protection and carbon sequestration – thus achieving multiple benefits for all. We need our best farm land to be productive and managed by those with the experience and expertise to deliver high quality food upon which we all depend. But equally, it is essential that private commercial production, such as intensive arable farming, does not totally dominate the landscape at the expense of alternative benefits the same land might and could produce, such as spaces for walking, for wildlife and clean water – benefits to be enjoyed by everyone.

As noted, land in the Scottish Borders provides us with a wide range of benefits. Some of these, such as food and timber production are obvious activities that support the region's economy, as well as being key components of the local landscape and the Borders' culture and identity. Other benefits, such as the provision of clean water, the maintenance of our archaeological heritage and the enhancement of recreation opportunities are perhaps less obvious or tangible, but they too rely on the way

in which we manage and use our land. But we also demand yet more from our land, such as the storage of carbon in peat soils, the protection of biological diversity and the prevention of flooding - benefits which are often hidden. And to this must also be added new opportunities, such as the provision of renewable energy, and the overarching challenge of climate change. Taken together, this provides us with difficult choices as to how best to optimise the ways in which we use land, so as to meet all these potentially conflicting demands and continue to benefit from it.

The various benefits that management of land and water can provide are sometimes referred to as 'ecosystem services'. These have been subdivided in to four types that together represent the main benefits that go to define our overall quality of life. These are: - **provisioning services** such as agriculture and forestry which provide food and timber; **regulating services** such as filtration of water flowing across the landscape that helps modify and control water quality and the risk of flooding; **cultural services** such as the existence of opportunities for recreation, aesthetic and spiritual benefits; and, underlying these three a set of **supporting services** such as soil formation, pollination and photosynthesis. Some services, notably the provisioning ones are easy to recognise, measure and put an economic value to, others, such as many cultural and supporting ones are more intangible and difficult to measure or value. In taking an Ecosystems Approach, the Land Use Strategy looks to promote the inclusion of all these services when considering options for land management and to ensure that benefits are optimised.

The Scottish Land Use Strategy

In response to this challenge, in March 2011 the Scottish Government published its first ever Land Use Strategy (www.scotland.gov.uk/landusestrategy), the development of which is a key commitment to their response to climate change. In it, the government set out a vision to guide thinking about the way we use our land and how we want to see that develop in the future. It acknowledges that at present we are not getting the best from Scotland's land, even though we continue to demand more and more from it. The Land Use Strategy therefore takes a strategic approach to the many different economic, environmental and social challenges facing land use in Scotland.

By recognising the benefits and implications of our decisions and by focusing on common goals for different land users, the aim of the Strategy is to achieve a more integrated approach to land use, maintaining the future capacity of Scotland's land. This vision is:
A Scotland where we fully recognise, understand and value the importance of our land resources, and where our plans and decisions about land use deliver improved and enduring benefits, enhancing the wellbeing of our nation.

In adopting this vision for land use across Scotland, the strategy recognises three interlinked objectives:
* Land-based businesses working with nature to contribute more to Scotland's prosperity
* Responsible stewardship of Scotland's natural resources delivering more benefits to Scotland's people; and
* Urban and rural communities better connected to the land, with more people enjoying the land and positively influencing land use.

The Scottish Land Use Strategy therefore provides a strategic framework that brings together a wide range of proposals and lays out a set of ten principles for Sustainable Land Use to guide policy-making and decision-making. In particular, it looks to encourage both the public sector, including local authorities, and private individuals to utilise these principles so as to deliver multiple benefits, working in partnership with nature and linking people with the land. It also identifies some 13 proposals that will be taken forward by the government, supported by its partners.

In December 2011, the Scottish Government published the Land Use Strategy Action Plan (http://www.scotland.gov.uk/Publications/2011/12/19161736/0) which sets out how the various proposals in the Land Use Strategy will be taken forward. Annual reports are also provided and in 2014 included a Refreshed Action Plan that provides details of how the Land Use Strategy is being delivered and sets out future action (http://www.scotland.gov.uk/Publications/2014/05/4575).

One of the key proposals in the Action Plan (no 6) is to *"Use demonstration projects to determine the best means by which land use and land management practice can contribute to climate change objectives"*, while no 8 commits to *"Demonstrate how the ecosystem approach could be taken into account in relevant decisions made by public bodies to deliver wider benefits, and provide practical guidance"*. In pursuit of this, the Minister for Environment and Climate Change announced in February 2013 the setting up of two pilot projects,

one to be led by Scottish Borders Council, which would develop regional land use frameworks for the relevant local authority areas. These pilots would use an ecosystems approach to consider existing and future land uses in a collective and integrated way.

Pressures on land use and the potential impacts of climate change

As we have seen, the scale and the issues around land use and land use change are both complex and challenging in their own right. Land is a finite resource and its management is under increasing pressure as we look to maximise its capacity to deliver essential services and other benefits both to the private and public sectors. However, the challenges are not just about development or economic factors influenced by market conditions but, in many instances include environmental, social, political and cultural ones as well. Aging and declining populations in the uplands for example provide challenges alike both to sustaining agriculture such as extensive sheep production and to maintaining rural communities.

Whilst the pressures on land use therefore are multiple and closely interlinked and, as noted the Land Use Strategy seeks a more integrated approach, one of the key drivers for its development has been as a response to the potential impacts of climate change on land use. Looking ahead to 2050, the Land Use Strategy sets out how proposals and policies will help achievement of the Scottish Ministers' duties in relation to adaptation to climate change under Section 57 of the Climate Change

The UK's Climate Change Risk Assessment (CCRA) published in 2012 includes an assessment for Scotland which identified over 130 impacts, the majority of which represent potential threats for Scotland, though some also present potential opportunities. The Scottish Adaptation Programme has principally been built around responding to these threats and opportunities. Whilst there will always be an element of uncertainty and it isn't possible to predict exactly how much the climate may change, broadly speaking Scotland will get warmer, wetter winters along with hotter, drier summers. Actual projections of the amount of change for individual climate variables and the associated probability of their occurrence can be assessed, as detailed in the Scottish Government's Climate Change Adaptation Framework http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/adaptation/AdaptationFramework/TheFramework.

The key changes are likely to be seen in:
- Temperature and Precipitation
- Sea level rise
- Frequency and intensity of Extreme events (such as more extended hot periods; major increases in maximum temperatures, increased intense rainfall events and fewer days of snow and frost); and
- Storms

In terms of the impacts that these changes will make, the threats identified in the CCRA for Scotland are wide ranging. Many of them are directly relevant to land use in the Borders, including those covering:

- Reductions in river flows and water availability during the summer
- Increased risks to agriculture and forestry of pests and diseases
- Increases in flooding which would affect properties, infrastructure and people
- Changes in, or loss of, species and habitats; and
- Increased disruption from extreme weather events.

As noted, there are also some potential opportunities, amongst which can be included:
- Longer tourist seasons and increased tourist numbers; and
- Longer growing season and possible increase in crop yields.

These changes and their associated impacts will have repercussions on the Borders economic performance, natural environment and on communities and individuals. As a result, the responses will need to encompass a range of policy objectives and directions. However, as noted, climate change is but one of the many and competing pressures on land use. The relative scope and scale of its influence in comparison to other drivers remains unknown, as are the means by which policies and practices can be directed to address it.

1.2. Why has a pilot Framework been produced for the Scottish Borders?

In order to explore how the national Land Use Strategy could be implemented, the Scottish Government decided to run two pilot projects at a regional scale. The two were to be developed independently but in each case were to be based upon the geographical area covered by the relevant Local Authority, thus ensuring integration with local decision-making processes and securing a democratic mandate. In the case of the Scottish Borders, this recognises the innovative work already done by among others Scottish Borders Council (SBC) and Tweed Forum in developing

initiatives as the Tweed Catchment Management Plan (2003); the Scottish Borders Woodland Strategy (2005); the Borders Wetland Vision (2006) and the Tweed Wetland Strategy (2010), as well as ground-breaking policies in such areas as biodiversity off-setting and flood risk management.

The pilots look primarily at those land uses which fall outwith the statutory planning system, such as agriculture, forestry, habitat management and conservation of biodiversity, rather than being an extension or alternative to the established planning processes. While a specification sets out the main elements of the work and the preferred approach, the pilots provide an opportunity to explore how this might happen in practice on the ground, through using an 'ecosystems approach'. This approach is one that focuses on integrating management of land, water and living resources, and which recognises that people are an integral part of this process. Local organisations, communities, land managers and individuals all need to be involved, rather than this being seen as something that is 'handed down from above' by some form of authority. In this way, the ecosystem approach looks to promote sustainable use of land and resources in a way; which understands the natural environment and the many benefits and services it provides.

What is the aim of the Framework?

The ultimate aim of the Framework is simply to enable more informed and integrated decisions to be made about how we use land in the Scottish Borders in a sustainable manner. The Framework aims to provide new information in mapped form on the multiple goods and services provided by land use in the Scottish Borders, some of which are possibly currently undervalued or overlooked.

This will enable users to consider in an integrated manner how potential land use changes might impact positively or negatively on the provision of other potential benefits or constraints from the same land.

In promoting use of the Framework, the aim is to make this information available to everyone and to present it in a new way, so that organisations can use it to inform other plans and strategies for which they may be primarily responsible. This will also help such organisations, land managers and indeed individuals to work in partnership to prioritise or guide decisions so as to optimise the use of the land and help address the increasing number of demands society places on it. Reflecting on the possible impacts of climate change on different options for land use, the Framework looks to identify the implications of existing and potential new policy directions that influence land use and might be followed in adapting to climate change.

The Framework does not try to present a picture of what impact climate change might have in the Borders in terms of land capability in the years ahead as a result of predicted changes in environmental factors such as temperature and rainfall. Neither does it aim to provide a single direction or master plan for future land use in the Scottish Borders. Instead, it looks to provide a means by which we can look at different policy choices and identify opportunities to deliver multiple benefits from different land use options. At the same time, it aims to identify where potential conflicts may arise between alternative land uses and suggest how these might be explored and trade-offs identified between competing policy priorities.

In summary then, in producing the Framework, we hope to test how, at a regional scale the Land Use Strategy might be delivered on the ground. In doing so, we shall investigate how existing and future land uses can best be planned and managed in an integrated manner within the context of changing policies that might be developed in response to climate change and other pressures on the rural economy, environment and society. And finally we look to see how this can be achieved through taking an Ecosystem Approach, one that recognises the centrality and importance of engaging with relevant local, regional and national stakeholders, such that they are part of the creation of the opportunities and solutions.

What the Framework is and what it is not

The Framework is designed to be a tool to aid decision-making about land use choices within the Borders region. This decision-making might occur at a number of scales and involve different organisations and individuals, but the Framework is structured such that it can be used by different organisations to assist their own work. It will also enable organisations and land managers facing similar choices about land use, to see which potential options might bring about multiple benefits at a certain location or, conversely create trade-offs between conflicting land uses.

The Framework aims to provide new sources of information about land use, encompassing not only well-recognised and valued management practices such as farming and forestry, but also the many, often hidden, non-market values and products provided by active land management as well. Up until now, some 'services' provided by the land (such as slowing and retaining flood waters, storing carbon or maintaining biological diversity) have not been recognised or valued. By mapping these alongside agricultural production and other traditionally recognised land uses, and then bringing this together visually, the Framework aims to help guide and align the focus and priorities of different organisations and land managers working in the same area to achieve a more integrated and sustainable pattern of land use. By identifying and promoting interests at this scale, there is the potential for real integration and delivery of effective targeted multiple benefits that could be owned and sustained by the local community - for example, its use could help facilitate discussions with land agents and flood protection engineers about priority areas for action to protect vulnerable watersheds or to promote measures to prevent flooding in a joined-up manner.

Whilst the Framework is all about choices for land use in the long-term, it is not part of the formal Planning system, neither will it be used as 'supplementary guidance' in the Planning process. Similarly, it is not being developed as a new regulatory tool, nor something that can or will be used to dictate choices about land use. Finally, the Framework is not about Land Reform. It will however be subject to formal consultation and rigorous review by the Council's Environment & Infrastructure Committee to ensure it aligns with existing policies and is subject to scrutiny and the democratic process at the local level.

Who is the Framework for?

The Framework will be available for use by anyone who has an interest in the way in which land in the Scottish Borders is currently used and how this might change in the future. The Scottish Government has made it clear that delivery of the Land Use Strategy is something that will be taken forward by itself, supported by its partners, including public bodies, land-based industries and others. They expect that the 10 principles for sustainable land use defined within the Land Use Strategy will be used by the wider public sector in the way it manages its own land, develops and implements its plans and strategies and promotes partnership working.

Within this broad definition, some groups are more relevant than others and we have worked within the Scottish Borders to identify and engage with the key groups (stakeholders) who have the most influence over and the most interest in how our land is managed. This includes such important sectors as land-owners and land managers (including SLE); farmers and foresters (including NFUS); environmental regulators, government agencies and their advisors (including RPID, SEPA, SNH, FCS, SRUC); local government and community interests; land-based and rural industries (including tourism); Scottish Water; environmental NGOs (including Tweed Forum, Borders Forest Trust, Southern Upland Partnership); major and other individual estates, community groups and members of the public. In this way, we hope that the Framework reflects work already being done by these organisations and individuals within the Scottish Borders, and that it will be of direct use to them in undertaking their respective functions and operations.

What are the key elements of the Framework and the associated material?

The core of the framework itself is a web-based tool that will allow individuals and organisations to interrogate a series of maps of the Borders which show the current and potential importance of different areas of land for delivering a wide range of benefits enjoyed by both local residents and others. This will enable users to quickly identify where actions to promote one land use might have significant impacts on the provision of other services and to consider, in such circumstances how multiple benefits might best be realised or where trade-offs will need to be resolved between conflicting options for land use and service provision.

i. The first set of maps describe the current baseline situation as it relates to the 17 most important ecosystem services provided by the existing pattern of land use. This is a series of separate maps each showing the relative importance of areas within the Borders for delivery of the specific ecosystem services associated with the particular land use type described, such as agricultural production, timber production, storage of carbon in soils, the enhancing of water quality, pollination and other services.

ii. A second set of maps identifies indicatively the most likely areas of search in to which each of these services might expand were a particular policy direction to favour and encourage (by whatever voluntary means) opportunities for land managers to choose this particular land use. To date, we have produced 7 such opportunity maps covering the key services that might be expected to increase, as derived from information and extensive stakeholder consultation across the Borders.

iii. A third set of maps identifies geographically where expansion of one particular type of land use may also deliver a range of complementary services in the form of other, multiple benefits in the same location. Again, we have mapped this for the set of 7 important services most likely to increase under policy directions that might be favoured in response to climate change.

iv. A final set of 9 interaction maps identifies areas where expansion of one particular type of land use may conflict with and potentially constrain the provision of other services at the same location. The choice of which

interactions to map has again been informed by a review of potential interactions in the Borders and extensive stakeholder consultation.

These maps are backed up by a suite of other materials that support and explain the methodologies used and the iterative process through which development of this new Framework has passed. Among these, key groups of document include:

- a series of reports detailing how and which ecosystem services were mapped, how decisions were reached on which data sets to use, and which interactions between different services were to be explored further;
- a detailed report on the extensive consultation that has been undertaken with stakeholders throughout the whole process of creating and validating development of the Framework;
- an analysis of the policy framework within which options for land management are framed and potential policy responses to adapt to climate change considered; and
- a Strategic Environmental Assessment.
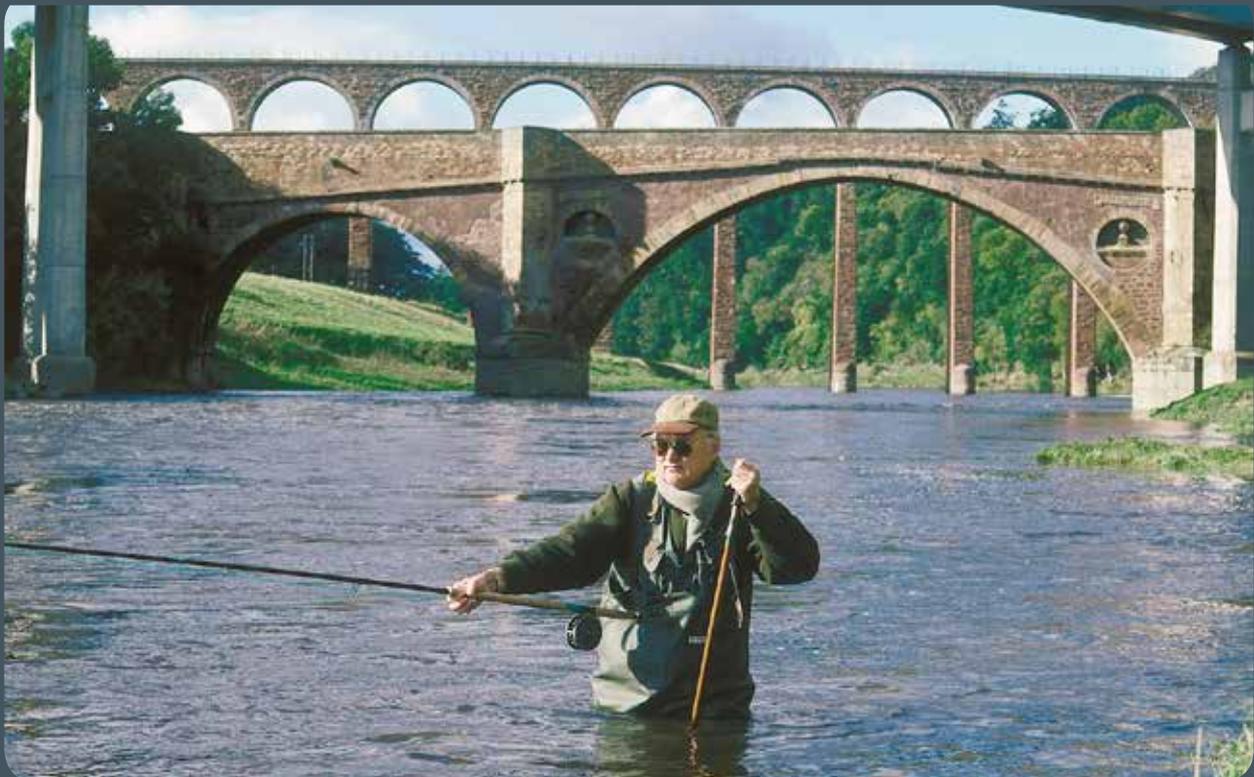
How to use the Framework?

As noted above, the Framework does not attempt to propose a single, ideal strategic land use solution for the Scottish Borders, but rather to identify what and where are the potential opportunities and potential constraints that might arise if a
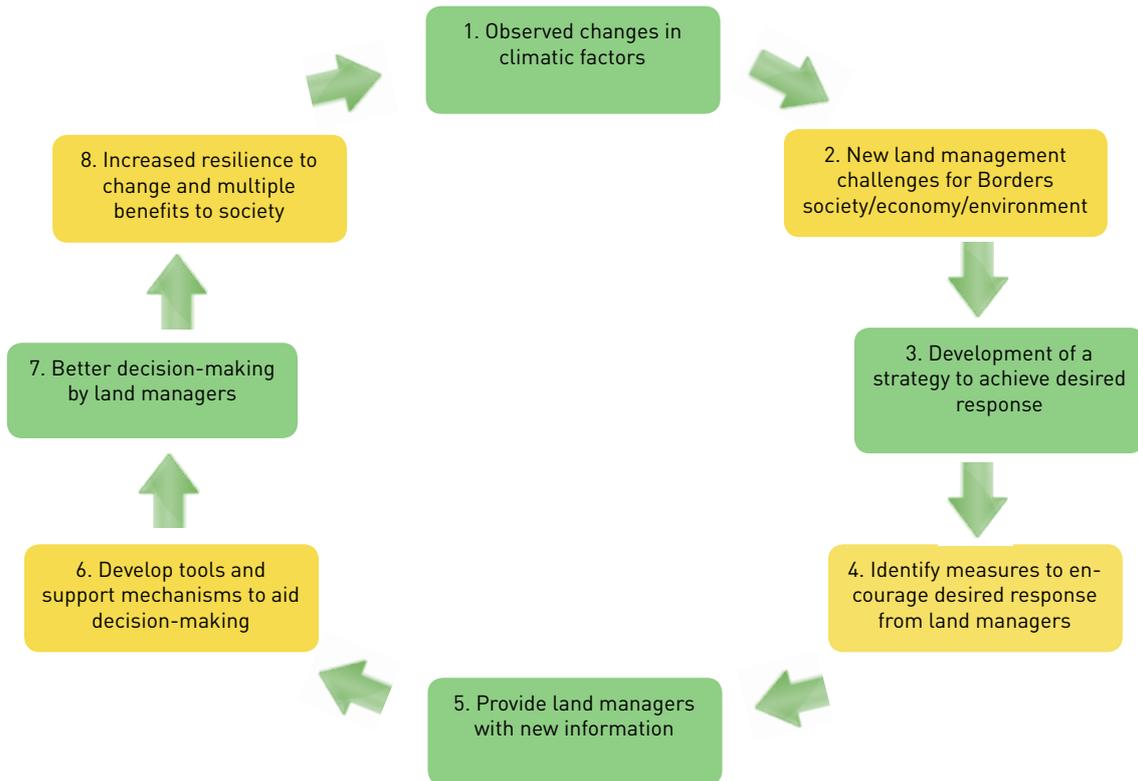
particular policy direction was adopted to favour the expansion of one specific land use type - potentially as a response to climate change. In such a circumstance, any organisation or stakeholder interested in this possibility (whether as a current land manager providing this ecosystem service or as a potential land manager considering a change of land use - or indeed as an organisation or individual interested in enabling the voluntary uptake of this type of land use through their own activities or funding support mechanisms) can interrogate the maps, using the web-based tool and explore the implications of such a change. This will also show which other stakeholders could be potentially impacted, positively or negatively by such a choice – and hence with whom early consultation and negotiation needs to take place.

For example, one potential response to an increasing risk of prolonged and intense winter rainfall might be to adopt policies that promote forms of land use that slow down the flow of water across the landscape and temporarily store flood waters - thus letting them recede before they move further downstream and flood lowland centres of population. In this scenario, examination of the maps will show where the best opportunities occur to achieve a slowing down of flood waters through land management (the ecosystem service of natural flood management). Further interrogation of the multiple benefit map for natural flood management will then highlight where such a change could achieve other benefits, such as

promotion of biodiversity or woodland expansion, thus adding significant value to the choice of that land use option. Examination of the interactions map meanwhile will show where such an expansion will conflict with existing services, such as agricultural production as either arable or pasture farming, and what would be 'lost' if natural flood management measures were promoted in that area. In both cases, the maps will also indicate who and where the potential providers (upland farmers and foresters) and beneficiaries (downstream settlements) of these services might be located and with whom possible multiple benefits might be achieved. This approach is illustrated in the flow cycle on p12.

The Land Use Framework and policy drivers for change:

1. Observed changes in climatic factors

2. New land management challenges for Borders society/economy/environment

3. Development of a strategy to achieve desired response

4. Identify measures to encourage desired response from land managers

5. Provide land managers with new information

6. Develop tools and support mechanisms to aid decision-making

7. Better decision-making by land managers

8. Increased resilience to change and multiple benefits to society

example: Natural flood management

1. Increased intense rainfall

2. Increased risk of flooding to agriculture, rural businesses, property infrastructure

3. Legislation Flood Risk Manaement (Scotland) Act 2009 and policies to promote natural flood management and reduce flood risk

4. Measures such as tree planting and blocking upland grips to slow down and mitigate floodwater across the landscape

5. Make maps available to land managers showing areas where the ecosystem of flood regulation could be enhanced (opportunity map)

6. Use the web-based framework to assess where such extensions could be combined with other ecosystem services to produce multiple benefits (multiple benefits map)

7. Identify where expansion of natural flood management would lead to adverse interactions (interaction maps) and compare options a land manager might choose (evaluation maxtrix) p32/33

8. Optional choice for long-term delivery of multiple benefits from sustainable land management

What the Framework does not try to do is place a value, monetary or otherwise, on any of the various ecosystem services or, in any other way suggest that a particular ecosystem service might be more useful or more valuable than any other one. Neither does the Framework specifically attempt to resolve potential conflicts between 'competing' ecosystem services, which might be seen as alternative options for use of a particular area of land. The ecosystem service maps and interactions matrix do identify where such potential conflicts and constraints might occur, and under what policy options - as also for locations where multiple benefits might be enjoyed through simultaneous delivery of complementary services - but not which should take precedence.

1.3. How has the Framework been produced?

Who has been involved in its development

The development of the Framework has been led by Scottish Borders Council, working in close partnership with Tweed Forum and with the Scottish Government. Further technical support has come from the University of Dundee and external GIS support from Environment Systems Ltd. A wide range of organisations in the Borders provided input and feedback, acting as a main Stakeholder group (see below) and many of these have actively contributed to the development of the maps and framework itself, as have the communities of the sub-catchment pilot areas where the mapping was tested. Throughout the whole process, a continuing dialogue and consultation has taken place with a wide range of stakeholders, both formally and informally.

The three main phases

The main phases in developing the Framework were:
1. Baseline mapping: - of the provision of ecosystem services from the different land use types; and of the key policies that influence choice of land use;
2. The creation of a series of opportunity, multiple benefit and interaction maps for a selected number of ecosystem services; and
3. The production of a draft Framework and public consultation on this.

The ecosystem service mapping

Fundamental to the approach adopted has been the mapping of ecosystem services by using local knowledge and an expert rules-based approach

to identify and define the ecosystem services produced by each parcel of land. This uses a proven methodology, SENCE (Spatial Evaluation for Natural Capital Evidence) developed by Environment Systems Ltd, http://www.scotborders.gov.uk/info/1225/countryside_farming_and_wildlife/964/biodiversity/5 which is based on 4 key influencing factors – what the land cover is; where in the landscape the parcel of land sits; what is the underlying geology and soil type; and what is the current land/water management. Where possible the extent or intensity of service provision has been indicated through shading that reflects high to low values of provision. The mapping has been co-ordinated through a pilot mapping Steering Group led by the Council, maps were subjected to review and amendment throughout as the Steering Group and key stakeholders input ideas and data. However, no new data was collected for the project, all of it comes from existing sources made available to the team.

The stakeholder engagement

The pilot was required to take an Ecosystems Approach to the development of the Framework. While part of this entailed the creation and use of ecosystem service maps to represent the value of the different types and forms of benefits derived from the use of each parcel of land, another key element of the Approach is the involvement of stakeholders throughout the whole process. Scottish Borders Council already has a well-developed mechanism for public consultation and full use was made of their processes and systems throughout. Progress reports and consultation responses were therefore requested at various stages, including the critical time period when the initial list of main ecosystem services chosen to be mapped was produced, and this will be continued throughout the process of developing the Framework itself.

In order to fully embrace the ethos of including relevant stakeholders in the process, at the outset a stakeholder engagement strategy was produced and a programme developed to engage with all relevant groups, using the most appropriate methods and at the critical times to support the development of the Framework. This was an ambitious and time-consuming challenge and, as locally-based specialists in stakeholder engagement, Tweed Forum led on this aspect. An extensive report was produced covering the various types and audiences targeted as part of the stakeholder facilitation during the project http://www.scotborders.gov.uk/info/1225/countryside_farming_and_wildlife/964/biodiversity/5
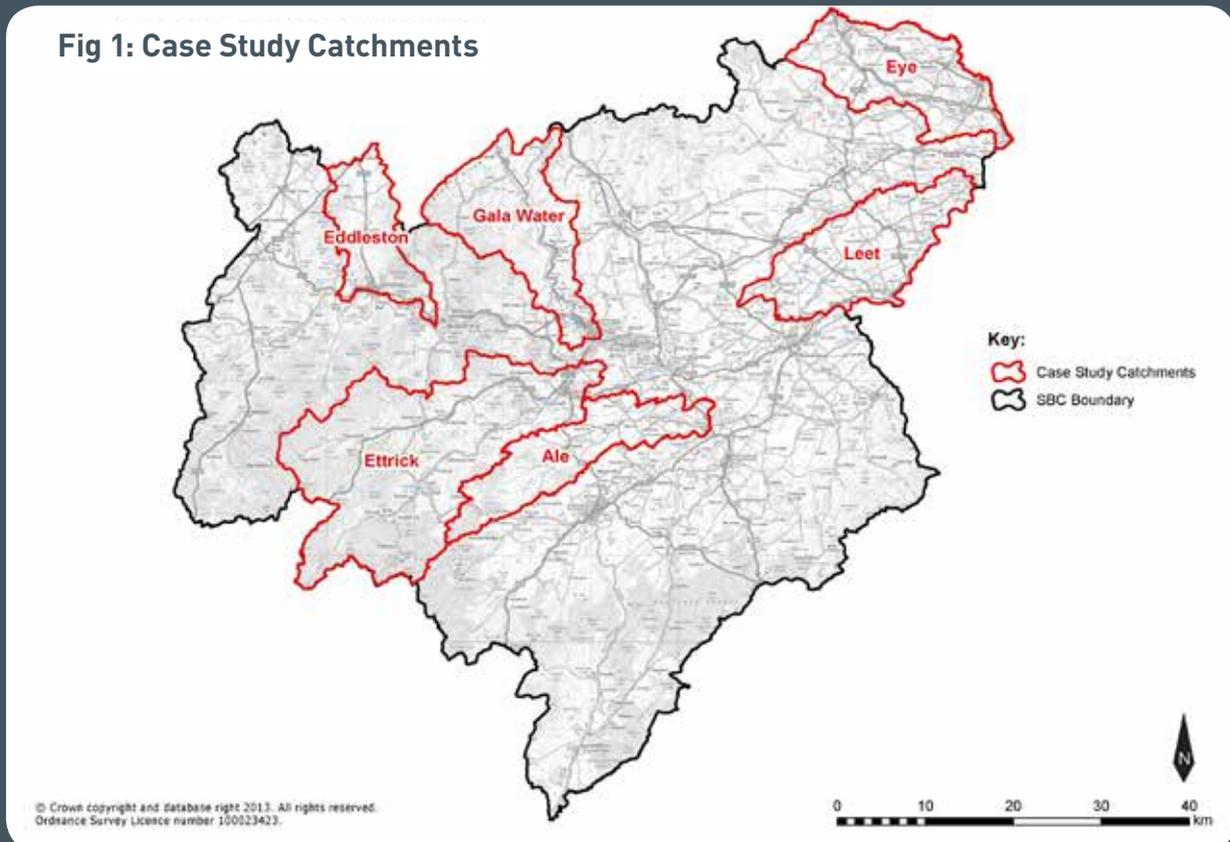
In order to ensure they not only captured local information and views, but also feedback on validation of the data, the systems, the processes and the mapped outputs, an advisory Stakeholder Group, led by Tweed Forum was set up comprising the main organisations in the Borders with influence on land management issues. This met regularly throughout the project. All main groups were also targeted with dedicated one-to-one organisational meetings and attendance at their own respective internal and members' meetings, including discussion on challenges and opportunities that the implementation of the strategy could raise. One such key group was the Royal Society of Arts, which organised a series of public meetings devoted to debate on the Land Use Strategy in the Borders. Articles and press releases were produced, and a web-site and telephone-answering service developed,

In addition six sub-catchments (one split in two) were chosen across the Borders (fig 1) as case studies for involvement of community groups and land managers at a local level. These areas were specifically chosen to represent a variety of key land uses and land management challenges representative of the typical issues faced by those communities living in and managing the land - from the intensive arable systems of the coastal lowlands to sheep farming and forestry in the uplands (Table 1). Specific ecosystem service maps were produced for each area and two evening meetings held in each to introduce the pilot and concept of an Ecosystem approach, to get their input and to assess their response to the pilot, to the maps and to the processes being undertaken.

Table 1: Catchment case study areas

PROPOSED CATCHMENT	ENVIRONMENTAL	ECONOMIC	SOCIAL
Ale water	Ale water initiative (SNH and Tweed Forum)	Business Biodiversity Group	Stakeholder engagement. Future scenarios and past (historical air photo) land management options
Eddleston water	River/Catchment Restoration project (SG, SEPA, Tweed Forum, Dundee University) Natural Flood Management Biodiversity offsets	Flood protection Maintaining sustainable farming/land management	Stakeholder engagement with farmers and community Future scenarios and past (historical air photo) land management options Natural Flood management. Cuddy Action Group
Eye water	RBMP priority catchment. Diffuse pollution control programme (Tweed Forum & SEPA) EU Bathing waters Link to Marine environment Biodiversity offsets	Berwickshire Coast-formerly Scottish Sustainable Marine Environment Initiative area. Onshore wind.	Bathing waters. Coastal Communities Fund.
Leet water	Diffuse pollution control Past project initiative on improving water quality	Food security/intensive arable	Past project initiative on improving water quality working with farmers
Gala Water	SBC Flood Protection Scheme (Gala) Natural flood management Biodiversity Offsets	Upstream storage & brownfield sites Flood protection Settlement expansion Borders Railway	Countryside Around Towns
Ettrick & Yarrow	SBC Flood Protection Scheme (Selkirk), Natural Flood management Biodiversity offsets	Woodland expansion (hill farming impacts). Onshore wind Water quality resource protection (Scottish Water reservoirs)	Ettrick & Yarrow community development (Southern Uplands Partnership), Woodland Expansion (community impacts)

Fig 1: Case Study Catchments

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Policy mapping and Strategic Environmental Assessment

Key to understanding the potential changes that might occur in delivery of ecosystem services in the Scottish Borders is the need to map the relevant policies that drive or influence choice – positively and negatively – as to what use a parcel of land is put to. In doing so, one has to acknowledge that one particular driver that essentially lies outwith the control of the Land Use Strategy is that of the market. Increasingly, this is a global market with food and produce prices driven by European and other external policy decisions on such issues as finance, security, trade, environment and social cohesion, as much as on regional or local agricultural production, forestry, land use planning or ecosystem services.

The Strategic Environmental Assessment (SEA) was undertaken by Scottish Borders Council, as required under the project brief and in compliance with European and Scottish legislation covering such public plans, programmes and strategies which might have a significant effect on the environment. It started with a policy mapping exercise leading to a Scoping report in January 2014 and subsequent relevant consultation. This included matching the relevant national and local legislative and policy drivers against the 9 'formal' topics within SEA (air, biodiversity/flora & fauna, soil, water, climatic factors, landscape/townscape, cultural heritage, population/human health, and material assets), in order to highlight where and which policies have an impact on the SEA topics. It then matched the 9 SEA topics against the ecosystem services identified by the Land Use Strategy mapping process.

The SEA also contains a 'causal chain' assessment which shows the likely reactions that will occur when increasing any one of the ecosystem services and how this impacts negatively or positively on other ecosystem services and the 9 SEA criteria. This is presented also in a table with the significant constraints and major benefits identified. The results match well the results obtained separately by interviewing key stakeholders within the advisory group as to which they saw as the main interactions between ecosystem services within the Borders. The SEA documents can be found at http://www. scotborders.gov.uk/info/1225/countryside_farming_ and_wildlife/964/biodiversity/5

A key conclusion of the work is that certain constraints are recognised between land use for food production and for a range of alternative ecosystem services at the same location; similar important constraints are recognised between commercial timber production and provision of the same alternative ecosystem services. The report also acknowledges that there are many opportunities for delivery of multiple benefits through increases in other ecosystem services, but without food production and commercial timber production. These constraint interactions are considered to be critical to the Borders where food and timber production form a large percentage of the total land use and the pressures that may arise as the impacts of climate change begin to be felt. Further work is seen to be needed to develop the multiple benefit interactions and align these with food production where possible.

SECTION 2 – WHAT ARE THE KEY LAND USES IN THE BORDERS AND HOW MIGHT THEY CHANGE

## 2.1. What are the important goods and services delivered by our Borders landscape?

In trying to identify and map the range of services provided by land in the Borders, some 104 different data sets were collected, covering a vast array of information about land use. From this, 74 were used to create layers and a total of 17 'stock' maps were produced for consideration by stakeholder groups. For each ecosystem service mapped, these stock maps show the current location and extent of provision of that service, described using available information. Where data was available, this was used to help provide an assessment in qualitative terms of the strength of provision of that service, though in many cases it was necessary to use a suitable proxy to describe the service itself.

The choice of services to map was informed by the available data on land use and by the stakeholder engagement process. Together with expert opinion and information from land use statistics, this was used to identify the priority land uses in the Borders. Further consultation on the key points arising from this round of stakeholder engagement confirmed these as the priority land use choices for the Borders and highlighted the opportunities to achieve multiple benefits from land use.

Stocks of Natural Capital:

(a) Stocks that deliver the main Provisioning and Market services (4 maps)

Food production (2 maps - livestock & crops) – Over 80% of the land in the Borders is agricultural land, with large areas of soil classes 4,5 and 6 used for grazing, especially upland sheep. By contrast, the eastern lowlands have much better soil, and rich arable farming is a feature of the Merse and similar areas of class 1, 2 and 3.1 to the east. Over time the percentage of agricultural land has varied in response to climatic, economic and market conditions, with expansion and retraction from the hills as agricultural and forestry policy changes influence subsidies and individual farm economics.
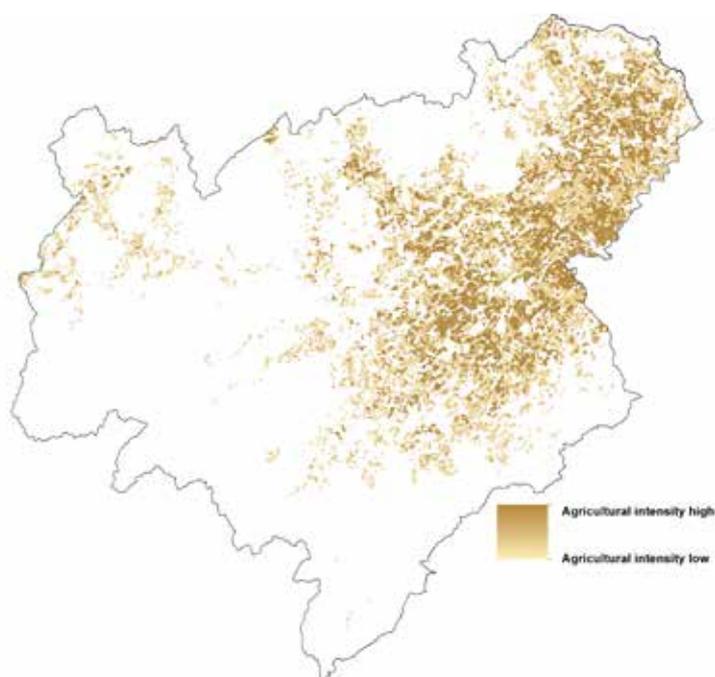

Food production - crops
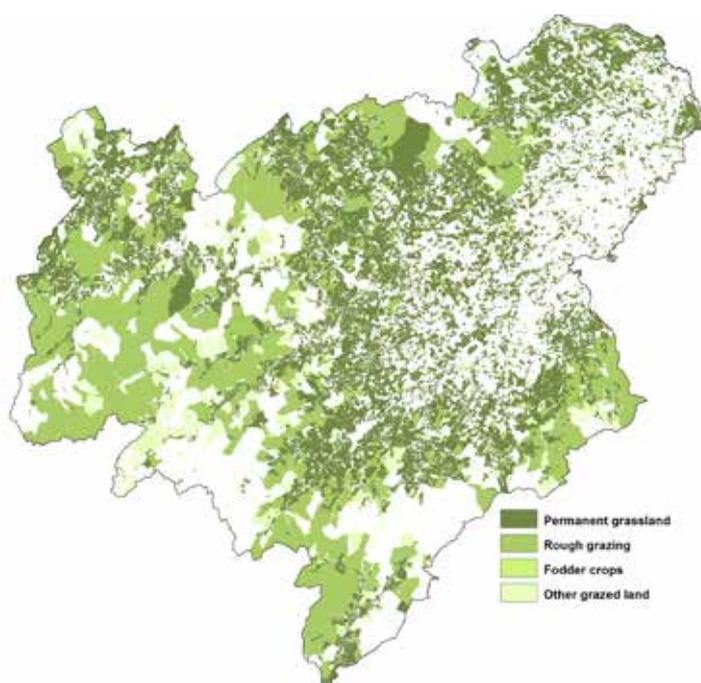
Food production - livestock

Timber and Woodland – Woodland is estimated to cover some 18.5% of the land in the Scottish Borders, with individual blocks having an average size of 30 ha. The vast majority of this is commercially grown conifers and only some 1.4% of this (0.26% total) is ancient or semi-natural native woodland with high biodiversity value. The main forested areas are in the west, with large plantations concentrated in the Craik Forest and Kielder border areas of the Cheviot Hills to the south, and in the upper Tweed and Ettrick valleys of the Southern Uplands. Very much smaller patches of woodland occur in the east, scattered within an agricultural landscape. Woodlands local to urban areas may have high cultural values as places for recreation and as landscape features.


Timber and woodland
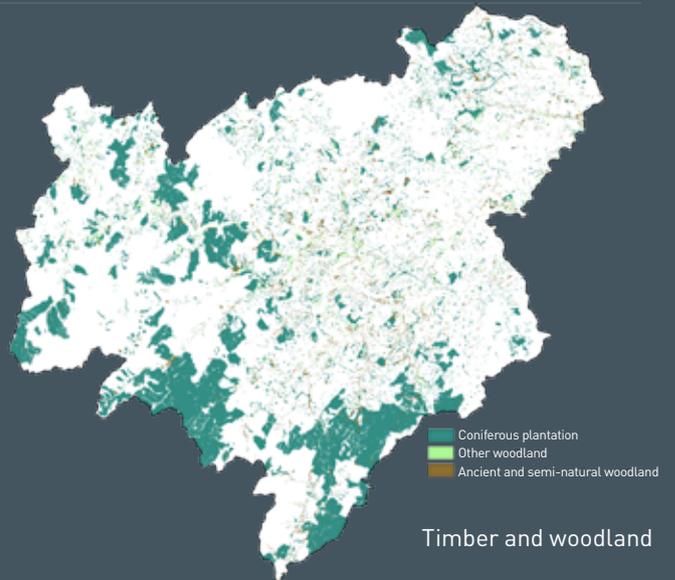
Renewable Energy – Hydro-power generation is very small in the Borders, as is wood coppice for biomass as yet, with what there is being influenced by developments outwith the region. However, government targets for renewable energy, reflected in tariff rates are the main driving force behind recent and ongoing expansion of wind farms in the region, with 20 wind farms (385 turbines) over 5MW and 88 smaller schemes (134 turbines) under 5MW already consented. These are distributed across the Borders, with a current concentration in the north and east, and other individual turbines adding to the stock.

Renewable energy - wind
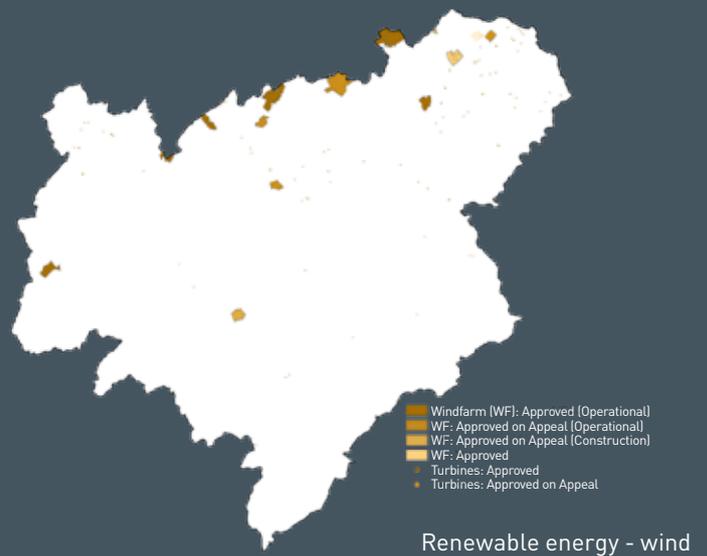
(b) Stocks that contribute to modifying and regulating natural processes in the environment (6 maps)

Natural flood management (NFM) – recent mapping of flood risk by SEPA confirms that most towns in the Borders are in 'potentially vulnerable areas', lying as they do along watercourses. Areas of land that can contribute to NFM through slowing the flow or temporarily storing floodwaters occur upstream of these areas and the best sites are defined in relation to slope, land cover and geology either in the top of the catchments or on the flood plain itself. SBC, Tweed Forum and Dundee University are in the forefront of national initiatives to promote, deliver and measure the effectiveness of NFM as an ecosystem service, with areas upstream of Selkirk, Galashiels, Hawick and Peebles/Eddleston prime examples

Natural flood management
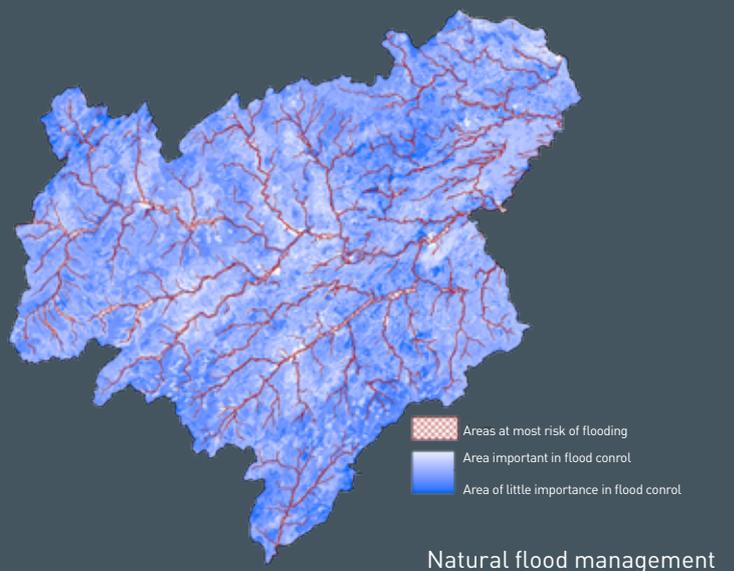
Diffuse pollution control – rivers and lochs in the Borders are generally of good or moderate ecological status, many failures being due to historical hydro-morphological pressures rather than water quality. With the exception of the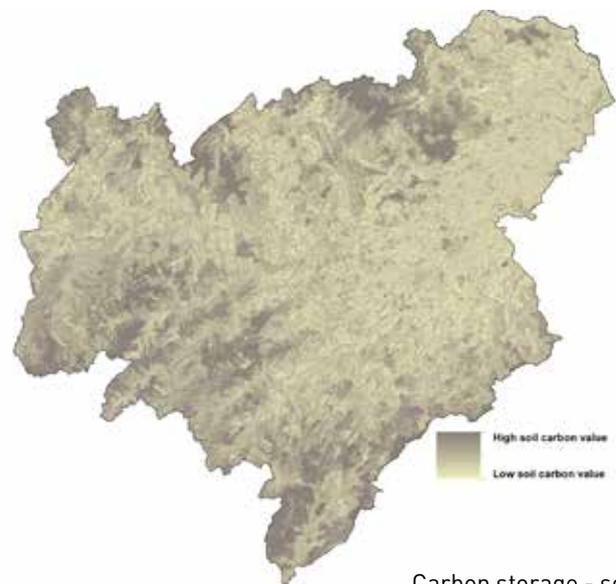 Eye Water, and other waterbodies that may be included in the next cycle of River Basin Management plans, water quality is not a major issue. The Eye Water however is one that suffers from intense agricultural runoff and is one of SEPA's priority catchments for improvement. Land uses that enhance raw water quality and protect waters from diffuse pollution, sediment and nutrient enrichment include restoration of upland bogs and of areas at risk of erosion on both peat and mineral soils through over grazing or intense cultivation, especially on slopes adjacent to water courses, and use of buffer strips within lowlands.

High impact on Water Quality Regulation

Little impact on water Quality Regulation
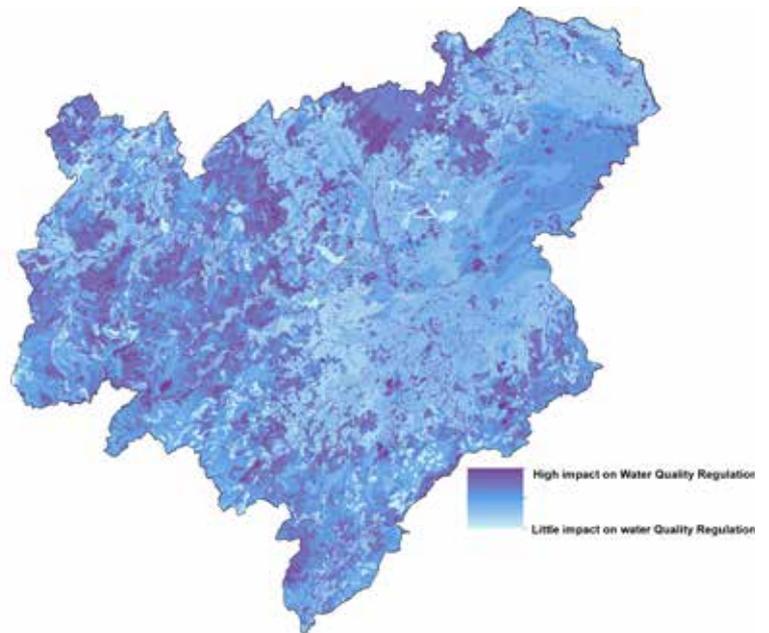
Water quality

Carbon storage (2 maps - in soil & vegetation) – the Borders has extensive areas of deep peat concentrated in the Uplands, which are considered to store significant amounts of carbon, as well as other more fragmented areas of class 4,5 and 6 soils as well. Carbon is also stored in vegetation and, as such more widely distributed across the Borders.

Two further services: Sediment input to water courses; and Land at risk of erosion were also mapped, but not subsequently progressed beyond this stage at this time.

High soil carbon value

Low soil carbon value

Carbon storage - soils

High vegetation carbon resource

Low vegetation carbon resource
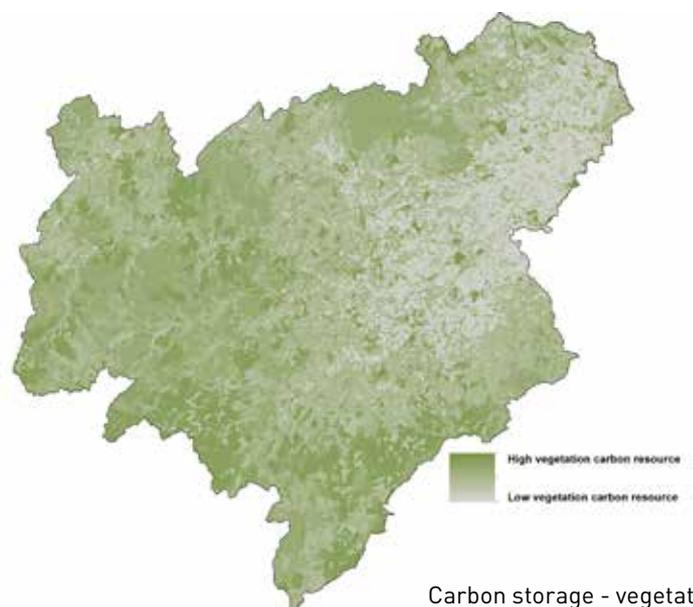
Carbon storage - vegetation

(c) Stocks that contribute to cultural and economic services and well-being (4 maps)

Recreation – the Borders has no National Parks, but a number of well-known long distance walking routes (Southern Uplands Way, St Cuthberts Way and Borders Abbey Way) and there is an extensive network of core paths around urban areas as well. Non-motorised recreation, including walking and horse-riding is an important part of the 'quality of life', as is sporting recreation such as angling and shooting. While much of recreation is informal in nature, some sites are visitor attractions in their own right, including those covering active pursuits, such as mountain bike riding at Glentress forest, and those relating to historical and cultural heritage, like Abbotsford, the former home of Sir Walter Scott.
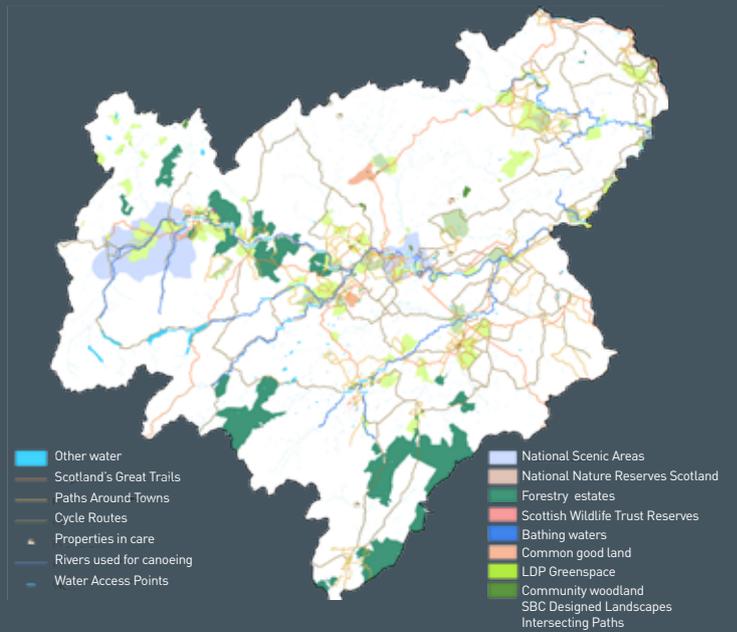
Four stock maps were produced, with that covering non-motorised recreation, including paths being chosen as the main one for further development and analysis. In addition, stocks of a further three services were mapped - field sports; historic sites and landscapes; and landscape designations. These latter three were not subsequently progressed beyond this stage at this time.

Development sites – urban development covers a very small percentage of the land in the Borders, unlike in other areas of Scotland, and development is not a major issue for land use in the region, except at a very local scale indeed, and is controlled through the ongoing statutory planning process. With the current Scottish Borders Local Development Plan in the process of review, no specific mapping of development sites was undertaken for the pilot.
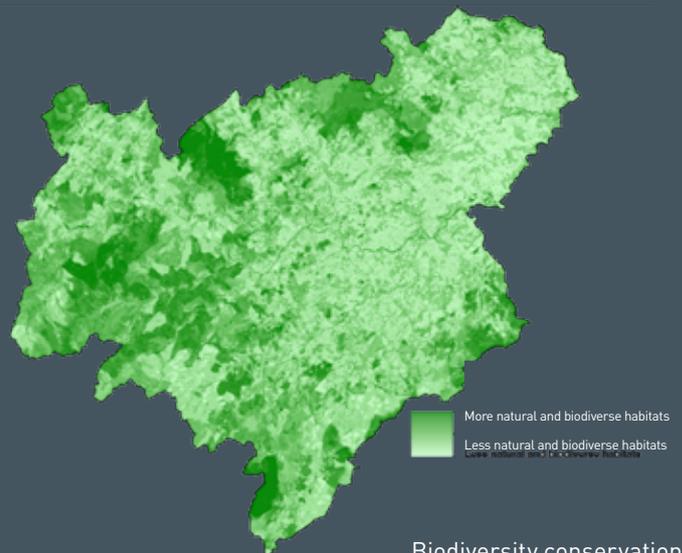
(d) Stocks that underpin life and support ecosystem functioning (3 maps)

Biodiversity (2 maps - Species conservation & biodiversity resilience) – Information on designated sites of importance for wildlife conservation is good, and the Borders has many such sites including 14 European Special Protection Areas and Special Areas of Conservation, including the Tweed itself, as well as nearly 100 Sites of Special Scientific Interest. The SBC and Local Biodiversity Action Plan partnership have further data on notable species and habitats of national importance, as well as a comprehensive Phase 1 habitat survey. The actual biodiversity value of any particular piece of land relates to such aspects as degree of 'naturalness', biological diversity, and of connectivity/isolation within the landscape. Information on resilience to change was collated through analysis of habitat networks and connectivity between habitat units across the landscape.

Pollination – pollination is one of the fundamental ecosystem services supporting life, but one that is spread widely across the landscape, rather than being concentrated in one habitat type or location. Whilst it was mapped across the Borders, this was not subsequently progressed further at this time.

Other water
Scotland's Great Trails
Paths Around Towns
Cycle Routes
Properties in care
Rivers used for canoeing
Water Access Points

National Scenic Areas
National Nature Reserves Scotland
Forestry estates
Scottish Wildlife Trust Reserves
Bathing waters
Common good land
LDP Greenspace
Community woodland
SBC Designed Landscapes
Intersecting Paths

Non-motorised recreation

More natural and biodiverse habitats
Less natural and biodiverse habitats

Biodiversity conservation

High biodiversity resilience
Very low biodiversity resilience

Biodiversity resilience

2.2. What are the drivers (laws, policies and regulations) currently influencing decision-making on land use and the spatial and temporal delivery of ecosystem services?

Along with the Land Use Strategy itself, the Climate Change (Scotland) Act 2009 provides the legal context within which the Land Use Strategy has been developed, along with proposals and policies such as Low Carbon Scotland - Meeting our Emissions Reduction Targets 2013-2027, which sets out specific measures for reducing greenhouse gas emissions. At a regional level, Scottish Borders Council's Local Development Plan and the Scottish Borders Low Carbon Economic Strategy are among other policies that reflect the requirement to reduce emissions of a range of greenhouse gases associated with climate change.

There are many other national, regional and local policy instruments however which have an influence on land use and ecosystem service delivery, some of which can be both positive and negative in their impact. A full analysis of potential drivers of change for these services was undertaken for the UK National Ecosystem Assessment Technical Report (2011). For the Borders pilot, an evaluation of the potential impact of policies was undertaken as part of the Strategic Environmental Assessment.

For each of the main ecosystem services provided by land in the Borders, an analysis was undertaken to determine which were the most relevant policy drivers, and how might prioritisation of these impact on this and other services. The key policy drivers were seen to be:

- **Food production (livestock and crops) –** Scotland Rural Development Programme (2014-2020 proposals); Farming for a better climate (2009); Recipe for Success – Scotland's Food & Drink Policy

- **Timber and Woodland –** Scottish Forest Strategy (2006); Scottish Government's Rationale for Woodland Expansion; Scottish Borders Woodland Strategy

- **Natural Flood Management –** Flood Risk Management (Scotland) Act (2009); Draft Flood Risk Management Plan; Tweed Wetland Strategy

- **Diffuse Pollution Control –** Water Environment & Water Services (Scotland) Act (2003); Controlled Activities Regulations (2011); Scotland, Solway/Tweed River Basin Management Plans

- **Carbon storage -** Climate Change (Scotland) Act (2009); Scottish Climate Change Adaptation Programme; Low Carbon Scotland – meeting the emissions reduction targets; Scottish Soil Framework (2009)

- **Recreation –** National Planning Framework 3 (2014); Land Reform (Scotland) Act 2003; Scottish Outdoor Access Code; Our Place in Time - Scottish Historic Environment Policy (2014); EU Landscape Convention (2000); Our Scottish Borders – A Vision for the Future, Community Plan; Core Paths Plan (2009) and emerging Local Access and Transport Strategy; Let's Get Scotland walking (2014)

- **Biodiversity –** Nature Conservation (Scotland) Act (2004); Wildlife & Natural Environment (Scotland) Act (2011); Scottish Biodiversity Strategy; Scottish Borders Local Biodiversity Action Plan

- **Renewable Energy –** Scottish Planning Policy (2014) Routemap for Renewable Energy in Scotland (2011); Biomass Action Plan for Scotland (2007); SBC Spatial Framework for Wind energy

- **Development –** Scottish Planning Policy (2014); National Planning Framework 3 (2014); South East Scotland Strategic Development Plan (2013); Scottish Borders Local Development Plan

Implementation of legislation and enforcement of regulation is only a small part of changing the behaviour of organisations and individuals. Market forces such as trade and food prices are in many instances a more powerful driver for changes in land use, but other forms of influence may be equally important and, as the Framework is a voluntary instrument, key to promoting action.

Behavioural changes may be positively directed by incentivisation - using such means as grants and loans, subsidies, advice and technical assistance to promote land management options that support a particular policy direction. At the same time, negative pressures may be brought to bear to re-inforce current land uses or to adversely impact on certain other options. Codes of practice, taxation, licences, regulations and economic barriers may all act as constraints to the ready uptake of options running contrary to a particular desired policy direction.

2.3. If, in response to climate change, policies were implemented that promoted specific actions, what are the potential implications for land use and the spatial location, extent and intensity of ecosystem services in the Scottish Borders?

Detailed assessment within the SEA, including causal chain analysis, combined with extensive stakeholder consultation highlighted a number of potentially significant changes in land use that might be expected to occur in response to climate change and as a result of other identified policy changes. These have been expressed as a series of indicative 'Opportunity maps' for the 7 main ecosystem services seen as being most likely the subject of change http://www.scotborders.gov.uk/info/1225/countryside_farming_and_wildlife/964/biodiversity/5

The key policy drivers and expected changes in land use and ecosystem services are:

1) **Reduce the risk of flooding** -> An increase in land area managed to deliver natural flood management services
2) **Achieve good ecological status for water bodies impacted by diffuse pollution** -> improve water filtration capacity and resistance to erosion of soils adjacent to water courses
3) **Increase timber production** -> expansion of areas planted with conifers
4) **Increase native woodlands** -> expansion of areas of native woodland
5) **Improve food security** -> extend the area under agricultural crops and livestock management
6) **Mitigate climate change through protecting soils with high carbon storage** -> increase in areas of land under active management for retaining carbon
7) **Halt the decline in Biodiversity** -> enhance the conservation management of ecologically degraded sites and habitat networks

It was also expected that there would be pressure to increase provision for renewable energy, especially but not only wind farms in the Borders; and for enhanced recreation opportunities. Opportunity maps have not been produced for these, or other services such as development opportunities, which are covered by existing statutory processes.

Some services are not readily amenable to mapping as they occur at a scale or with such a wide distribution in small amounts that they cannot be adequately represented in this way. A service such as pollination can occur across the whole landscape, but does not occur in sufficient 'quantity' in any one large area so as to be meaningful. Actions to improve pollination as an ecosystem service will instead be reliant on such initiatives as planting different species, and by creating wildflower meadows and verges almost anywhere across the region, including urban areas and around field margins.

The opportunity maps are indicative and do not show the precise location for expansion of a service, nor that a specific location is where land use should be retained or changed. The example below (p23) shows the indicative opportunity map for reducing flood risk, thereby mitigating the hazard from flooding. The map shows those areas where changing the way the land is currently managed could either slow the flow of water across the landscape or temporarily store it. The land has been categorised as to its potential to deliver different types of flood water regulation – areas suitable for tree planting to slow run-off; areas of drained and degraded upland bog which, if restored could hold more water; and areas which could be returned to wetland habitats, such as floodplains. Such a change on the floodplain could potentially have a significant impact on the land's ability to produce food however.
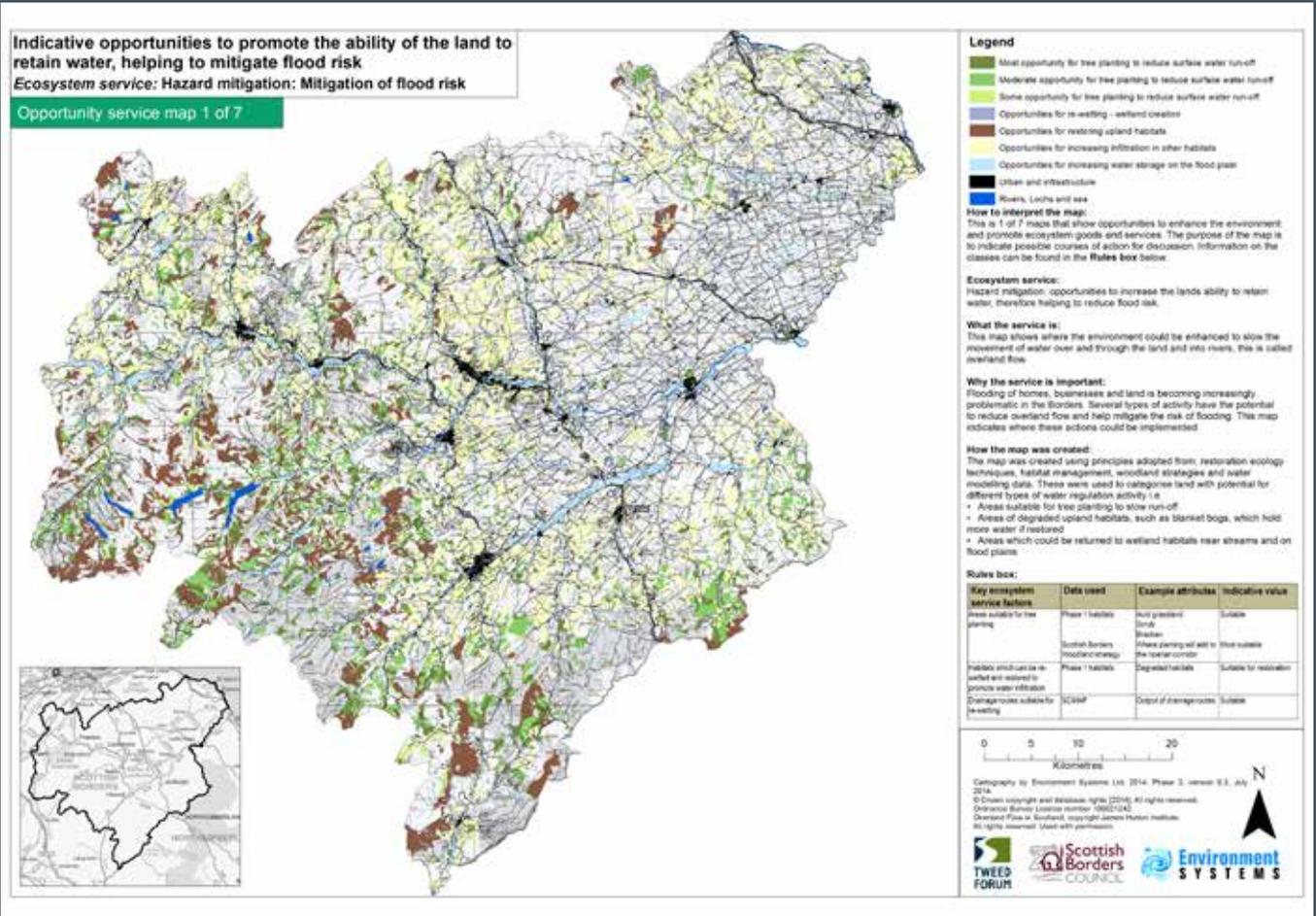
Clearly, ecosystem services do not operate in isolation, and any one land use, however intensive will be potentially capable of delivering other ecosystem services, especially if management is aware and sympathetic to that possibility. Conversely some ecosystem services constrain the delivery of others almost completely. The extent to which different ecosystem services impact on each other was examined both through literature review and research, and through asking stakeholders to complete a matrix of interactions.

The resulting matrix shows the main interactions in the Scottish Borders to be between potential expansion of agriculture and forestry as a prime land use and the delivery of other ecosystem services. In the case of forestry, there are significant differences as to the positive or negative impact depending on whether it is softwood conifer plantations or hardwood native woodland. The diagram also shows for which ecosystem services multiple benefits have been mapped and where interactions between 'competing ecosystem services have also been highlighted.

Interaction Matrix:
Matrix of interactions and multiple benefits between ecosystem services in the Scottish Borders:
(+++ large to + small beneficial interaction / --- large to - small antagonistic effect 0 neutral effect)

Existing ecosystem services

Existing Land Use (columns) × **Possible New Land Use** (rows)

Possible New Land Use \ Existing Land Use	Food production - livestock and crops	Timber and Woodland	Renewable Energy (wind farms)	Natural flood management	Diffuse pollution control	Carbon storage (soil & vegetation)	Recreation	Development sites	Biodiversity
Food production - livestock and crops		− 1	+	−	− − −	−	+ −	−	− −
Timber and Woodland	−		0	+	− / + +	(+) +	− +	−	−
Renewable Energy (wind farms)	0	−		−	−	−	−	+	−
Natural flood management	− −	+	+		+ +	+ +	+	−	+ +
Diffuse pollution control	−	+	+	+		+	+	+	+ +
Carbon storage (soil & vegetation)	(+)	0	− +	+	+ +		+	−	+
Recreation	−	+++ +	−	+	−	+		+	−
Development sites	− − −	− − −	+	− − −	−	−	−		+
Biodiversity	−	+	+	+ +	+ +	+	+	+	

Yellow highlights = interaction maps; Blue highlights = Multi-benefit maps (as keyed below).

Proposed expansion of service

Yellow - interaction maps (9) incl. softwood conifer plantation

Blue - Multi-benefit maps (15) incl. native woodland expansion

The matrix was designed by considering mainstream, land use scenario's within the Scottish Borders rather than specialist features. For the existing land use "Recreation' would include specialist playing fields and footpaths etc. Biodiversity refers to sites being managed to enhance biodiversity either through designation or individual farming practices. Natural flood management are where an existing scheme is present. To read the interactions, for example, at 1 the negative effects would be from a situation such as the felling of farm woodland to grow crops, rather than agro-forestry (which could produce a neutral effect), as this is currently not a common or likely land use in the SBC area. Renewable energy in SBC at present concentrates on wind energy and therefore only wind energy has been considered. Development here refers to standard planning development, rather than environmentally sensitive development.

2.4. Where could change lead to potential delivery of multiple benefits

To examine the positive 'overlap' between the main ecosystem services, a series of 7 'Multiple Benefit' maps were produced by overlaying the opportunity map for the service under consideration on top of the different ecosystem service maps for the same area. This reveals which services are potentially synergistic and at which locations their expansion might be able to deliver multiple benefits.

The maps for multiple benefit produced so far are:
1) Planting native and mixed woodland + Natural flood management, biodiversity, water quality, soil carbon storage
2) Creating areas for natural flood management + biodiversity, water quality, soil carbon storage
3) Improving water quality + natural flood management, biodiversity, soil carbon storage
4) Planting conifer plantations + natural flood management, soil carbon storage
5) Re-placing softwoods with native/mixed woodland to promote biodiversity + water quality, soil carbon storage
6) Enhancing soil carbon retention + biodiversity, water quality
7) Enhancing biodiversity + water quality, native woodlands, soil carbon storage

Figure 2 (p26) shows as an example the distribution of areas where managing land to enhance natural flood management (number 2 above) could also lead to the delivery of other ecosystem services at the same location. Prime amongst these would be improvements to biodiversity, water quality and soil carbon storage. The map doesn't prescribe a course of action, rather it reveals areas of search in which other ecosystem services might be improved were natural flood management to be introduced as a land use here. The map does not indicate the 'strength' of provision of the services, nor the precise location. It does however point to areas where consideration should be given to the added value of delivery of these synergistic services.

2.5. Where could change lead to potential challenges?

The interaction matrix above also reveals where different ecosystem services may generically constrain or compete with other services. As noted, and as expected, the two main land uses in the Scottish Borders, agriculture and commercial forestry, potentially clash with many of the other services.

The distribution of these interactions has again been mapped and 9 such interaction maps are available to look at. As before the choice of which interactions to map has been the subject of observation, research and extensive stakeholder consultation again. This is very much therefore a Scottish Borders' list and one might expect different results to be obtained in areas with a different mix of land uses, settlement patterns and economy. In addition, one would expect the situation will change over time, and as new policy directions and priorities come forward.

The key interactions mapped are:
1) Expansion of woodland vs land currently used for grazing livestock
2) Introducing Natural Flood Management vs current agricultural uses
3) Opportunities to control diffuse pollution vs current agricultural practices
4) Increasing agricultural production vs biodiversity
5) Increasing agricultural production vs water quality
6) Expanding conifer plantations vs water quality
7) Enhancing biodiversity vs conifer plantations
8) Enhancing storage of soil carbon vs current agricultural production
9) Enhancing biodiversity vs improving agricultural production

The map below (Fig.3 p27) shows as an example the distribution of areas where enhancing the natural flood management capacity of the land would lead to constraints and clashes with their current agricultural usage. Natural flood management techniques work by slowing the speed of water flow across the land and by temporarily storing floodwaters, before gradually releasing them once the storms have gone - thus providing an element of protection to downstream communities at risk of flooding. With increased probabilities of extreme rainfall and wetter winters as the climate changes, there already is an active policy promoting the take up of such land use as part of an overall sustainable flood management approach. Whilst certain techniques for NFM such as grip blocking in the uplands may be compatible with the local type of agriculture, such as extensive grazing, other techniques, such as tree planting or wetland creation are not compatible with, for example arable production.

Fig. 2

Potential multiple benefits of creating natural flood management (NFM)

Decision Support Map Set 2 - Multi-benefit
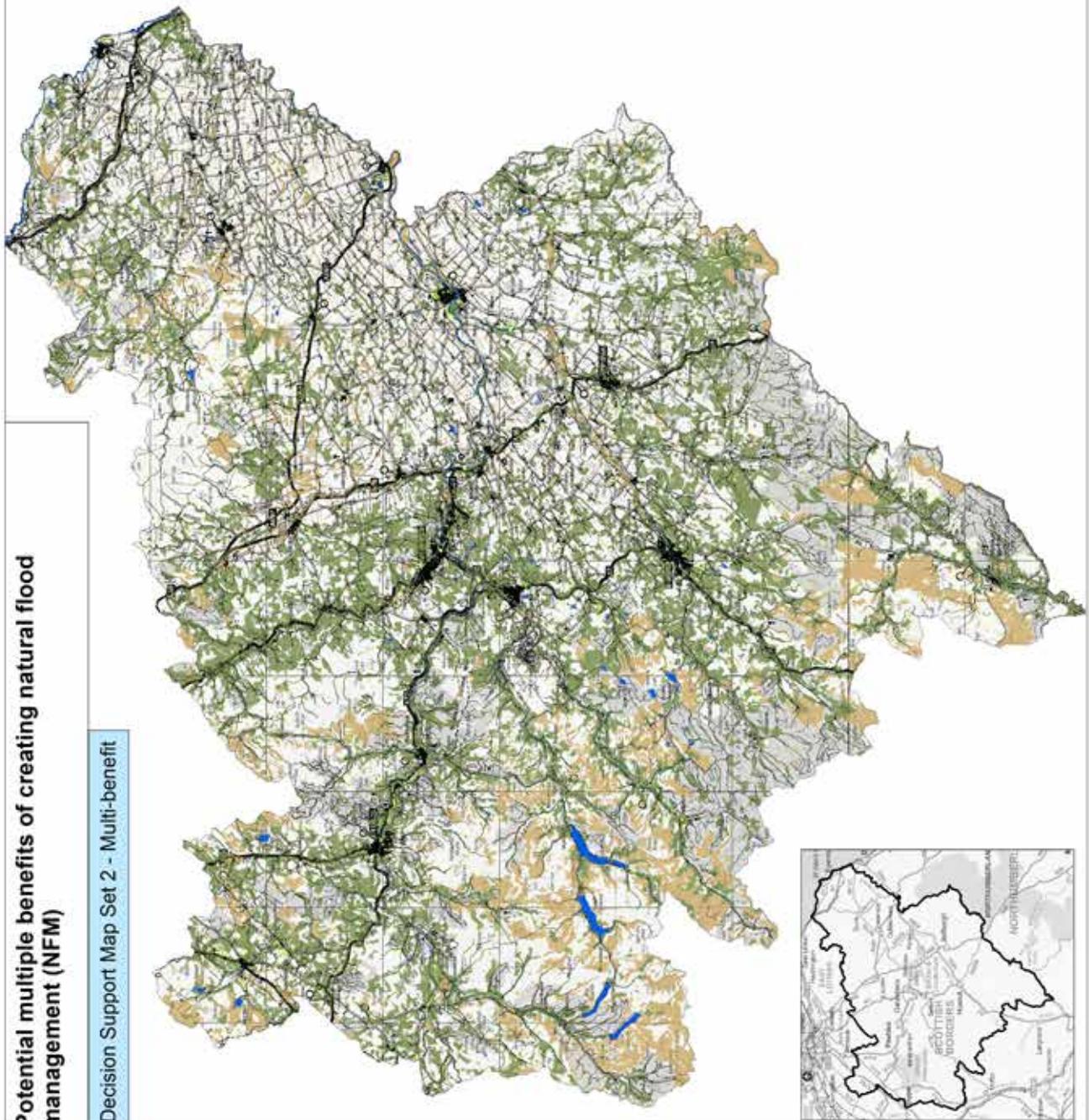
Legend

- NFM opportunities only
- NFM opportunities multi-benefit with 1 other opportunity
- NFM opportunities multi-benefit with 2 other opportunities
- NFM opportunities multi-benefit with 3 other opportunities
- Urban and infrastructure
- Rivers, lochs and sea

Theme to consider:

It is probable that climate change may to be adding to the frequency of extreme storm events. Natural flood management techniques help the rivers and surrounding countryside by reducing the speed at which rainfall reaches the rivers. Implementing natural flood management measures in the catchment builds resilience in the environment to buffer against the effects of climate change.

What the map shows:

This map shows areas where a land use change to aid natural flood management may provide multiple benefits for other ecosystem services. These include enhanced biodiversity, improved water quality and enhancement of soil carbon.

How the map has been created:

The map has been created by looking at where opportunities to enhance natural flood management overlap with opportunities to enhance biodiversity, water quality and soil carbon.

The map is one of a set of 9 maps that explores the current and potential use of land in the Scottish Borders. It is not intended to prescribe a course of action, but rather to act as a decision support tool. This map highlights the other ecosystem services that could be enhanced with a change of land use in these areas.

Rules box:

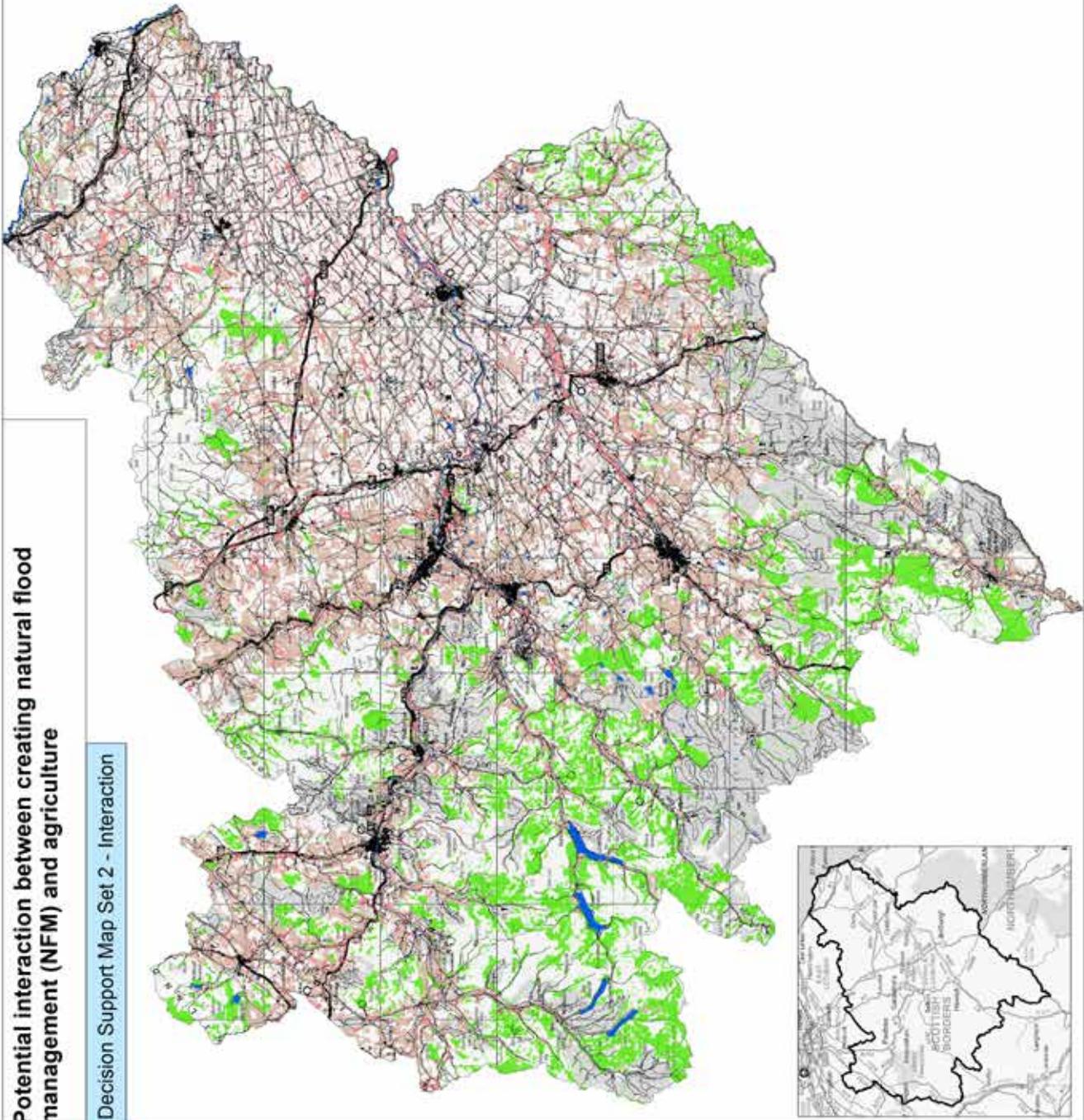| Key ecosystem service factors	Data used
Mitigation of flood risk	Opportunities map 1 of 7 indicative opportunities to promote the ability of the land to retain water, helping to mitigate flood risk
Potential multi-benefits if overlapping with	Opportunities map 4 of 7 indicative areas with potential to enhance biodiversity and nature conservation
	Opportunities map 6 of 7 indicative opportunities for improving water quality
	Opportunities map 7 of 7 indicative opportunities to enhance soil carbon storage

N

0   5   10   20
Kilometres

TWEED FORUM

Scottish Borders COUNCIL

Environment SYSTEMS

Fig. 3

Potential interaction between creating natural flood management (NFM) and agriculture

Decision Support Map Set 2 - Interaction

Legend

- Opportunities for NFM on arable land
- Opportunities for NFM on improved pasture
- Opportunities for NFM on other pasture
- Urban and infrastructure
- Rivers, lochs and sea

Theme to consider:
It is probable that Climate change may to be adding to the frequency of extreme storm events. Natural flood management techniques help the rivers and surrounding countryside by reducing the speed at which rainfall reaches the rivers. Implementing natural flood management measures in the catchment, builds resilience in the environment to buffer against the effects of climate change.

What the map shows:
This map shows the interaction between opportunities for carrying out natural flood management measures and current agriculture. Opportunities may be most limited in arable areas where food production is a priority (dark pink), and there may be constraints in areas of high quality grazing (light pink).

How the map has been created:
The map has been created by combining specific classes of information from the stock maps of agricultural livestock and crops (from the IACS 2013 data) and the opportunities map which shows areas suitable for enhancing natural flood management.

The map is one of a set of 9 maps that explores the current and potential use of land in the Scottish Borders. It is not intended to prescribe a course of action, but rather to act as a decision support tool, highlighting where different options for land use change may impact in these areas.

Rules box:

Key ecosystem service factors	Data used	Example attributes	Displayed
Land currently used for agriculture (Ecosystem service agricultural goods, livestock and arable)	Provisioning service map 1 of 4 Crop production	Classes Used – Currently arable	Land under consideration
	Provisioning service map 2 of 4 (Land supporting food production grazing intensity for livestock)	Currently improved pasture	
Land helping to mitigate flood risk (Ecosystem service Hazard mitigation Mitigation of flood risk)	Opportunity service map 1 of 7 Hazard mitigation Mitigation of flood risk	Land suitable for NFM on arable and improved pasture	Pink
		Land suitable for NFM on rough pasture	Green

N

Kilometres
0   5   10   15   20

Cartography by Environment Systems Ltd. 2014. Phase 3. version 0.2. September 2014.
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Overland Flow in Scotland, copyright James Hutton Institute. All rights reserved. Used with permission.

By way of showing how multiple benefits can accrue from the Ecosystem Services approach to land management decision making, two case study examples are provided. They relate to implementing natural flood management measures at both the individual farm level and through farmer co-operation, at the sub-catchment scale.

Example Project 1: Achieving multiple benefits- Implementing Natural Flood Management measures at the farm level, Crookston, Heriot.

© Keith Robeson

Floodplain woodland establishment on the Armet Water, is designed to help slow the flow of rainwater run-off rates leading to reduced flood water levels in towns downstream

Applying an ecosystems approach to land management

The towns of Stow and Galashiels on the valley of the Gala Water have suffered a significant number of flooding events over recent years. Tenant farmer, Mr Jim Sinclair and son Graeme have taken steps to reduce overland flow rates. 24ha of native woodlands were established on floodplain areas and a series of wetland scrapes.

Delivering multiple benefits to the farm business, the environment and the community:

- Greater stock control through fencing of wetland
- Reduced risk of liver fluke amongst livestock
- Enhanced water quality
- New areas of woodland and wetland habitat created
- More species diversity
- Increased carbon storage
- Higher aesthetic, landscape and amenity value

"The steps we are taking to reduce surface water run-off rates will hopefully have a positive effect on reducing potentially damaging flood water levels in Stow and Galashiels, whilst at the same time benefitting our livestock management and also the farm environment" Graeme Sinclair

The programme of conservation works was facilitated by Tweed Forum staff. Funding was obtained from a number of sources including the Scottish Rural Development Programme and farm Biodiversity Offset funding facilitated by Scottish Borders Council.

SECTION 3 – MAKING USE OF THE FRAMEWORK

3.1. The Framework as a Non-Statutory Strategy for the Borders

The Framework is a non-statutory document, but one that can potentially add value to the work of a wide range of organisations within the Scottish Borders. It can probably best be seen as a new form of technical advice, presenting information in a spatially explicit way on both the well-recognised and hitherto often hidden values of the services provided by land.

It is recognised that this is a new initiative and that it will need reviewing and updating as new and better information become available and lessons are learned from the pilot projects as to how and where it can best be applied. Equally important will be to learn where the Framework does not fit current processes or does not add value to existing systems for deciding between land use options or, indeed where other initiatives are already proving more successful.

3.2. How could these indicative opportunity and interaction maps be utilised to make 'better' decisions?

By presenting this in an integrated way, the maps challenge the traditional view of land as solely a location for economic production, and raise the possibility of opportunities of potential changes in land use in a new way. As noted, the Framework is not a statutory instrument of any type, but there are various ways in which it can potentially assist and support decision-making about land use that is currently undertaken through existing processes and methods. Among these, some of the most relevant opportunities and areas for exploring the Framework's use, including further development would seem to include:

- Catchment Management – the process of planning and implementing actions to improve the quality of our waters and wetlands is framed within the River Basin Management Planning (RBMP) process led by SEPA, but delivered by all those with responsibilities

and interest in the wetland environment. RBMP already utilises a range of mapped material and has a formal stakeholder consultation process, but the LUS Framework and maps could potentially add value to the prioritisation, cost-benefit and delivery of measures to improve 'failing' water bodies and secure other benefits for partner organisations and individuals. Within the 2nd round of RBMP, SEPA have already identified the key wetland ecosystem services provided by each water body.

- Flood Risk Management – a rapidly developing area of increasing importance with the impacts of climate change and environmental change a high priority. Flood risk management in the Borders is very much a partnership between SBC and SEPA, with support from Scottish Water, local landowners, communities and Tweed Forum. The Framework provides new spatial information on natural flood management which, along with the opportunity and interaction maps can help inform the development of the Council's Flood Protection Schemes and guide actions on the ground to gain best value from a whole catchment approach. SBC are recognised as being leaders for this approach, with the Selkirk flood protection scheme , the first scheme in Scotland approved under the Flood Risk Management (Scotland) Act 2009, providing a fine example of a catchment-based ecosystem approach.

- **Protection of Drinking Water sources** – in addressing potential problems (nutrients, pesticides, dissolved organic carbon, faecal matter and zoonoses) in raw water 'at source' in the watersheds above their abstraction points, rather than only relying on treatment downstream at their works, Scottish Water have a great opportunity to utilise the Framework. NFM mapping, along with that of other potential ecosystem services can help identify and deliver multiple benefits alongside cleaner water. Their Sustainable Land Management Incentive Scheme provides a suitable mechanism for exploring this further.

- **Promotion of agri-environment and other rural schemes** –The Scotland Rural Development Programme (SRDP) is a key potential target for Framework use. If able to take a sub-catchment or landscape view, RPID, agencies and farmers may all be able to utilise the Framework to help assess local priorities and steer applications for agri-environment funding to achieve maximum public benefits from a range of complementary services. Others, such as FCS and SNH may also use it to support promotion of key land uses through planting or management grants for example, that will deliver on their various remits and partner objectives.

- **Development Planning** – although currently in the latter stages of the Scottish Borders Local Development Plan production, as it develops, planning policy development could potentially be better informed by the Framework. Although not a statutory document, the information within it and the holistic manner in which it has been displayed will be available for those involved in planning and could be used as contextual information to guide future development of plans and policies reflecting the multiple values and use of land

- **Advisory services** – a range of potential advisory services could gain from utilisation of the Framework to help steer their resource allocation and work. This may be as wide as Tourism and Recreation bodies on one side through to Farm and Rural Business Advisors, Rural NGOs and organisations such as NFUS and SLE.

- **Regulatory aspects** – The Framework is not a regulatory instrument, but where bodies such as SEPA, FCS and others need to regulate using a light touch, the Framework may help in identifying and assessing impacts of non-compliant actions on other ecosystem services.

- **NGOs** – Tweed Forum and other participatory catchment organisations could use the Framework to help prioritise areas and topics for attention, including project development and support in facilitating others to act.

- **Individuals** – whilst the maps are not at such a scale that individual properties are mapped, they are available to all to interrogate. For large estates, the approach may bear similarities to their own sustainable approach and some, such as Buccleuch lead the way with their ecosystem service mapping and sustainable land management. Individual land owners and managers however can also use the Framework to assess options for their own land units in the context of the wider whole.

3.3. How might this new information be used to evaluate different land use options?

The key part of the Framework is the web-based tool as it provides the means by which the system can be interrogated. It is essentially a spatially based system, and the maps form a logical progression from stock (baseline) maps to Opportunity maps, Multiple benefit maps and, finally Interaction maps. In each case, the 'direction' of travel in terms of the expansion of different land uses is based on the expected direct and indirect impacts of climate change and of other key policies affecting land use in Scotland. These may change over time, so this is not a set pattern for ever, and we also make no predictions as to any change in land use capability or capacity in response to any climate changes that might happen.

Many organisations are already involved in programmes and projects that take at least in part an Ecosystem Approach, so for them the simplest way to utilise the tool is to see how it might 'fit' to their own decision-making processes, rather than try to re-invent a new process.

The basic way to use the Framework and maps is to explore the implications of expansion in just one policy driver as it might affect the particular ecosystem service and location one is interested in - and checking how expansion of that one would impact on any other services. As noted, there is no attempt to value one service against another - that is left to the individual to ascertain in as much or as little detail as they can or need to. One approach would be to use a simple matrix to compare options. This could be done at any scale, but would possibly work best at either a farm / estate scale, or at the community / small catchment scale.

The matrix below (p32) gives a hypothetical example at the farm unit scale, built up from data in the maps, starting with an arable farm and working through potential changes under a do nothing scenario (climate change), and an option reflecting possible policy drives towards promotion of natural flood management to combat flooding. The aim of the matrix is not to value the changes, but, by transferring the information from the maps to a matrix to clearly show what interactions might occur in the locality of the farm as reflected in the light of the policy changes described and, by implication which areas and sectors of society will gain or lose by this change. As the maps are at a smaller scale than the actual farm, this can only be indicative at the outset.

In this instance, the matrix highlights that were the policy driver to reduce flood risk to be promoted, this would lead to a significant loss in agricultural production (a provisioning service) as indicated by the interaction maps, but increases in a whole raft of other services – as indicated by the multiple benefit maps. It is also clear from the matrix that the public at large are the main beneficiaries from many of these newly improved services, rather than the land manager directly, raising important issues as to how and where payments for delivery of these services might need to be addressed.

Hypothetical Example Matrix for comparison of options for land use change in response to increasing flood risk – ecosystem services on a farm unit in response to opportunity map for flood risk policy drivers, expressed as positive **(+)**, negative **(–)** or neutral **(0)**.

POTENTIAL Ecosystem services	CURRENT Ecosystem services produced on the land in arable production (from Ecosystem Stock maps)	Scenario 1 DO NOTHING Climate change on business as usual	Scenario 2 FLOOD RISK REDUCTION policy option: change to Mixed Farm & NFM measures (from Multiple benefit & Interaction maps)
Food - arable	High	0	––
Food - livestock			++
Flood risk reduction	low	–	+++
Water quality			+
Carbon storage	low	–	+
Biodiversity	low	–	+
Recreation			+
Timber production			+
Landscape	low	–	+
Renewable energy			
Sporting recreation			++
Other			

It will also be possible to use the multiple benefit and interaction maps to build up a similar matrix for a much larger area, presenting a series of land use options (or scenarios), each based on promotion of different policy drivers working with a local community to do essentially the same exercise over a larger area. In this instance, the potential for expansion of different services is multiple, as is the starting point, and it would be necessary to get a group, such as a local catchment partnership to agree a number of scenarios, as was undertaken in the Carse of Stirling Ecosystem Project referred to earlier.

In the hypothetical example given below, three different scenarios (presented as policy responses to climate change) are given – to improve agricultural production to increase food security; to improve conservation of wildlife and biodiversity to enhance environmental resilience; and to encourage the uptake of natural flood management measures to reduce flood risk. As above, no attempt is made to value the different ecosystem services here (though techniques are available), rather to demonstrate where the interactions between 'competing' services will occur under the different land use policy scenarios, and where opportunities arise for the delivery of multiple benefits. It is clear that in this example, an increased focus on food security would lead to major impacts on other services, particularly biodiversity, as well as 'trade offs' with other services as well. In comparison, policies that promote conservation of biodiversity can also deliver many other complementary benefits, but at the expense of food production. The challenge could be to have a mix of land uses within such a sub-catchment and to ensure that a balance can be struck between private provision and public benefit for the whole raft of ecosystem services.

Hypothetical Example Matrix for comparison of options for land use change - ecosystem services at a sub-catchment or community level in response to potential policy drivers (Food security, conservation of biodiversity, reduction in flood risk) expressed as positive **(+)**, negative **(-)** or neutral **(0).**

		Scenario 1	Scenario 2	Scenario 3	Scenario 4
POTENTIAL Ecosystem services within the Catchment	CURRENT Ecosystem services produced on the land	DO NOTHING Climate change on business as usual	FOOD SECURITY Land Use Option (1) - Drin and Convert to arable	BIODIVERSITY Land Use Option (2) - plant with native woodland	FLOOD RISK Land Use Option (3) - Mixed Farm & NFM meausres
Food - arable	∗	0	+++	--	-
Food - livestock	∗	0	---	--	-
Flood risk reduction	∗	-	-	++	+++
Water quality	∗	0	--	+	+
Carbon storage	∗	-	---	++	+
Biodiversity	∗	-	---	+++	+
Recreation	∗			++	+
Timber production				+	+
Landscape	∗	0	-	+	+
Renewable energy					
Sporting recreation				++	++
Other					

Example Project 2: Achieving multiple benefits - Implementing Natural Flood Management measures at the catchment scale, Cringletie, Eddleston

Re-meandering of a canalised sections of the Eddleston Water is designed to help slow the flow of rainwater run-off rates, re-connect the river with it's floodplain and provide significant habitat enhancement

Applying an ecosystems approach to land management

The Eddleston Water is tributary of the River Tweed and has a catchment area of some 70 sq. km. In the early 19th century, the river was canalised and straightened throughout the majority of its length and embankments constructed to protect the surrounding land from flooding. A key objective is to work with land managers and communities in bringing about meaningful and sustainable land & water management changes, and to recognise the services nature provides to society. Slowing the flow of flood waters is a key objective. Over 25 individual sites are being enhanced using measures such as re-meandering, native woodland planting, ditch blocking, creating water retention ponds, placing log jams and bankside revetment.

Delivering multiple benefits to the farm business, the environment and the community:

- Reconnecting the river with its floodplain
- Reduced riverbank erosion
- Reduced water flow rates and flood water levels in towns downstream
- Restoring a more natural riverine system
- Creating more diverse wildlife habitats
- Enhancing water quality through wetland filtration
- Creating carbon storage areas

The project is led by Tweed Forum but is a partnership involving Scottish Government, Dundee University, SBC, SEPA, FCS, SNH, EA, Tweed Foundation, British Geological Survey, Woodland Trust, Forest Carbon, CEMEX, Scottish Power and a large number of landowners.

SECTION 4 - NEXT STEPS

Production of this draft Framework has involved intensive evidence-gathering and extensive consultation, but these have just been the first steps on what is a totally new project and process. Further progress will depend on how it is taken forward and the degree of buy-in that comes from landowners and other key stakeholders who make use of it. Where appropriate, the Framework could potentially be used to help remove any perceived or real barriers between stakeholders and to help start a conversation at a local level, perhaps through local catchment partnerships, about land use choices on a more democratic basis with landowners, managers, tenants, foresters, agencies, councils and others. 'Learning by doing' will be an important way in which we review and improve its contents and we look forward to hearing how it is received by those who try to use it.

The national Land Use Strategy is nearing the end of its first cycle and preparations for the development of the next strategy, due in March 2016 are already underway, with public consultation expected in 2015. With this in mind, we have included only an interim action plan for the Borders' pilot for this first year, 2015/16, recognising that it falls in to this period in between - and before the Scottish Government is able to give guidance or set targets and budgets for the second Land Use Strategy beyond 2016. The inclusion within the Borders Land Use Strategy anyhow of a longer-term 'Action Plan' might have seemed to suggest that there was an agreed goal and an agreed (costed and resourced) way forward to its achievement. We are also mindful that this current 'Next Steps' will itself be subject to stakeholder consultation and actions could be brought into the 2015/16 action plan if recommended by the relevant stakeholders.

If the Framework and Action plan within it are seen solely as a technically driven process to produce maps, it risks becoming less democratic and essentially something over which parties can argue – for example as to the validity of the data, or who pays for changing 'my use of my land' or indeed who has a right to 'tell' a land owner how to manage their land. So, there is an opportunity to enhance partnership working if maps are used to give the broad picture and partners do not immediately become focussed on individual sites.

4.1. How could this new information be embedded in relevant policies and practices?

The Conceptual approach taken in the Borders LUS pilot study was to address the potential impacts on delivery of ecosystem services that might result from possible changes in policy direction affecting land use. The changes in policy direction considered were those that might be adopted in response to climate change. Thus, we have not tried to predict what changes to land capability or ecosystem services per se might arise as a result of predicted biophysical changes in the climate, rather to consider what the impacts might be on land use and ecosystem service delivery of a number of different policy priorities and options that could be promoted by government in response to climate change. For example, were a policy response to be that Scotland needed greater food security from with its own land and resources, then what would be the implications of such a policy direction that promoted the expansion of agricultural production at the expense of other ecosystem services?

In an ideal world, one might hope to be able to quickly have available a proven, standardised and simple working methodology capable of mapping, integrating and valuing the complete range of relevant ecosystem services provided or potentially provided by any area of land under consideration. From here, with help from participatory stakeholder engagement, one could then perhaps compare the marginal changes in those key services of interest under different possible future policy scenarios – these scenarios being ones developed with the relevant stakeholders to reflect the range of possible policy directions adopted to deal with climate change – and then make decisions as to the favoured options and how best to promote actions to achieve them.

This indeed would seem to be the ultimate goal for real sustainable land use, but an action plan also needs realistic stepping stones and rewards for participation and progress.

As noted, the Framework therefore presents the next steps in two ways:
1) An interim action plan covering the immediate future, and in particular those actions that can be delivered by the key stakeholders themselves; and
2) A set of suggested potential national, regional and local actions that cover the main ecosystem services provided by land use in the Borders' and which could be implemented under a regional framework informed by, and informing the direction of development of the 2nd national Land Use Strategy.

Another way to look at the next steps is to consider actions that address:
a) Existing policies and plans, and how they match with the LUS Principles;
b) Integrating the LUS approach within and building upon existing initiatives; and
c) Developing an innovative approach to integration at the local, community level.

In each case, the key will be to engage fully with the relevant stakeholders at the outset and to measure progress and impact.

4.2. An Interim Action Plan for 2015/16:

The immediate actions identified in the draft framework are focussed initially on those organisations whose operations in the Borders are already well embedded in the ecosystems approach to land use management and, in particular the first three involved directly with developing the Borders pilot itself.

Scottish Borders Council:
- Utilising the Framework with ongoing Local Development Plan policy development - particularly policy EP3 Local Biodiversity and refreshment of the Local Biodiversity Action Plan with regard to the Scottish Biodiversity Strategy update and policy EP12 Green Networks
- Testing the application of the draft Framework to help inform the emerging Local Flood Risk Management Plans and the development of the Hawick Flood Protection Scheme
- Guide delivery of biodiversity offset and woodland comprensation schemes as they arise under Planning
- Continue the development of the Historic Land Use Value pilot and link to the emerging Historic Environment Land Use policy and guidance
- Awareness raising and education: Ongoing liaison with relevant Council departments and sections to consider the linkages to e.g. LEADER programme 2014-2020, Low Carbon Strategy Adaptation Plans, Neighbourhood Services Review of Operations.

- General action to promote LUS pilot through the SBC website/ mapping tool and through presentations at national and local events
- Continued involvement in post-pilot partnership and development of new initiatives.

Tweed Forum:
- Review how Tweed Forum can utilise the framework to help prioritise project development and target areas for action within its Tweed Catchment Management Plan and Tweed Wetland Vision
- Develop a pilot project for assessing the potential use of the framework to aid effective targeting of work to support the delivery of multiple benefits at the landscape scale through SRDP
- Work with partners on integrated catchment management through an Ecosystems Approach, including Dundee University on Eddleston Water and Scottish Water in Upper Tweed, to map ecosystem services, target improvements and measure delivery
- General action to promote LUS pilot through the Forum website and through presentations at national and local events
- Continued involvement in post-pilot partnership and development of new initiatives

University of Dundee:
- Review of historic landscape change and ecosystem services in two catchment pilot areas in the Borders to assess change over time in ecosystem service provision
- Review of lessons learned from the pilot project process and practice on the ground
- Work with partners including Tweed Forum and SBC on integrated catchment management on Eddleston Water through an Ecosystems Approach
- General action to promote LUS pilot through research and presentations at national and local events, including involvement in post-pilot partnership and development of new initiatives

4.3. Potential national, Regional and Local actions that cover the main ecosystem services provided by land use in the Borders

The pilot identified, through stakeholder engagement, a range of potential actions that could be explored, although there is no commitment to deliver them. They have been included in a Postscript as it was felt they could help guide future use of the Framework and be useful to stimulate discussion for future action.

Example Project 3: Using land use strategy opportunity mapping data to highlight potential areas for land use change, Fruid Reservoir (Scottish Water)
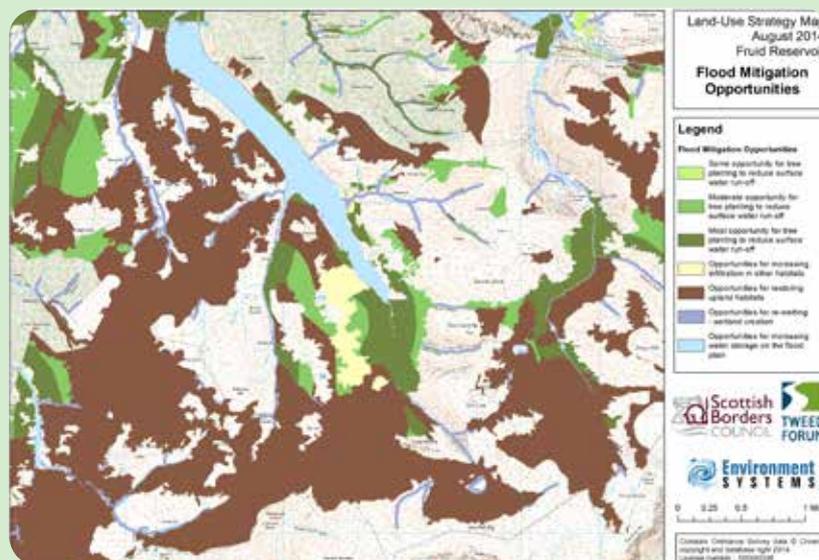
Land use opportunity map for Fruid Reservoir highlighting areas of potential land use change to target multiple benefits including improved water quality and reduced sediment input to the reservoir

Opportunity Mapping within the Land Use Strategy (LUS) pilot

The upper Tweed reservoirs supply drinking water for Edinburgh and the degree of treatment required is a reflection of the surrounding land use. This exercise tested the ability of the Land Use Strategy maps to pick up alternative land uses on the ground with the goal of improving water quality. Maps showing flood mitigation opportunity, water quality enhancement, biodiversity improvement and areas for carbon storage, were the most useful in demonstrating where land management could be altered to enhance water quality.

Site visits to the reservoir catchments were made to assess conditions on the ground and locate where remedial measures might be implemented. When this information was mapped and overlaid on the LUS maps, a good correlation was evident. The walk over survey recommendations, devised to buffer and filter potential dirty water sources, were found to be a close fit with the combined LUS mapping data generated.

Adding value and delivering multiple benefits to Scottish Water's core business, the water environment, the landscape and the community, through opportunity mapping

By converting potential land use opportunities into practical action, in respect of woodland planting, ditch blocking, wetland creation and including areas of livestock exclusion, the following multiple benefits could accrue:
- improved water quality
- increased carbon storage
- reduced sediment input
- enhanced wildlife value
- reduced flood risk
- increased woodland expansion
- increased recreational value

The project is led by Tweed Forum but is a partnership involving Scottish Water, University of Dundee and Environment Systems.

Example Project 4: Using a natural approach to reduce diffuse pollution within the Eye catchment

Water quality within the Eye Water catchment has improved through targeting of measures to reduce diffuse pollution, such as fencing off watercourses

Applying an ecosystems approach to land management

Between 2005 and 2007 Eyemouth beach failed the requirements of the EU Bathing Water Directive due to pollution levels caused in part by run-off from farmed land. In 2008, staff from the Scottish Environment Protection Agency (SEPA) walked the Eye Water and its tributaries and highlighted potential areas where sources of 'Faecal Indicator Organisms' (FIO's), produced by livestock, could be entering watercourses. Simple grass buffer strips alongside watercourses have the potential to reduce pollutants to rivers, significantly.creating water retention ponds, placing log jams and bankside revetment.

Delivering multiple benefits to the farm business, the environment and the community:

Between 2009 and 2011, Tweed Forum worked with farmers within the Eye catchment to put in place practical conservation measures to reduce diffuse pollution and create new wildlife habitat. The diffuse pollution measures employed included:

- Fencing off watercourses to exclude access to the river by grazing livestock.
- Positioning water troughs in fields well away from the river banks.
- Creating wide grass buffer strips which help catch potential pollutants such as fertiliser run-off, pesticide run-off and sediment input.
- Planting clumps of native trees to stabilise the banksides and add landscape value.

This joint initiative by SEPA and Tweed Forum resulted in improvements in water quality, improvements in the bathing waters, reduced erosion by livestock and an increase in riparian habitat. By using the services that nature provides, many benefits to the environment and the farm business, can be achieved. As pressure on land for food production increases, good soil and water conservation programmes will become increasingly important

SECTION 5 – MONITORING AND ASSESSMENT

5.1. How will we know if we are making a difference?

Climate change does not occur rapidly, neither does landscape change nor many other environmental changes either, so it is unlikely that the immediate impacts of the pilot Framework would be visible on the ground in the near future. And similarly, neither policy development, nor implementation in practice would necessarily follow closely behind either. Finally even if and when changes are observed, it would not necessarily be clear if and how such changes related to use of the Framework, as opposed to one of many other potential drivers of change.

As with the choice of ecosystem service measures themselves, so the choice of indicators to monitor progress needs to be as simple, yet as robust as possible. And there is a clear need for standardisation and the use of similar metrics both at different scales and at different locations across Scotland. We look to national guidance and development of such indicators

5.2 Monitoring Outcomes:

It will be very difficult to establish that the Land Use Strategy framework has been effective, or indeed ineffective, in terms of influencing outcomes and

achieving a sustainable land use (even assuming one could define that outcome in some measurable manner). In the long-term of course there will be measurements that can be made and these should be utilised to help establish correlations between action and outcome, even if causal relationships are harder to prove.

Outcome measurements will largely be those that are already being recorded by relevant organisations, and will include data which forms the basis for each of the ecosystem service maps, such as water quality, agricultural production and renewable energy provision. The frequency with which such measurements are made though will likely reflect the timetable of reporting for the purposes of which they are collected – annual for some agricultural statistics, every 6 years for river basin management plans, less frequently for some site condition monitoring, etc., such that consistency and timing may not be ideal. Their collection though will largely be undertaken by statutory bodies with quality assurance and trained staff, such that reliability and availability should be good.

Nationally, consideration should be given to the adoption of a set of agreed indicators of ecosystem service health and, rather than creating a new set to reviewing and adopting some of those from existing work on developing a set of 15 Ecosystem

Health Indicators undertaken for the Scottish Biodiversity Strategy, which recognises the need for spatial indicators of ecosystem health that operate at a national and regional level (http://www.snh.gov.uk/docs/A1308427.pdf).

5.3. Monitoring Actions and Outputs:

What is more amenable to monitoring are the actions and the outputs from these actions. For the 2015/16 Interim Action Plan, for example, it will be possible to check progress against the itemised actions and this should be reported on at the end of the pilot and in any follow-up phases.

The other specific actions detailed in the Next Steps of the Framework are all capable of transparent and quantitative or qualitative assessment, and the reporting thereof. Each one could therefore be the subject of at least an annual check on progress, with new data collection as necessary, and reporting every 5 years minimum. Subject to any policy direction arising from the revised national Land Use Strategy.

A key aim of monitoring actions and outputs will be to try to record information on land use change and, for example biodiversity change at a regional and local level in response to uptake of policy drivers, such as agri-environment schemes within the SRDP. Similarly, it will be necessary to assess practical actions to assess promotion, uptake and acceptance of use of the framework, such as the facilitation of meetings through Tweed Forum, or the number of relevant grant applications submitted, or the number of land managers visited and schemes initiated. It is essential to be able to measure changes in biodiversity and other ecosystem services in response to actions on the ground to promote it.

Finally, there will be a need to monitor acceptance and uptake of the framework in terms of the perceptions and use of it by key stakeholder bodies and individuals. This can be achieved through targeted questionnaires, interviews and meetings of stakeholder groups.

POSTSCRIPT

4.3. Potential national, Regional and Local actions that cover the main ecosystem services provided by land use in the Borders

4.3.1 Assessing existing policies and plan against the LUS Principles

In the 2011 Guide to Scotland's first Land Use Strategy, the Government committed itself and its partner bodies to take forward the Principles for Sustainable Land Use and the 13 proposals contained therein. It goes on to state that *"We expect the wider public sector to take a leading role in implementing the strategy – by utilising the Principles for Sustainable Land Use in the way it manages its own land; develops and implements its plans and strategies; and promotes partnership working".*

Action a - National

Relevant stakeholder bodies should undertake a simple review in the development of their relevant practices, plans and strategies against the 10 Principles of Sustainable Land Use.

These are:
A. Opportunities for land use to deliver multiple benefits should be encouraged
B. Regulation should continue to protect essential public interests while placing as light a burden on businesses as is consistent with achieving its purpose. Incentives should be efficient and cost effective.
C. Where land is highly suitable for a primary use (e.g. food production, flood management, water catchment management and carbon storage) this value should be recognised in decision-making
D. Land use decisions should be informed by an understanding of the functioning of the ecosystems which they affect in order to maintain the benefits of the ecosystem services which they provide.
E. Landscape change should be managed positively and sympathetically, considering the implications of change at a scale appropriate to the landscape in question, given that all Scotland's landscapes are important to our sense of identity and to our individual and social well-being.

F. Land-use decisions should be informed by an understanding of the opportunities and threats brought about by climate change. Greenhouse gas emissions associated with land should be reduced and land should continue to contribute to delivering climate change adaptation and mitigation objectives.
G. Where land has ceased to fulfil a useful function because it is derelict or vacant, this represents a significant loss of economic potential and amenity for the community concerned. It should be a priority to examine options for restoring such land to economic, social or environmentally productive uses.
H. Outdoor recreation opportunities and public access to land should be encouraged, along with the provision of accessible green space close to where people live, given their importance for health and well-being.
I. People should have opportunities to contribute to debates and decisions about land use and management decisions which affect their lives and their future.
J. Opportunities to broaden our understanding of the links between land use and daily living should be encouraged.

4.3.2. Integrating the LUS approach within and building upon existing initiatives

Although we recognise the imperative of promoting a fully joined-up approach to land use management and ecosystem service delivery in the LUS pilot, current initiatives have necessarily been focused

around specific sectors and organisations – be they to do with agriculture, water, forestry, biodiversity, etc. This part of the Borders Action plan therefore looks to build up on these existing initiatives, taking as its starting point the key ecosystem services defined by our mapping and stakeholder engagement processes, and the potential policy directions that might be expected in response to climate change:

- Food production – livestock and crops
- Timber and Woodland
- Renewable Energy
- Natural flood management (NFM)
- Diffuse pollution control
- Carbon storage (soil & vegetation)
- Recreation
- Development sites
- Biodiversity – Species conservation and habitat linkages

4.3.2.1 Food production – livestock and crops

Largely dominated by market forces and European policy, agricultural production is a key land use component of the Borders economy, changes to the location and intensity of which can have significant impacts on the delivery of other ecosystem services. At the individual unit level, the Framework can help farmers to make decisions on land use in response to changing government policy objectives and, in doing so to focus on having the right land use in the right place - thus achieving production targets and achieving multiple benefits where possible. At a wider scale, the Framework could be used to help target funding under SRDP to bring about integration of ecosystem service delivery at a landscape scale. Finally, the Framework could also be used to help reveal and enable better understanding of the true 'value' of farmland in delivering not just food (provisioning service), but other ecosystem services (environmental and social) as well.

The interface of the pilot LUS with SRDP is clearly an area of great potential interest. Within the EU Common Agricultural Policy, Pillar 1 payments provide direct single farm payments, but there is limited opportunity to utilise the Framework to influence land use, as farms are either eligible or not. Pillar II however supports agri-environment schemes and potentially the Framework could offer opportunities to target certain areas and activities to deliver multiple benefits through the scoring system and agglomerations of similar interventions. Collaboration between neighbouring land managers does not occur on its own, so mapping can provide target areas and activities for NGOs, such as Tweed Forum to actively facilitate and deliver landscape change in a joined up manner on the ground. This might also occur possibly with Ecological Focus

Areas under Pillar 1, which covers 5% of arable farm land, by encouraging collaboration with neighbouring farmers in location of their field margins, buffer strips, etc. to link and provide wildlife corridors for example.

Potential responses to climate change could see changes in crop distribution as the biophysical factors affecting plant growth alter, leading to expansion of arable areas perhaps at the expense of in-bye land. At the same time, one might expect issues of food security to become increasingly important, with a focus on producing more agricultural produce from within Scotland, rather than relying on imports. Both trends could lead to policies that support expansion of agricultural production, potentially at the expense of other ecosystem services.

Action a - Local

Encourage the development of land use plans at an individual farm and estate level that recognise the delivery of multiple ecosystem services. Within many tenanted farm operations, the options to utilise the Framework are somewhat limited by scale, but we should endeavour to promote its potential use to individuals, not just organisations, and specifically in the development of whole farm plans, as featured in the SRDP

Action b - Local

Develop awareness of the potential role individual farms can play in delivering multiple ecosystem services within the context of sub-catchment communities. As farms are not isolated businesses, and do not operate in a closed environment, we should endeavour to promote spatially 'joined up' actions at a landscape scale such as natural flood management or pollination.

Action c - National

Explore the use of the Framework, especially the web-based ecosystem service mapping tool to help deliver policy objectives through SRDP mechanisms. As noted, the Framework provides a potential means to help target public funds to deliver the 'right things in the right places', including support to farms to ensure private delivery of relevant 'public' ecosystem services. The SRDP is a key funding mechanism through which policy priorities can be directed and delivered - not through imposition, but by encouraging voluntary uptake by farmers – and in assisting in determining local level spend.

Action d - National

Determine the true value of agriculture as a land use – in market terms and in non-market terms (including social and cultural ecosystem services, as well as environmental ones) and in terms of resilience to climate change. As the Framework and LUS highlight previously 'hidden' non-market aspects of land use, we should work with NFUS, SLE and others to reveal the scale and extent of delivery of such services and who benefits from them.

Action e – National

The LUS pilot framework could be utilised as a mechanism to help locate priority areas for targeted land management opportunities and funding within the SRDP. Recognising that whatever the outcomes of current negotiations with Europe, the Scottish Rural Development Programme will play a major part in determining land use options, the web-based tool offers opportunities to target certain areas and activities to deliver multiple benefits through the scoring system and agglomerations of similar interventions. Mindful of scale and individual farmer circumstances, such an approach would have to ensure that it did not favour or adversely impact on farmers within or without a pilot area, and will need careful assessment and introduction.

4.3.2.2. Timber and Woodland

Forestry Commission Scotland's work already encompasses an approach and principles that are similar to elements of the LUS and Framework, enabling the targeting of public resources to achieve desired effects in the private (and public) forestry sectors. Their roles in incentivising change in existing woodland and encouraging particular directions for new planting stress not just production of timber but, increasingly multiple benefits delivered through complementary ecosystem services - providing recreation, natural flood management, water quality and biodiversity conservation, alongside timber. In addition to use of Environment Impact Assessments for analysis of options for forest planting, Forest Research have developed tools to help technical mapping and assessment of grant options, including opportunity mapping of woodland creation sites to improve water quality and reduce flood risk (http://www.forestry. gov.uk/pdf/Tay_OM_Report_June13.pdf/$FILE/ Tay_OM_Report_June13.pdf).

The Framework highlights tensions between forest expansion and other land uses, whether in the public or private sector, and could be used to show how one might support different choices; and also how to promote policy development and delivery associated with these choices. Raising awareness of the many different ecosystem services that land management delivers, especially the 'hidden' public ones, should be a prime aim of the Framework. Woodland Expansion is already a major policy objective, and the Framework cannot supersede existing planning processes, but it could begin to engage key stakeholders in a better appreciation of the impacts of different land use choices on a much wider range of environmental, economic and societal issues than currently considered. The Framework and tool could assist in 'opening up' this discussion as a first step towards better informed decision-making.

The policy direction for expansion of woodland already well set, with the Scottish Government wishing to increase woodland cover, but to do so in a way that is integrated with other land-based objectives. Wherever possible woodland creation should complement and integrate with other land uses to help reduce conflicts, including new ways to integrate woodland management and farming. On top of this, climate change will lead to changes in environmental factors affecting tree growth and potentially also the occurrence of more diseases and pathogens. Public use of woodlands for recreation can be expected to increase and further attention paid to the importance of native woodlands for biodiversity.

Action a - Regional
The LUS principles are similar to FCS's existing approach and the Scottish Borders Woodland Strategy already articulates changes in location, in type, and in composition of existing woodlands, alongside targeting support for new plantings on a local basis by 'woodland type' (4 'thematic' types in the Borders), including guidance on expansion of native woodlands – see: http://www.scotborders.gov.uk/info/1225/countryside_farming_and_wildlife/1011/forestry. Guidance is available in terms of a sensitivity rating as to where new woodland could/could not go (e.g. avoiding areas of deep peat); and, at a more local "sub-regional" scale where it should go, such that other ecosystem service benefit deliverables and impacts can be factored in. As well as **reviewing its activities in line with the 10 LUS principles, FCS and partners should explore how they can utilise the web-based tool to further refine current locational priorities for woodland planting in the Borders.**

Action b - Regional
Where FCS can identify potential planting areas at a sub-catchment level where delivery of biodiversity, natural flood management, water quality and recreation can be prioritised, **support for planting to achieve these multiple benefits should be provided by targeting of grant resources and advice to key areas.**

Action c- Regional
FCS should work at a local scale with partners such as **Borders Forest Trust and Tweed Forum** as 'trusted intermediaries' to facilitate uptake and agglomeration of new planting opportunities to **create a greater impact on ecosystem services at a landscape scale,** using funding mechanisms such as LEADER and others, to support such initiatives.

Action d - Regional
FCS could build on the excellent work already done in the Tay catchment, Opportunity mapping of new woodland sites to provide multiple benefits should be explored, combining ecosystem services mapping data from the Borders with techniques for mapping developed by Forest Research elsewhere

4.3.2.3. Renewable Energy
In the Scottish Borders, the only current foreseeable significant growth in provision of renewable energy is through the development of on-shore wind farms, contributing to the Scottish Government's commitment to achieving a 42% reduction in emissions by 2020. Increases in biomass production may also be expected, but is hard to quantify and will largely be met through forest planting. An increase in the number of run-of-river hydro schemes is also expected.

Unlike many other areas of land use, wind farm developments dealt with by formal land use planning procedures including, where necessary full Environmental Impact Assessment. Whilst development of renewable energy therefore needs to be encompassed in the overall LUS Framework, current procedures and policies guide what is possible. SPP recognises that development plans should seek to ensure an area's full potential for renewable sources is achieved in line with national climate change targets, giving due regard to relevant environmental, community and cumulative impact considerations. And NPF3 advocates that planning must facilitate the transition to a low carbon economy and help to deliver the aims of the Scottish Government.

The development of all types of renewable energy raises questions as to trade-offs with existing and alternative future land uses, and the location of large wind farms in particular can create strong opposition on cultural and landscape concerns in some areas. At the same time, such developments may create opportunities for biodiversity enhancement, either on site or regionally through the imaginative use of biodiversity offsetting.

Action a - National
Explore with the Renewable Sector the potential for using the web-based mapping tool to aid discussion on wind farm location and power line routes, and on achievement of multiple ecosystem service delivery from wind farms and other renewable developments. As the pilot Framework is 'non-statutory', it is not appropriate for use in the development management process to determine the outcome of planning applications. However, as provision of energy is potentially an important land use and one that stakeholder consultation shows

to be of importance, we should use this opportunity to explore means to help resolve potentially contentious locational challenges. SEPA are already exploring this with Scottish and Southern Energy in relation to some power lines.

4.3.2.4. Natural flood management (NFM)

The potential for certain types of land management to actively contribute to reducing flood risk downstream is one that encapsulates the opportunities and challenges of taking an Ecosystem Approach to land use. Potential clashes arise between increasing NFM and some farming activities, but potential synergy with others, and with forestry. In many cases, there will be opportunities for other benefits to also be delivered, such as enhanced water quality, carbon storage and improved biodiversity. Using the Framework will help recognition of such constraints and opportunities for delivery of these 'unseen' public benefits from the management of private (and public) land, but equally on the losses in production that adoption of some NFM techniques would entail.

Climate changes such as the occurrence of wetter, warmer winters, of more frequent and intense rainfall, and of decreases in days of lying snow will all increase flood risk. Utilising the natural characteristics of the land to help 'slow the flow' and temporarily store flood waters is not only an important ecosystem service (flood regulation), but a key element of sustainable flood risk management, as required under the Flood Risk Management (Scotland) Act (2009) and associated policies and practices. Indeed, Scottish Borders Council, SEPA and Tweed Forum are in the forefront of policy and practice in respect of delivering NFM on the ground and, with Scottish Government and University of Dundee in measuring the impacts of NFM measures on flood risk, biodiversity and other ecosystem services.

Action a - Regional

SBC, SEPA and RPID should use the multiple benefit and constraints maps within the Framework to help prioritise areas for promotion of NFM initiatives at a catchment level. The stock maps developed for NFM encompass information derived directly from SEPA's mapping of Potentially Vulnerable Areas to flooding, which shows many of the main settlements in the Borders to be at risk. The opportunity maps reveal areas upstream of these settlements where 'Natural characteristics' and land use can be modified to provide additional protection from flood risk. RPID can also use this information to assist consideration of areas where uptake of agri-environment scheme options that deliver NFM might be favoured (as also below)

Action b - Local

Facilitate discussions with land managers and agents at a local level to consider locations with NFM potential that will, when implemented together deliver landscape scale changes in ecosystem services. Actual uptake of NFM measures and delivery of flood regulation and other ecosystem services relies on land being available, on funding being forthcoming and on the willingness of land managers to take up such opportunities. In addition, to be meaningful such NFM measures need to be geographically contiguous and functionally coherent. The web-based tool can be utilised by Tweed Forum as a Guide to achieving this.

Action c - National

Use the Framework as a means to identify locations and stakeholders connected through delivery and receipt of NFM services with the aim of exploring 'Payments for Ecosystem Services'. Since delivery of flood risk reduction through NFM is a 'public' service and relies (largely) on private land for its generation, the opportunity exists to make these connections transparent and to seek novel ways to fund such desired outcomes.

4.3.2.5. Diffuse pollution control

Diffuse pollution, from agricultural and some forest sources remains a challenge for water quality in the Borders, particularly in the Eye catchment. In the first River Basin Management Plan, the entire Tweed was proposed as a potential area for targeted action, focussing on the causes of diffuse pollution. Following further work looking at current pressures and their likely sources, sensitivity of protected areas and a number of other criteria across Scotland, SEPA have identified 2 areas within the Borders impacted by both diffuse pollution and changes to morphology as potential priority catchments for action for the period 2015-2021. A further group of water bodies was also identified which, while not meriting a complete priority catchment approach, should be targeted in some way from 2015 onwards. In addition SEPA commissioned a review in to how they might optimise River Basin Management Planning using an Ecosystem Services Approach (http://www.crew. ac.uk/publications/wfd-rbmp-ea).

Upland areas that are the primary source of raw water for subsequent treatment and provision for drinking are particularly important in the upper Tweed, above the main reservoirs of Megget, Talla and Fruid. Land here will be able to provide initial filtration and purification services, as well as potentially reducing the outflow of dissolved organic carbon and attendant water colour issues. Scottish Water already have a programme to

support sustainable land management in 'problem' areas across Scotland, with financial measures available to help protect drinking water sources in a number of key catchments. While none of these catchments of key concern are on the Tweed, a pilot project is underway with Tweed Forum to explore the potential of ecosystem service mapping to help identify areas of conflict and potential multiple benefit above the main reservoirs, alongside a wider research programme across Scotland with James Hutton Institute and University of Dundee on the value of activities to protect such catchments.

Climate change per se is unlikely to directly lead to an increase in diffuse pollution, though more intense rainfall events and flooding could cause greater mobilisation of nutrients, pesticides and sediment, leaching them from land in to water courses, lochs and reservoirs. Other policy directions, such as the achievement of good ecological status for water bodies under the WFD, enhancement of natural flood management and increasing agricultural productivity to meet food security will have an impact. There may be high value agricultural areas where measures to improve water quality and/or physical condition improvements are required, yet these measures may be seen to compromise agricultural production

Action a – Regional
Use the Framework to help review the choice of priority catchments for integrated action on diffuse pollution and other pressures. SEPA have progressed work on using an ecosystem services approach within the second round of River Basin Management Plans and, within the Borders identified priority catchment for delivery of improved water quality, alongside hydro-morphological restoration, rehabilitation of migratory fish passage and other potential ecosystem services. The new information on ecosystem service provision across the Borders provides a new source of extra information that could enhance the process of decision-making. At the same time, the pioneering work being done by SEPA will provide many learning points to the pilot itself

Action b - Regional
Explore the use of the new ecosystem service maps to help inform decisions on timing and ambition for restoring those water courses identified as being damaged by diffuse pollution. Where pressures have been identified leading to failures of ecological status due to diffuse pollution, the new maps can be utilised at the water body level to explore the costs and benefits of different means to achieve delivery of better water quality and multiple ecosystem services through tackling problems at source within the surrounding land.

Action c - Regional
Integrate the ecosystem services mapping information into the protection of drinking water catchments on Tweed. In addition to their Sustainable Land Management Incentive Scheme, Scottish Water have begun an ecosystem service project with Tweed Forum in the upper Tweed to identify areas of conflict and opportunities for bringing about beneficial land management changes. The Framework can be utilised to help take forward this project and, in turn the project itself can inform a review of the effectiveness of using the Framework to achieve multiple benefits while protecting drinking water supplies.

Action d - Local
Explore the development of catchment maps for each sub-catchment, owned by the community. Where catchments are identified for action to reduce diffuse pollution, this should be complemented by development at a local, community level of an integrated 'catchment overview'. Whilst this initiative should be much wider than just diffuse pollution control, this provides a starting point geographically to address one of the key conflicts identified by the mapping process. Using Tweed Forum as a trusted intermediary and facilitator, this will encourage linkages between all sectors at the community level, and use of the web-based tool will enable the identification of opportunities for delivery of new initiatives and highlight areas of competing priorities.

4.3.2.6. Carbon storage (soil & vegetation)
As noted, the Borders has extensive areas of deep peat which are considered to store significant amounts of carbon, as well as that also stored in vegetation. Unlike some other land uses, there is as yet no single soil or vegetation carbon management or restoration plan, though recognition of its importance is clear in the Scottish Climate Change Adaptation programme and in the

2020 Challenge for Scotland's Biodiversity, which includes a key imperative to restore Scotland's peatlands. However, a National Peatland Plan is currently out for consultation (http://www.snh.gov.uk/docs/A1306595.pdf), led by SNH, and earlier in 2013 the Scottish Government announced that the restoration of Scotland's peatlands would be supported by £15 million worth of new funding.

Whilst climate change is seen to be one factor driving loss of carbon from, in particular upland peat soils due to break down of peat from excessive drying and also from leaching under extreme rainfall conditions, it is likely that land management techniques will have had and continue to have a greater impact on loss of soil carbon, due to drainage, erosion and overstocking. Activities such as forest planting on deep, upland soils can be very damaging and FCS guidance, which has existed since 2000, was recently updated to aid decision-making for both regulation and promotion of new planting based on the likely carbon storage or release from different management options on deep peats (http://scotland.forestry.gov.uk/images/corporate/pdf/peatland-habitats-supplementary-guidance.pdf). Choices about land use and management at the landscape scale are therefore key to promoting carbon storage and opportunities for restoration in both soils and vegetation.

Action a - Regional
Use the Ecosystem service maps for soil and vegetation carbon to inform the development of a Borders peatland action plan. Work is already underway supported by SNH funding to identify areas of degraded peat that could be the subject of restoration. This use of the Framework can help identify key areas where resources should be focussed and to direct Borders Forest Trust, Southern Upland Partnership and Tweed Forum in prioritising their engagement with landowners in these locations to achieve delivery of carbon restoration targets alongside other benefits in the best locations.

Action b - Regional
Explore the synergies between priority areas for carbon storage and management and those with opportunities for biodiversity conservation and enhancement. Areas with high potential for or existing carbon storage are often those also of high or potential biodiversity value. The Local Biodiversity Action Plan partnership have developed detailed plans for enhancing and protecting habitats and species in the Borders. Use of the ecosystem service maps for carbon can help prioritise carbon storage and restoration in combination with important wildlife areas, ensuring protection from potentially damaging operations

such as those from renewables development, forestry, agriculture or other land uses.

4.3.2.7. Recreation
Recreation is one of several cultural services, such as sense of place, societal identity, and awareness and appreciation of the historic environment, for which techniques of mapping the ecosystem services are as yet not as far advanced as for other services. Originally four stock maps were produced for the Borders, but attention has been focussed at this stage on non-motorised recreation and, in particular on core paths and associated routes enabling and promoting public access to the wider natural environment. This has been strengthened by the new National Walking Strategy 'Let's get Scotland Walking' which focuses on the health benefits of such exercise, both in terms of physical and mental well-being.

Climate change may present challenges to maintaining infrastructure e.g. loss of paths along rivers and in coastal areas. Increasing summer temperatures may lead to greater use of the 'outdoors' for both informal and formal recreation. Expansion of recreational opportunities however could in places lead to potential competition with certain other land uses. The development of core paths and access provision is part of the ongoing work of Scottish Borders Council and will be further enhanced by the introduction of the new Local Access and Transport Strategy in 2015. With limited other information currently available though, no opportunity maps have been developed at this stage.

Action a - Regional
Establish the demand and supply for recreation amongst residents and amongst incoming tourists in order to establish a baseline of service provision and beneficiaries. A current initiative by Scottish Wildlife Trust, SEPA and SNH is piloting the use of EcoServ-GIS to map not only the supply of recreational and other cultural services, but Borders LUS should work to develop the mapping techniques for this and other important cultural services.

Action b - National & Regional

The recent production of 'Our Place in Time - The Historic Environment Strategy for Scotland' (http://www.scotland.gov.uk/Publications/2014/03/8522) and the work by SBC supported by Historic Scotland on historic land use should be continued and expanded to integrate with the ecosystem services approach of the Framework. Historic Landscape ecosystem services have not been assessed and mapped yet in a consistent way, similar to some of the other themes mapped. Work by SBC to produce maps on historic land use with High/Medium/Low ratings are encouraging and could be developed potentially to include point-based data as well, such that they can feed in to the Framework for land use.

Action c - Regional

Further work should be undertaken on defining the value of sporting recreation across the Borders in terms of both economic impact and its positive and negative impacts on delivery of other ecosystem services. Shooting, fishing and other field sports are part of Borders' culture, society, environment and economy. The use of the Framework can highlight potential areas for delivery of multiple benefits and, through the work of the Southern Upland Partnership and others facilitate their implementation.

4.3.2.8. Development sites

As noted, the Scottish Borders Local Development Plan is currently in the process of review, so no specific mapping of development sites was undertaken for the pilot. Clearly development that takes place on land currently producing food or other ecosystem services will displace delivery of these services, though this is thought to be at a very local scale in the Borders compared to other regions at present. There may also be opportunities to realise some additional benefits in the form of green infrastructure and certain cultural services, including provision of paths.

Climate change will not impact directly on development in terms of land use, except to further constrain potential building in the floodplain. Pressure for development will be driven by economic considerations and societal demands, including the government's focus on sustainable economic growth and the need for more housing, with rising numbers and an aging population.

Action a - Regional

Once the Scottish Borders Local Plan has been formally adopted, consideration should be given as to how development might be mapped in ecosystem service terms. The creation of the Borders railway would seem to have been a good example of one of the few significant developments in the Borders that might lead to the potential for an ecosystems approach to any subsequent exploration of options for land use in adjacent locations.

4.3.2.9. Biodiversity

The Framework identifies many land uses the expansion of which will impact negatively on biodiversity and also conversely situations where enhancement of biodiversity will constrain production. Loss of habitats and species has been highlighted in the 2020 Challenge for Scotland's Biodiversity (http://www.scotland.gov.uk/Publications/2013/06/5538) Scotland's response to the Aichi Targets set by the United Nations Convention on Biological Diversity, and the European Union's Biodiversity Strategy for 2020.

Whilst development, habitat degradation, pollution and competition from non-native invasive species are some of the main drivers for biodiversity loss, climate change is also a direct and indirect cause of changes in species distribution and abundance. Changes in the timing of seasons, the arrival of new pests and diseases, higher temperatures and altered patterns of precipitation are some of the climate induced changes impacting on our native flora and fauna, and they will act alongside the pressures from potential changes in land use.

Action a - National

Use the Framework to promote a better awareness of people's relationship with the land that surrounds them and how it is managed. Raising awareness of the dependence of communities on their local environment should be a specific aim in itself. Seeing the supermarket as the source of food for example misses the whole point of human reliance on ecosystem functioning and land management, whether this is for food provision or spiritual enlightenment.

Action b - National & Regional
Identify those habitats and species of highest biodiversity value and ensure that their future health is not compromised by development of alternative land uses. The framework can be utilised in its simplest form to highlight areas where potential land use change might cause maximum damage to existing areas of high biodiversity.

Action b - Regional
Use the Framework to promote networks of habitat to support the resilience and condition of the existing designated conservation site network against climate change. This could be achieved by supporting land use choices that maximise connectivity between habitat patches and which promote complexity in habitat structure at a landscape scale around designated conservation sites. In this way, it could be used as a tool to support the Scottish Biodiversity Strategy in addressing wider countryside issues, such as fragmentation of isolated areas of habitat, such as the Borders basin mires

4.3.2.10 An innovative approach to integration at the local, community level
The actions above essentially focus on individual ecosystem services and land uses in terms of ambition for effective delivery of sustainable land use. They represent a response initially to a single overarching policy driver, one that might be adopted in response to climate change or other pressures on land, such as expansion of woodland cover, or promotion of natural flood management activities. In doing so, we hope to promote the alignment of policies and priorities from within these existing initiatives such as forest strategies or catchment flood management plans and, in doing so promote more sustainable land use. However, in working to influence existing programmes such as these, there is a risk of repeating and re-emphasising a sectoral approach to what is a multi-faceted and complex problem, rather than taking a truly integrated view, encompassing an Ecosystems Approach and from the 'bottom up'.

Although covering an area much smaller in size, work by SNH and SEPA with the community in the Carse of Stirling (http://www.snh.gov.uk/publications-data-and-research/publications/search-the-catalogue/publication-detail/?id=2113) has been effective in promoting awareness of the interconnectivity between different ecosystem services and land uses within the catchment, starting with a 'blank canvas', rather than with an existing challenge that needed resolution (such as flooding). It has led to the production of a 'community owned' action plan and the

identification of a series of initial projects to enhance delivery of multiple benefits from within the catchment. Whether it has yet led to any changes in land use to deliver significant 'extra' ecosystem services or trade-offs between competing land uses is open to question, and the area is far smaller than the Borders region, but the project did take an integrated and community-led approach that potentially has much to offer.

Action a - Local
Develop a series of community-led local sustainable land use plans. As part of their stakeholder engagement process, Tweed Forum worked with 6 communities in sub-catchments of the Tweed to explore their perceptions and knowledge of land use and ecosystem services within their own area. The opportunity should be taken to follow this up and, where the community are receptive to work with them to develop their own community catchment map, and land use strategy action plan for their area.

Action b - Regional
The key stakeholder organisations in the Borders should together prioritise sub-catchments for action across Tweed, and help identify where the gaps are and where the potential overlapping ambitions and interests may lie. Recognising that a number of organisations already have catchment-based or at least sub-regional management plans, a strategic overview is needed to guide resources to achieve greatest benefit. Collaboration between neighbouring land managers does not occur on its own, so mapping can provide target areas and activities for NGOs, such as Tweed Forum to actively facilitate and deliver landscape change in a joined up manner on the ground.

Appendix Glossary and Acronyms –
Including excerpts from Scottish Land Use Strategy Action Plan Update – May 2014

This glossary provides a guide to terms as they are used in the Land Use Strategy Action Plan.

biodiversity   The variety of life on Earth.

biodiversity offsetting   Development causing a loss to biodiversity in one place is allowed to proceed so long as ecological gains are achieved elsewhere, thereby ensuring no net loss to biodiversity

carbon   A chemical element which is part of many greenhouse gases, for example carbon dioxide and methane. Greenhouse gas emissions are reported in carbon dioxide equivalents - for which 'carbon' is often used as shorthand.

carbon sequestration   Processes that remove carbon dioxide from the atmosphere.

community   The term community includes individuals and groups, and can be based on location (for example people who live, work or use an area) or common interest (for example the business community, sports or heritage groups).

ecosystem   A dynamic complex of plant, animal and micro-organism communities and their non-living environment, interacting as a functional unit.

the ecosystem approach   A strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way, and which recognises that people with their cultural and varied social needs are an integral part of ecosystems.

ecosystem services   The benefits people obtain from ecosystems; these include provisioning services such as food, water, timber and fibre; regulating services that affect climate, floods disease, waste and water quality; cultural services with recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis and nutrient cycling.

FCS   Forestry Commission Scotland

GIS   Geographic Information Systems - a computer system designed to store and analyse all types of spatial or georgraphical data

land-based businesses   Businesses which derive products and services from the management of land; for example farming, forestry, renewable energy, recreation and tourism.

low-carbon economy   An economy in which less energy and resources are used - domestically, commercially and across the public sector; where energy increasingly comes from sources that produce fewer carbon emissions, such as water, wind, wave and solar power; and where economic opportunities from efficiencies and saving carbon are realised.

NFUS   National Farmers Union of Scotland

prime agricultural   Land which is capable of producing the widest variety of crops (identified as being of Class 1, 2 or 3.1 in the land capability classification for agriculture, as developed by the Macaulay Land Use Research Institute).

Appendix b Glossary and Acronyms
(cont'd)

RPID	Rural Payments & Inspections Division of Scottish Government
SEPA	Scottish Environment Protection Agency
SLE	Scottish Land and Estates
SNH	Scottish Natural Heritage
SRDP	Scottish Rural Development Programme
SRUC	Scotland's Rural College
sustainable development	Development which meets the needs of the present without comprimising the ability of future generations to meet their own needs.
sustainable land use	Land use that makes its best possible contribution to fulfilling our Objectives, with regard to the Principles in this Strategy, whilst maintaining the land's capacity for future use.

Scottish Borders COUNCIL