



## **Future Land Use Change – Working locally, thinking globally**

Research briefing on the development of a regional land use decision making framework  
and Aberdeenshire Local Focus Area workshops Oct 2013-Mar 2015



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## Executive Summary

- The Aberdeenshire Land Use Strategy Pilot project produced a new approach to regional land use to facilitate the delivery of policies, strategies and objectives supporting decisions about integrated land-use.
- The project had two layers: developing a regional strategic planning tool (see <http://rlup.hutton.ac.uk/>) and working in two Local Focus Areas (LFAs: Ballater and Huntly) to explore how local people understood and benefitted from their local ecosystems (see <http://www.hutton.ac.uk/research/workshops>).
- The project was novel in its attempts to link drivers of land manager choices; differences in how land managers might respond; ability to change land use when constrained or enabled by land capability and climate; and the consequences for a suite of ecosystem services (carbon storage, sediment retention, nutrient retention, recreational access, food production and timber production).
- The tool allows the user to visualise, as maps, complex calculations that link land, water, access, carbon and biodiversity issues. It provides a mechanism for identifying the delivery of multiple benefits and trade-offs arising, across space and over time (out to 2050). It is interactive and the user can weight criteria to reflect their priorities, recognising the range of views on a 'good' solution.
- The results show that a) achieving policy targets for woodland expansion may only involve a relatively small area of Aberdeenshire and b) even with this land use change, there is a decline in the delivery of some ecosystem services - mainly attributable to the potential expansion of prime land under climate change.
- The LFA deliberations drew attention to how people perceive bundles of ecosystem services in the landscape and their awareness of the benefits provided by land to the local, regional and national economies. Participants were aware of the complex set of influences on land manager choices (from neighbours and urban visitors to international markets) and wanted policy to respond to these complexities.
- It is useful to work at more than one scale: the regional scale allowed strategic choices to be appraised but the local level provided insight into how land use and land management interact. Any strategic choices need to be 'ground-truthed' before decisions are taken.
- The pilot provided a forum, that otherwise did not exist, for engaging a wide range of stakeholders in discussion over land use change and the delivery of ecosystem services. Diverse stakeholders often found unexpected common ground. Local focus area participants were willing to engage with complex data on ecosystem services and future change during facilitated discussions. This local knowledge enriched these discussions and helped shape the development of the approach.
- The findings were used as part of the review of the Land Use Strategy (2011-2016) and the development of the draft LUS2 (2016-2021). Further research and application to support the implementation of the Scottish Rural Development Plan

and other related policies is planned under Scottish Government Strategic Research Programme 2016-2021.

- Lessons learnt for future research include focussing the data collection and tool around the most important issues and ecosystem services; addressing trends not snapshots in time; using the tool outputs in discussion rather than as an end in themselves; addressing land management choices as well as land use change within such tools; and analysing how the benefits and costs of managing multiple benefits are distributed.

## Introduction

This report summarises the main findings from research activities carried out as part of the Aberdeenshire Land Use Strategy Pilot Project (ALUSPP). The Scottish Land Use Strategy (2011) (LUS) promotes integrated and multifunctional land use. It seeks to balance competing land uses and optimise existing land uses, and uses the ecosystem approach as a means to achieve this. The two pilot projects in Aberdeenshire and Scottish Borders were local authority led and tasked with encompassing the full geographic area of the local authority. The aim of the pilots was to “consider existing and future land uses in a collective and integrated way with a view to optimising the use of the land, and to establish a mechanism to prioritise or guide decisions about possible competing or conflicting uses”. The overall objective was “to produce a regional land use framework in each pilot area, which will facilitate the delivery of policies, strategies and objectives in relation to integrated land use by providing a framework to guide decisions about land use”.

The Aberdeenshire Project comprised three stages working at the regional level: Stage 1: Baseline mapping, which involved collating the available spatial data on land use and ecosystem services as well as the associated policies; Stage 2 involved identifying the constraints on, and the consequences of, the policy goals encompassed in the Land Use Strategy; and Stage 3 integrated the work in Stage 2 into a framework based on a spatially explicit computer-based screening tool to visualise the potential land use changes and the trade-offs inherent in these choices. To complement this regional level focus, research was undertaken at the local level, focussing on two contrasting Local Focus Areas (LFAs): the Upper Dee, within the Cairngorms National Park, and the town of Huntly with its upstream catchments. The activities in the LFAs set out to a) understand the values and benefits derived from the landscape that local people recognise in their area, b) explore the drivers that affect the decisions local stakeholders make about land use and c) how local stakeholders responded to innovative regional strategies for land use and the effect of local knowledge, preferences and solutions might have for implementing land use decision making for multiple benefits.

Part 1 of this report deals with the insights from developing the regional framework and Part 2 summarises the findings from the Local Focus Areas.

These findings have been used by Aberdeenshire Council to provide their overall lessons learnt regarding the pilot to Scottish Government. The [final report](#) was submitted to Scottish Government at the end of March 2015. The material was also presented to stakeholders at various Land Use Strategy events in May and June 2015. In turn, the Scottish Government is using the results from the Aberdeenshire and Borders Pilots to help develop the Land Use Strategy 2016-2021 (see <http://www.gov.scot/Topics/Environment/Countryside/Landusestrategy> for more information).

## **Part 1: A spatial land use framework for decision making**

The aim of the pilot was to develop a tool that could provide support to strategic deliberations over where to focus decisions on land use change that could deliver multiple benefits. The main output was an interactive map based tool for exploring the implications of land use change on ecosystem services focussing on where native woodland expansion can have multiple benefits. This took place in three stages which were evaluated by a regional stakeholder group that included representation from government agencies, environmental NGOs and the private sector. An overview of land use issues in Aberdeenshire and a final report are available from the Aberdeenshire Council web site<sup>1</sup>. Stage 1 involved the collation of around 50 spatial data sets that illustrated both natural assets and spatially definable policies, where available (see Appendix 1 for details). Stage 2 utilised the stage 1 data to develop map-based predictions for how ecosystem service delivery would be affected under different policy goals relevant to the Land Use Strategy. For a detailed description of the method, the maps and participants' discussion and critique, please read the Stage 2 report<sup>2</sup>. The maps were also evaluated in the second workshops in the two LFAs<sup>3</sup> (see part 2 below). Stage 3 integrated stage 2 modelling to create a web-based interactive tool that allows the user to explore the consequences of land use for ecosystem service delivery. The tool takes into account the constraints and opportunities derived from policy goals and the potential land capability under a medium prediction for climate change for 2050.

### **Main findings from developing the web based tool:**

#### **A role in developing regional level objectives for the management of land**

The council was given responsibility for the pilot in recognition of its legitimacy as an elected body and its statutory role in planning at a regional level. However, the Council's statutory role with regards to the land use change is predominantly related to the built environment and infrastructure. Rural land use change is largely outwith its traditional planning remit. In this respect, the pilot facilitated the deliberation of cross-sectoral and cross-policy issues in

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<sup>1</sup> <http://www.aberdeenshire.gov.uk/environment/energy-conservation/aberdeenshire-land-use-strategy-pilot/>

<sup>2</sup> <http://www.aberdeenshire.gov.uk/environment/energy-conservation/aberdeenshire-land-use-strategy-pilot/>

<sup>3</sup> <http://www.hutton.ac.uk/research/workshops>

a more integrated way for sustainable land management. This included the interaction between the forestry, agricultural and sporting estate sectors with catchment management and local planning. These interests were represented on the regional stakeholder group which met at each stage of the project which provided an opportunity that is otherwise absent for a more integrated and inclusive discussion over land use change to address policy goals and climate change. The group could see the benefits from and supported a more integrated and holistic approach to rural land-use planning although there was also recognition that there are still difficulties in developing such an approach. The tool was limited in its ability to integrate all relevant issues because of a) the complexity of working at a regional scale and b) the gaps in data and understanding. Whilst the pilot aimed to provide a mechanism for considering land use change at a regional level, such regional strategies may need to be developed in the context of an analysis at the national (Scottish) level so that the strengths and weaknesses of the various regions in their ability to provide different services and benefits is taken into account. Regions can then respond to this: setting their regional priorities. Equally important is the need to understand better how these regional priorities are implemented by land managers at the local level (See Part 2 & 3 below for more discussion on this). Ultimately, the tool that was developed is a pilot and as such would have no statutory influence on planning or decision making. Although this may have allowed a freer discussion among the stakeholder group, its lack of statutory influence may limit its legacy in developing a more integrated approach to land use change.

#### **A mechanism for identifying trade-offs and delivery of multiple benefits**

Rural land use issues are complex and the challenge for the pilot was to address this complexity but also to create a relatively simple and accessible engagement tool that recognises the multiple benefits land can provide as well as the consequences of land use change options for the delivery of these benefits. In an intermediate stage in the development of the integrated tool, opportunity maps were produced making use of the available data from Stage 1. These explored six questions<sup>4</sup> relating to the land use changes that would be needed if policy goals were to be realised, taking into account constraints on changing land use because of other policy priorities. Defining these questions and focussing efforts on the data needed to address these policy areas was regarded as a more efficient approach than starting with cataloguing all the available data regardless of whether it was going to be useful or not. Essentially the maps illustrated how suitable a land use change would be for a particular area - defined by how well it satisfied a number of policy relevant criteria. These maps were then discussed by the steering group:

- The predictions for *areas suitable for wind energy* development were notable for the relatively small areas that the analysis showed as suitable for new installations. Responses from the stakeholder group indicated that although wind energy did not

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<http://www.aberdeenshire.gov.uk/media/6222/20140603aberdeenshirelandusestrategystage2stakeholderworkshop060514reportfinal.pdf>

conflict with agricultural management there were a number of issues that the model had not included such as local attitudes and alternative energy technologies.

- The predictions for *water management* were, for reasons of data availability, based on water supply without consideration of the changes in demand that might occur due to demographic dynamics and development planning. Further work on this topic is needed if water issues are to be considered in a more integrated way. There is also a need to build into the model the potential consequences of drivers of change on the supply and demand for groundwater and the potential increased need for agricultural irrigation in the future.
- The other predictions, relating to *biodiversity, carbon storage, food production and connecting communities to the land* were explored through the lens of woodland expansion: a useful and timely lens because of the current government targets and because of the multiple benefits woodland can provide (e.g. carbon storage, recreational activities, controlling the run-off of rainfall and biodiversity). However, the strong focus on woodland expansion as the land use change that the model considered was criticised by the stakeholder group who recommended developing other lenses to explore land-use change.

These land use suitability maps aimed to illustrate where multiple benefits would most likely be achieved and where there may be trade-offs. For example, if a safeguarding food production agenda was prioritised, this would compromise how woodland expansion could be distributed to the benefit of water quality and the reduction of flood risk. Although the tool illustrates in a relatively simple way the complexity around achieving multiple benefits and addressing trade-offs, it is clearly not able to incorporate all the important factors identified by stakeholders. In particular, a major area in how services and benefits could be delivered better is through changes in management of existing land uses rather than land-use change. This is a key aspect to address with land managers when exploring how the strategic level options for land use change can be implemented in local contexts.

### **An approach to consider the consequences of climate change for ecosystem services**

The predicted suitability for woodland and the associated constraints and opportunities are based on a model that uses a land capability for agriculture map predicted for a medium climate change scenario in 2050. It is clear from this work that the greatest potential land use change is in the predictions of an increase in prime land (Class 3.1 or better) which can potentially increase by up to 46% (Fig 1a & b). For example, if safeguarding food production is prioritised this constrains this larger area of prime land from being suitable for woodland expansion. The modelled output for ecosystem service delivery takes this into account as well as any change in land-use to woodland.



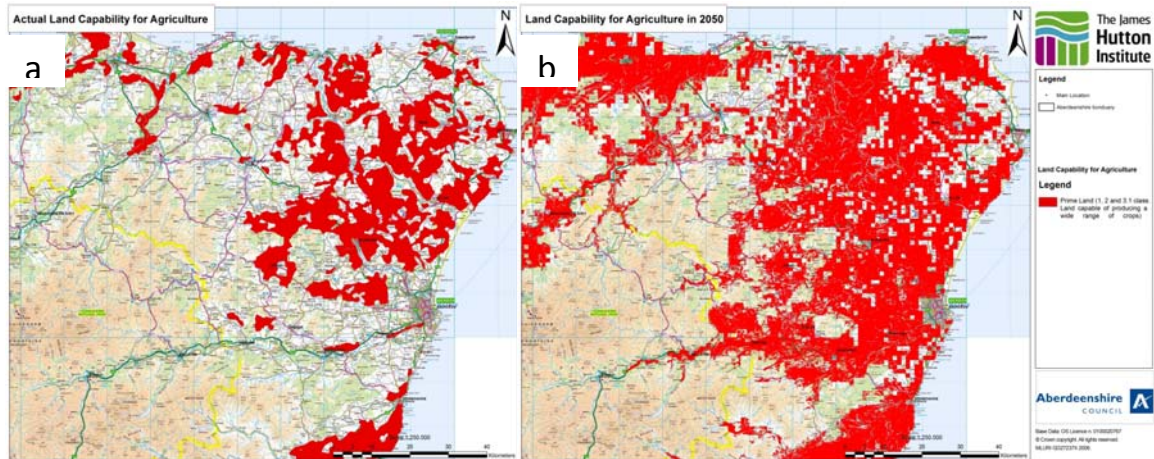


Figure 1a) a map of prime land of class 3.1 or better (red areas) in Aberdeenshire; b) a map showing areas predicted to be class 3.1 or better under a medium climate change scenario for 2050.

A limitation of the tool is that it assumes that all this potential prime land will become cultivated and the tool needs to be refined in order to relax this assumption. However, one of the strengths of this tool is that it incorporates the effect of climate change on land use which is often lacking in other decision support tools.

### Illustrating the consequences of land use change on key ecosystem processes

A major feature of the tools is that it does not just display the suitability for woodland but also predicts the change from baseline predictions (given the current land use) in the delivery of three regulating services at a catchment scale. The advantage of this is that it uses established biophysical relationships to predict how land use affects ecosystem service delivery<sup>5</sup> rather than being based on expert knowledge converted into look-up tables. Using the model to display the suitable pixels for a target area for woodland (e.g. 9,000ha by 2020), it illustrates that, on a regional scale, this only affects a very small land area (Fig 2a) and is relatively feasible. Interestingly, the maps of the change in regulating ecosystem services resulting from this change in woodland show that, even with this increase in woodland, there is deterioration in the delivery of many ecosystem services in nearly all catchments (e.g. Fig 2b). This is due to the potentially much larger increase in prime land which the model assumes will be cultivated (see above).

<sup>5</sup> InVEST modelling framework



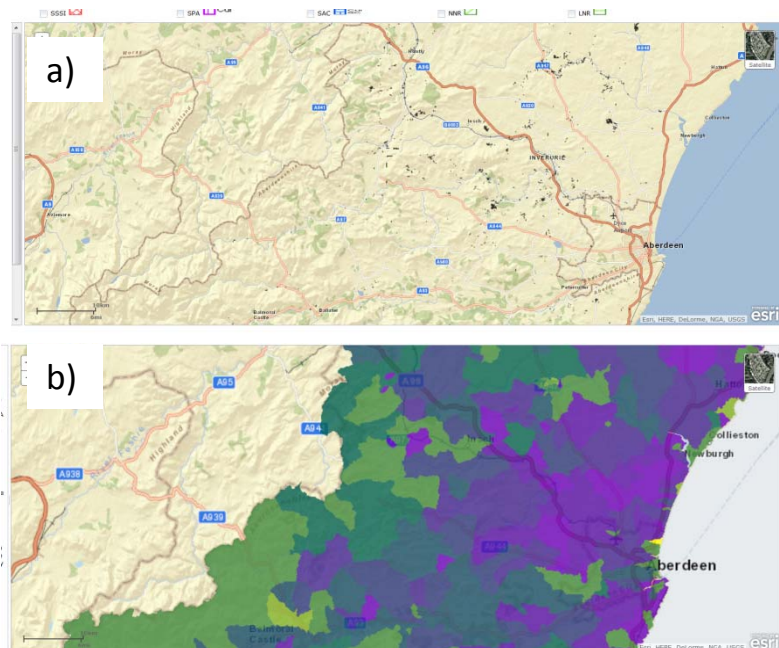


Figure 2 a) A screenshot from the RLUP tool that indicates the 9000ha of land (small black polygons) with the highest suitability for woodland expansion taking into account policy priorities such as water management and safeguarding food production; b) a map of the predicted sediment export for the sub catchments in Aberdeenshire under the woodland expansion scenario in a) taking into account the prime land expansion predicted from climate change as illustrated in Fig 1b.

### A framework to integrate data with different policy objectives

Whilst the tool can demonstrate how multiple benefits can be achieved by, for example, identifying areas where woodland could deliver carbon, water management and recreation opportunities, it also has the potential to be developed to identify areas where conflicts over land uses remain and need to be resolved, for example, where infrastructure and housing development are planned in relation to flooding, water supply and water quality. It was recognised that the tool has limitations when applied to specific sites but has more value at the strategic regional level. For example, it can show for the region where the woodland expansion can achieve multiple benefits. This could help with targeting the distribution of grants and incentives to optimise the benefits from public spending. However, a major issue in its uptake as an aid to regional planning or in decision making over incentive schemes is how it can be integrated into existing processes such as SEA or policies such as woodland strategies.

### Lessons learnt

An important lesson from developing landscape land use tools such as this (which is also relevant to other projects that are attempting to take an integrated approach to land management), is to define the goals and main issues first, and only then gather the data and information required to address these goals. However, as set out in the brief, the project did the reverse and whilst this has led to a large catalogue of data, it was essentially an inefficient process because it was not clear what the collated data was going to be used to address. Identifying the key land use change issues and a scoping of the goals and capacity of the pilot would have resulted in a more focussed approach to the gathering and mapping

of data. Much of the Stage 1 data represented a snapshot in time. Of greater benefit, would have been to focus on trends and change over time. The Pilot would then have been in a better position to reflect and respond to the significant issues.

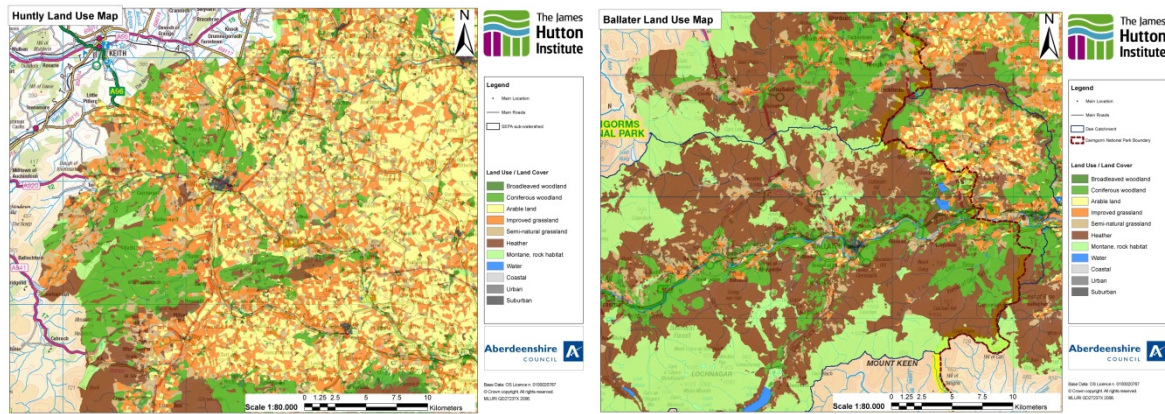
### **Future directions**

The tool has a role to play in supporting catchment management, woodland strategies and the targeting of grant funding. Users are seen as those planning, administering, funding and/or responding to land use change, including public agencies such as SNH, SEPA, Forestry Commission, SGRPID and Aberdeenshire Council. Through these bodies, such a tool might inform river basin management planning, strategic and local development planning, flood risk management planning, forest and woodland strategies and agricultural/woodland grants. The process also created an opportunity for increased stakeholder engagement in and public understanding of all these processes. The approach taken in developing this integrated land use change tool the focus of work planned in the future Scottish Government Strategic Research Programme 2016-21. Key improvements will include providing a range of lenses to view land use change and its consequences, adding to the range of ecosystem services that are included in the predictions and incorporating more sophisticated approaches to exploring cultural services such as landscapes by constraining land use change in relation to the proportion of different components in the landscape that are important for its character.

For more information on the regional pilot research, see the main [Pilot website](#).

## Part 2: Research Undertaken in the Local Focus Areas

Three workshops were held from Autumn 2013 to Autumn 2014 in both the Ballater and Huntly areas of Aberdeenshire, resulting in six in total. Existing land use differs in each place (see Figure 3) but land based industries are very important to both areas.



**Figure 3: Land Use for Huntly and Ballater. Note the differences in the amount of arable, improved grassland, heather moorland and montane habitat.**

Over 150 possible organisations were identified using interest-influence matrices, resulting in 53 participants attending one or more workshops. These participants came from a range of organisations. Some were land managers (farmers, estate factors, managers of nature reserves); some had business interests that relied on the local landscape (tourism, renewables); some were from local and national NGOs (nature conservation; recreation; health) and some were from relevant public bodies (council; community councils; agencies). The workshops built on one another. Workshop 1 was designed to elicit the values different stakeholders had for the area and the drivers that affect their land-use decision making. Workshop 2 was designed to a) allow stakeholders to evaluate a conceptual model of the system and b) to get stakeholders to evaluate the land use changes that might result from following particular policy goals relevant to the LUS (see part one above). Workshop 3 involved stakeholders evaluating outcomes of three possible future scenarios (based on those developed for the National Ecosystem Assessment), which were explored using multi-criteria analyses to consider their economic, environmental and social impacts. A simplified system model, shown in Figure 4, was used to structure a Bayesian belief network that calculated the probability of one change leading to another change somewhere else in the system. This allowed us to consider how different conditions under each scenario might lead to land use change and impacts on ecosystem services.

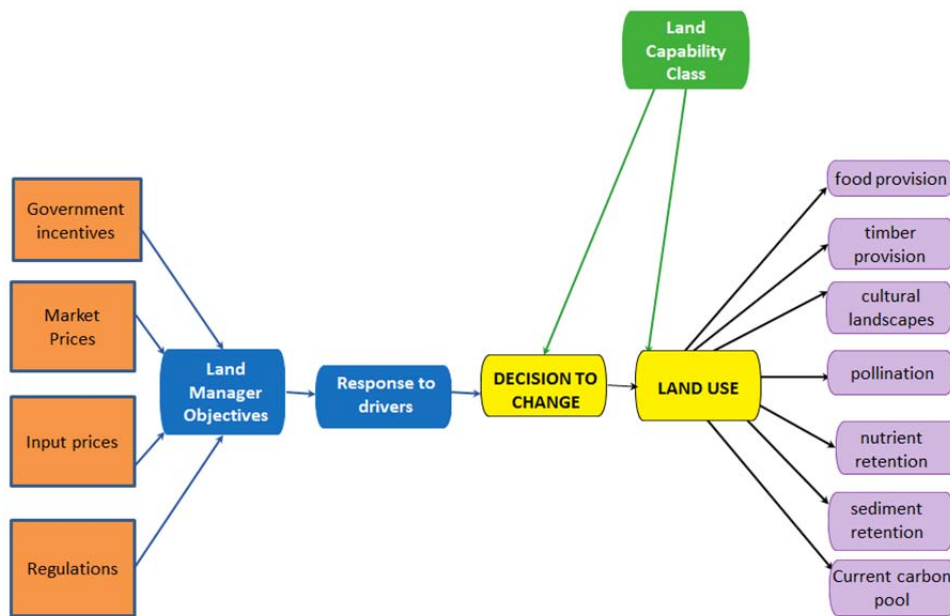


Figure 4: System Model used in both workshops

The materials and science utilised in these workshops were generated through the Scottish Government Strategic Research Programme (Ecosystem Services) 2011-16. The individual workshop reports can be found [here](#). This report builds on a [previous appraisal](#) of applying the ecosystem approach in Aberdeenshire.

## Main Findings

Overall, we found that LFA participants were supportive of more integrated land use planning and better coordination between different policy drivers.

### Bundled benefits were clearly understood

Participants were clear about the many benefits that their local land and waterways provide. Ecosystem services are not restricted to nature reserves but include the provision of food, energy and timber that local land based businesses are premised on. Ecosystem services were best understood as interconnected, such that landscapes produce bundles of ecosystem services. For example, the same hillside may provide food, timber, energy, a popular site for walking, a sense of local identity, historical artefacts, carbon sequestration, filtration of pollutants and management of water flows. It is these 'bundles' from a mosaic of land uses that generate 'landscape character'. Therefore, participants wanted to emphasise the feedback loops between ecosystem services, such that intervention in the management of one should consider the knock-on impacts on others (e.g. more intensive food production and its impact on recreation and landscape character). Participants also drew attention to the ability to access services, noting that benefits were only derived when people were able, and encouraged, to use their local landscapes. There were also discussions about how different people understand and appreciate the benefits that

ecosystem services provide in different ways, for example, some domestic and international consumers pay a premium for North-East produce but others are more interested in the cost of their food, regardless of where it comes from or how it is produced. These findings also challenge conventional approaches to mapping, modelling and valuing ecosystem services that tend to consider individual services and add them up, rather than exploring their synergies and trade-offs; and how different users perceive and value services in different ways.

### **Land management versus land use change**

Whilst the objective of the workshops was to explore land use change, much of the discussion was focussed on the effect of land management on the delivery of ecosystem services. Ecosystem services delivery depends both on land use but also on the land management regime. There were also interesting discussions about how to manage the behaviour of those who use land and water to improve the delivery of bundles of ecosystem services. For example, whether a policy objective of increasing community access to the land through more paths for recreation use were effective, would depend a great deal on how the paths were designed and maintained as well as preventing anti-social behaviour e.g. litter, use of quad bikes etc. The pilot took a strategic screening tool approach that focussed on land use change in 2050. Predictions in the form of land use maps showed land use change that largely resulted from a switch from improved grassland to arable; or from grazing to woodland under conditions of possible climate change. Linked with these land use changes, predictions for how ecosystem services would change were also mapped at the sub-catchment scale. Stakeholder evaluation of these landscapes of the future (based on regional level spatial datasets) illustrated a mismatch with local knowledge about land management impacts in specific sites. The value of the strategic regional approach was that it allowed local people to illustrate how their personal interest in their own business or local area connected with wider regional, national and international issues. Indeed, it was striking how many participants struggled to separate their own interests from those of the wider community and country when evaluating the scenarios in the third workshop.

### **Ecosystem services sustain rural communities**

Participants were very keen to connect ecosystem services into the wider rural context and debate about regional sustainability. For example, whilst the provision of food, timber and fibre were themselves considered vital ecosystem services, they were also important as they maintained employment not only in land management, but also in the supply chains supporting these land based businesses. Therefore, issues such as availability of skills, suitable infrastructure, available labour and access to markets were as important to maintaining these bundles of ecosystem services as the underpinning biological processes that sustain soil and water quality. The derived benefits from healthy ecosystem services (e.g. a rural workforce sustaining the local economy and social networks) were very important. The participants were very aware of, and interested in, the fact that their livelihoods and health were dependent on the state of the environment. They were not

surprised by the results of the scenario modelling and the threat of climate change, and were already aware of the need to steward the land against future threats. Nonetheless, the evaluation results suggested that most people improved their knowledge through participating in the workshops, with the majority of participants in both Huntly and Ballater agreeing they had increased their ability to think about multiple issues associated with land use.

### **Landscapes under threat from climate change**

Scenarios were a useful way to explore the future for these local areas and illustrated an increase risk to the ecosystems from climate change. Whilst there was some debate over the assumptions made by the models and the scenarios, the combination allowed participants to think about future change in a structured way. Under all three future scenarios of change, even the 'pro-environmental' scenario 'Nature@Work', the modelled impacts on water quality, soil erosion and carbon loss increased. In Figure 5, the baseline for the Huntly area can be compared to the three future scenarios (Go with the Flow, GWTF; Nature@Work, N@W; and World Markets, WM) and illustrates that carbon emissions could almost double in the world market scenario. The findings suggest that whether we 'go with the flow' and continue as we are now, or adopt a very stringent approach to environmental protection, the impact of climate change could be negative; and draws attention to the need to continue the focus on mitigating the climate change impacts of the land use sector. However, the discussion brought out many interesting ways to mitigate climate change based on changes in management rather than large-scale land use change. These included different grazing management regimes; better utilisation of farm buildings for solar arrays; more efficient supply chain processes etc. Furthermore, there was also emphasis on looking at non-land based rural mitigation measures, such as improving building insulation and better public transport links, when trying to implement the climate mitigation.



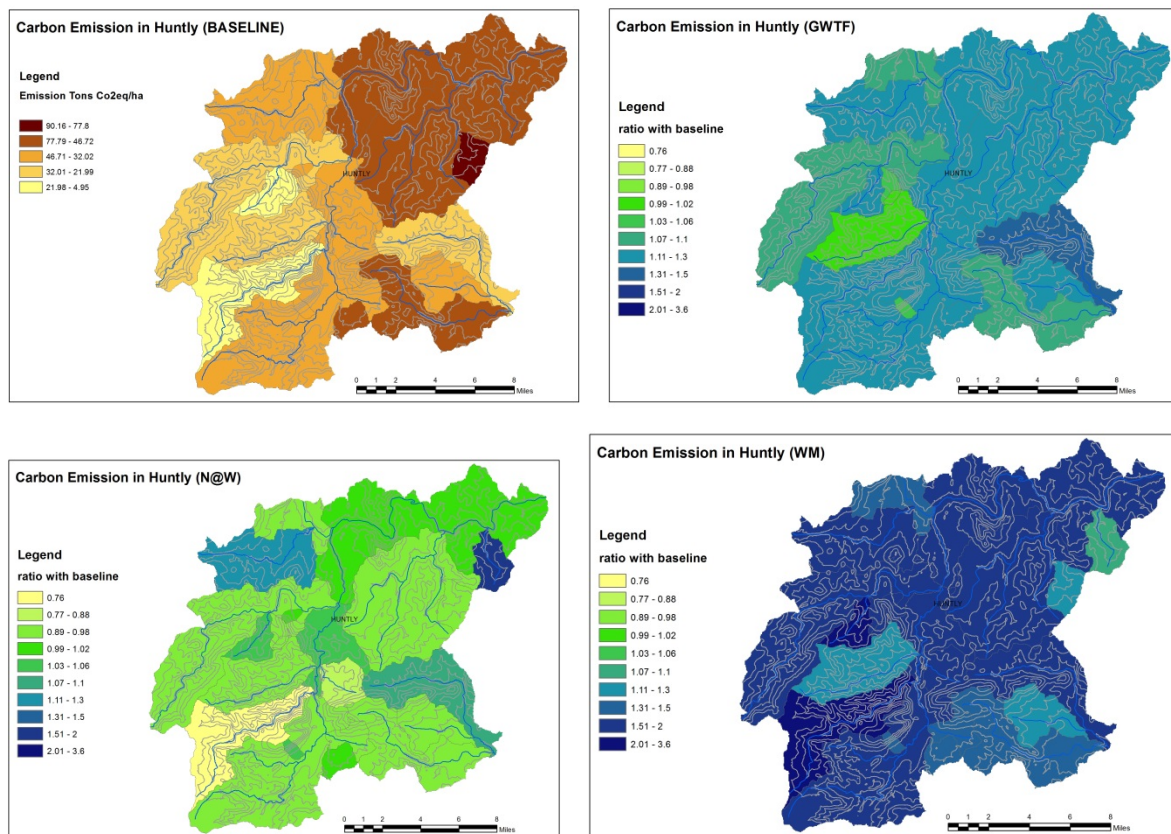


Figure 5: Changes to Carbon Emission under different future scenarios. The baseline map show the estimated emissions of greenhouse gases in CO<sub>2</sub> equivalent for the sub catchments in the Huntly local focus area. The other maps represent the proportional change from the baseline in these catchments under three scenarios that include a median 2050 climate change prediction: Go With The Flow (GWTF); Nature at Work (N@W) and World Markets (WM). In all the scenarios and all the sub-catchments, the emissions are greater than the baseline.

### Common ground, diverse perspectives

The model of the system and its responses to change included different types of land management objectives, using a typology of land managers, ranging from ecological stewards, through community stewards, economic stewards, multi-functionalists and other (covering lifestyle farmers and land held by land banks). Whilst the proportion and definition of each type was robustly discussed, the principle of recognising diversity in land managers and therefore differences in the choices they might make was strongly supported.

The multi-criteria analysis demonstrated that not all participants think the same, but many issues were relevant to participants from different sectors in their local focus area. For example, criteria relating to landscape beauty and protected area habitats were considered important by the majority of participants in Ballater; and sediment/nutrient retention by the majority in Huntly; with the majority of participants in both areas agreeing that health and well-being were important. However, other criteria were more polarising, for example there was a huge diversity in the relative weighting placed on carbon capture or income generation in Ballater; or on carbon capture and local energy security in Huntly. In both areas, participants consistently scored the Nature@Work scenario most highly against their own individually weighted economic, environmental and social criteria.

Working with local residents in two different communities highlighted the diversity of views within communities of place (e.g. those in favour, or opposed to, wind turbines in Huntly) and illustrating where there is common ground for a regional solution. The ability to discuss common land use issues in a diverse forum was greatly appreciated by participants, who noted that they often found common ground where they least expected it. It also helped individuals learn more about other sectors with connection to the local landscape and to better understand their needs, preferences and practices. Participants emphasised the need to engage those living in rural areas, but without direct knowledge or experience of the land, in such discussions through which all sectors of the rural community are engaged.

There were also very interesting discussions about the perceived influence of urban residents on land use through their choices as consumers, voters or members of conservation organisations. The influence of public opinion on land use choices, be these local communities or neighbouring land managers or more diffuse ‘publics’ was discussed in both LFAs. This highlights the complex influences on integrated land use delivery. Thus implementation of the LUS must consider the full suite of diverse and diffuse ecosystem service beneficiaries and how these interact with the range of land use policies.

### Complex, multi-scale systems are hard to predict

Participants were aware of the complexities surrounding managing a system that connected global drivers of change with the variety of different individual land manager preferences. For example, there are a wide range of possible combinations of drivers that land based business may have to respond to; and these often influence choices in more immediate timescales than the potential for climate change. Participants highlighted the diversity of land manager preferences and objectives in their areas, with implications for how land and therefore ecosystem services are managed.

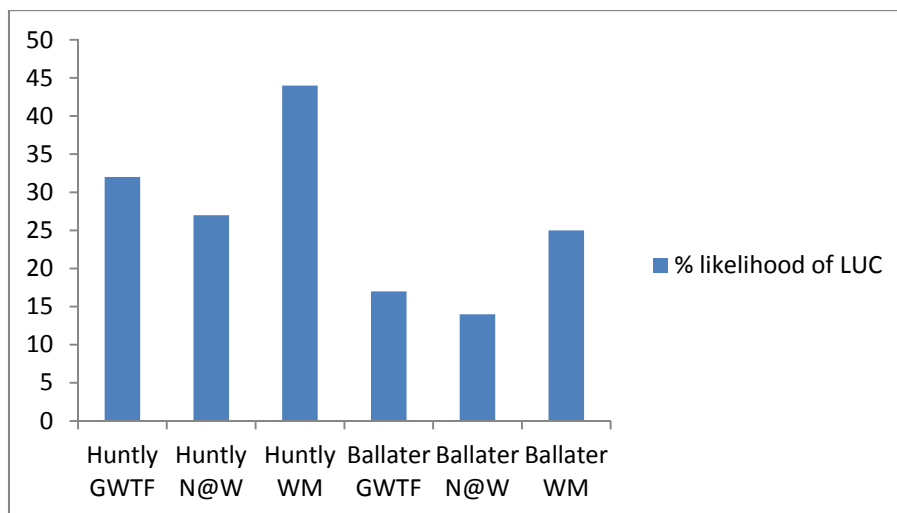


Figure 6: Results from BBN after different scenarios

Our model suggested there might be very little land use change in either area despite the potential for prime land to expand in the Huntly region. Figure 6 shows that in both cases,

most land use change would occur under the World Markets scenario; and that more changes are likely in the Huntly area than in the Ballater area. This is partly due to the lack of available land in the Ballater area that could be suitable for new land uses, even under climate change, but also a reflection of the types of land managers that have land in these areas. The discussions illustrated that biophysical-climate constraints and opportunities were only one part of the decision making process, and that change in ownership, e.g. acquisition of farms without successors by Forestry Commission or by an investment company, could have the most impact on land use change in the medium term. The likelihood of these occurrences is difficult to predict, but such findings illustrate the benefits of using models and scenarios for deliberation and exploration of ideas, rather than trying to predict the future.

### **Working across scales**

Whilst there was some scepticism about the likelihood of the scenarios, these provided a useful tool to elicit more discussion about how land managers might react to changes in the markets or government policies and the impacts these might have on local communities, as well as the ecosystem services in the area. For example, some participants were unconvinced that a World Market scenario would occur resulting in a full free market in Scotland, but the discussion then turned to the vulnerability of local farmers to world market prices and the ability for other nation states or agri-businesses to manipulate these prices. Whilst many of the policies relevant to the Land Use Strategy are developed under Scottish legislation, the biggest driver of land use incentives and regulations is the European Common Agricultural Policy, and many participants wanted to explore how changes to EU membership might impact on these local areas.

During discussions of the system diagram and of the regional pilot policy options, there were many references to the intersections between local action and actions taken by regional, national and international actors. Many participants hoped that there was a feedback loop from the state of the ecosystem services (see right hand of Figure 4) and the drivers on the system (see left hand of Figure 4). For example, improvements in water and soil quality as influenced by nitrogen and sediment retention should be reflected in how land managers are incentivised and regulated by government. There was also discussion about how changes in ecosystem services might affect how their products sell on world markets, and the connection between the local landscape and the brand for land based industries. However, many participants felt there was a disconnection in the system, whereby the drivers acted on them as local land managers and land users, but they were unable to influence these drivers of change in return. There was a clear interest in having an influence on future land use policies, including the revision of the Land Use Strategy.

### **Implications for future practice**

The Local Focus Area work within the Aberdeenshire Pilot Study illustrates that a range of stakeholders, not just the usual suspects, can and will engage in discussions about future

land use change. The combination of public, private and 3<sup>rd</sup> sector actors with different interests in local land use led to a stimulating discussion and was highlighted by participant evaluations as one of the major benefits of the process. All participants, including those with no scientific or land use background, seemed able to understand and critique the models and maps used in the workshops; and to work with the concepts of ecosystem services once explained to them.

However, participants wanted to know how their views will influence land use choices and policies in order to stay engaged. The focus on building and critiquing a model of potential land use changes in 2050 was interesting but somewhat distanced from the more pressing issues of responding to CAP and SRDP consultations; and running their businesses. Whilst participants seemed to welcome Aberdeenshire Council's interest in strategic and joined-up thinking about land use in the region, there was little direct benefit to their individual decision making processes from their participation in the workshops. Some participants explicitly asked how the insights generated by the workshops would be taken on board and used to change land use policies by Scottish Government, whereas we could only promise that the insights would be added to the overall evidence on which the revised Land Use Strategy will be based.

It seems more relevant for people to relate to land management, than longer-term land use change. Participants not only provided valuable insights and improvements to the scientific models but many interesting suggestions about how existing land management practices could be improved, alongside ideas for non-land based rural businesses, and rural residents, to play their part in more sustainable rural development based on ecosystem services. However, the preference for focussing on incremental changes to land management may mask, for some participants, a desire to continue with 'business as usual' rather than confront the environmental impacts of some intensive production systems. This needs to be addressed such that local knowledge is not romanticised. When planning how to meet national climate change targets, a regional screening process about possible land use changes, e.g. from marginal grassland to forestry, may be the most effective way to *ex-ante* evaluate how best implement climate change mitigation policies. Further work is planned to connect regional policy appraisal (see Part 1) with the use of the tool at a local (catchment) level to consider how and where to target incentives for changes in land management as well as land use. In future, research should integrate land management practices with predictions of possible land use changes. Research should also integrate an understanding of the drivers and motivations that influence the decisions people (both land managers and other stakeholders) make. These are not simply different scales, but different foci.

Finally, working at the local scale does not mean only considering local issues or actions, as participants highlighted a whole suite of changes they would like to see involving national and international governance and trading arrangements. Participants were often very proud of their local areas, keen to promote the benefits arising from the land and to protect the

ecosystem services on which the benefits depend. However, many recognised that they were actors in a wider governance network that influences land use and its impacts, and pointed out these interconnections with different publics, governments, agencies, NGOs and businesses. Although our model did recognise heterogeneity in land managers, we were not able to reflect these insights into the complex and multi-level governance of the land use system in each local focus area.

### Part 3: Aberdeenshire Land Use Pilot: insights for integrated land use planning and management

Analysis of the regional and local processes has provided important insights to help us deliver the vision of the Scottish Land Use Strategy - *“a Scotland where we fully recognise, understand and value the importance of our land resources, and where our plans and decisions about land use will deliver improved and enduring benefits, enhancing the wellbeing of our nation”*. The regional land use pilot provided a forum, that otherwise did not exist, for engaging a wide range of stakeholders in discussions over land use change and the delivery of a range of ecosystem services.

Working at both scales allowed us to reflect on the experience of applying the Ecosystem Approach<sup>6</sup>. Complementing this approach was the application of an ecosystem services framework, which was useful in helping us to illustrate how the benefits enjoyed by local communities, land-based businesses and Scottish society depend on the underpinning ecosystems, which provide provisioning, regulating and cultural services. The Ecosystem Approach helped us to take a holistic focus that encouraged participants with a wide range of views, bringing different experiences, values and preferences. This inclusive process allowed a more integrated deliberation of the positive and negative consequences of land use change on ecosystems and the services they provide, enhancing the value of an ecosystem service framework.

Perhaps reflecting the approaches taken at both regional and local levels, it seems as if the ecosystem services framework helped people think about major land use changes, whilst the Ecosystem Approach seemed to support discussions about managing existing arrangements in better ways. At the local scale, people were more comfortable talking about how land is currently managed, and solutions to improve ecosystem service delivery from existing land uses. This may reflect the fact that they are ‘experts’ on current and past land use choices. So although they were willing to discuss possible futures, they were less willing to accept modelled projections for land use change and ecosystem service delivery. At the regional scale, participants were less involved in practical management and therefore less focussed on the Ecosystem Approach principles relating to inclusive decision making. Instead, they were more interested in the ability of the tool to help understand ecosystem service trade-offs. However, they felt the value of modelled regional projections was compromised to some extent by the lack of inclusion of some services and the focus on native woodland expansion.

The approaches taken at both scales recognised the complexity in the delivery of goods, services and benefits. The processes were novel in their attempts to link drivers of land manager choices; differences in how land managers might respond; ability to change land

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<sup>6</sup> A strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way (<https://www.cbd.int/ecosystem/default.shtml>)



use when constrained or enabled by land capability and climate; and the consequences for a suite of ecosystem services (carbon storage, sediment retention, nutrient retention, food production and timber production). This is complex and difficult to communicate in a straightforward way, particularly in the context of future scenarios with all the uncertainty around these modelled projections. However, local stakeholders felt there were many gaps in our representation of the system. Therefore the process at both regional and local levels reflected a pragmatic compromise between the available data, the flexibility of our scientific tools, and the preferences and values of the stakeholders. A key attribute of both the web-based tool and the local focus area model was the incorporation of the ability to adjust the importance of criteria that influenced the predicted outcomes for land use and ecosystem services. This allowed the recognition that users have different preferences and can illustrate that what is a 'good' solution for one person, may not look 'good' to another.

We found that quantifying and mapping projections was useful for encouraging debate and helped make consequences of change more explicit. However, due to debates over the credibility and validity of the models and maps and the data they were based on, people felt that their value lay in aiding discussions in the development of strategic principles and regional plans. Thus, the approach was useful for identifying, at a regional scale, the trade-offs and win-wins for how land use change can affect ecosystem service delivery, but it was not precise enough for field-by-field decisions. Overcoming this is likely to need a combination of ground-truthing and more precise data combined with a participatory approach where implementing regional strategies is facilitated by engaging with local people and their knowledge of how land use and land management can best achieve policy goals.

In both the regional and local level meetings, participants expressed their appreciation of the opportunity for deliberation about land use and its benefits across sectors. This was particularly important for Aberdeenshire where such a 'multi-stakeholder' group does not currently exist. Whilst there are existing sectoral-based fora associated with the environment or land use in Aberdeenshire, this process was seen to bring together new combinations of organisations and individuals. This allowed new relationships to be built up and for new understandings about land use and its consequences to be put in the context of different needs and preferences. Through discussing the maps and modelled results, people from different backgrounds started to understand and respect differences but also to identify common solutions. In fact, there were often surprising instances of common ground between very different organisations or individuals, when they were focussed on discussing how to increase the multiple benefits we get from our land. However, our process was not all encompassing and did not engage or represent all the interests in Aberdeenshire. Whilst those who did attend were invaluable in refining and extending the understanding of land use, there will be many other perspectives that are missing or under-represented as they did not engage with the process.

Overall, there was strong support for a more integrated approach to land use at both regional and local scales. People were clear that taking a holistic perspective must have better outcomes and provide better value for money than working on single issue ‘silos’. In particular, people felt that such a holistic perspective meant that it was more likely that any knock-on consequences of a new policy (or voluntary management practice) would be more explicit and the consequences better understood. In contrast, participants quoted a number of examples where they felt decisions were having unintended consequences. Participants attending both regional and local meetings had existing interests in land and the environment but the ecosystem services framework was useful for bringing alive the importance of ecosystems to all sectors, not just the conservation interests. This was facilitated by combining the ecosystem services framework with the Ecosystems Approach which encouraged discussions to change from development versus conservation to where there were opportunities to have both development and conservation.

The focus on integration also revealed the importance of considering urban populations within the pilot projects, even though the regional and local foci were on rural land use changes. Whilst this land use is not part of the urban footprint, the actions taken by urban populations do affect rural land use – ranging from voting preferences to shopping choices to how people behave on their trips out for a country walk. Whilst it is hard to include everyone in a conversation about Aberdeenshire land use, it was clear that residents of Aberdeen city and other major settlements, plus decision makers and opinion formers in Scotland, the rest of the UK and Europe were also important stakeholders in this process. They should be included in future discussions about regional land use choices.

The Ecosystem Approach is designed to support the Convention on Biological Diversity’s objectives including “fair and equitable sharing of the benefits”. Some of the deliberations focussed on ensuring that land is managed and used for the benefit of all society, from local communities through to protecting natural assets for the global population of the future. However, there was also concern that any ‘burden’ of changing how land is managed or used in the future was also equally shared amongst all sectors and all communities. In other words, land managers were concerned about additional burdens to provide services to urban populations and business sectors. A counter argument was made that the Ecosystem Approach and ecosystem service frameworks can ensure that public funding for the land based sector is focussed on benefits for all.

The regional and local focus was on developing a non-statutory framework for potential use in the future. However, existing and potential regulations and incentives were often brought into the discussion given their influence on land use choices and land management practices. There was considerable interest in understanding how to improve the delivery of ecosystem services; and how to protect ecosystems; using a combination of statutory and

voluntary delivery mechanisms. There was debate over whether existing funding sources could be redirected or whether new sources, including working with businesses and developers, could be a way forward. Either way, whilst more dialogue and integration should save money and deliver more in the long-term, participants recognised that resources were needed to support and enable these forums to continue. Stakeholders did give the impression of a lack of appetite for complete re-invention in relation to rural land use planning. Perhaps this stems less from a rejection of the need for change, and more from a sense of apprehension of more 'bureaucracy' and constraints on land based businesses. On that basis, 'evolution rather than revolution' would appear the more acceptable approach. In addition, in a time of squeezed budgets and staff resource, the ability of public bodies to deliver an entirely new approach is questionable.

There are many different scales whereby such processes could be carried out including local/community, parish, river catchment, district and region. However, our participants highlighted that it is working across scales that matters as there will need to be actions and solutions at all scales. Whilst participants, particularly in the local focus areas, were interested and engaged in what they could do, they were also interested in the national and international dimensions of the issue, including the need for strong international/national leadership to make integrated approaches a reality. The end product - regional web based interactive tool to explore strategy at a regional level - is one tool but implementing land use change with specific land managers in sub catchments requires that local knowledge and values are taken into account. Only if both these two scales are addressed will sustainable decisions be made.

However, the implications of the ecosystem service modelling illustrates that even in an area endowed with healthy ecosystems, the consequences of climate change could be far-reaching and severe. Therefore, these processes should be seen as a start of a longer term focus on enabling a comprehensive and holistic approach to working with nature, drawing on the abilities and ideas of all sectors and communities.