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APPRAISAL OF SUSTAINABLE RURAL POLICY AND LAND USE (SURPLUS) – SCOPING STUDY

Final Report to Defra and HM Treasury
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Executive Summary

1 Introduction

This report presents the results of the Scoping Study for the Appraisal of Sustainable Rural Policy and Land Use (SURPLUS) project, part of the Defra Horizon Scanning Programme. It forms part of the Defra Horizon Scanning Programme and was co-funded by the Treasury's Evidence-Based Policy Fund. Defra and HM Treasury commissioned the current Scoping Study to guide the further development and implementation of the overall SURPLUS project.

The aim of SURPLUS is to improve the ability of Defra and other organizations to carry out policy appraisal based on a full ex ante assessment of future changes in land use, recreation, amenity and rural economic activity, and the impact of such changes on the rural environment and rural communities. The proposed objectives of this Scoping Study, as stated in the brief, were to:

- develop cost-effective tools for assessing trends as well as forecasting and anticipating future changes in direction, over 5-20 year timescales.
- test and evaluate the tools with empirical data and provide measures of the uncertainty of forecasts and sensitivities with regard to input assumptions.
- ensure that the tools are relevant and useful to policy customers in government departments and agencies, nationally and regionally.
- ensure that the tools build on or link with existing methods and experience and utilise existing data as far as possible; and
- apply the tools to a range of policy issues, such as those identified in *Our Countryside: The Future*, the England Biodiversity Strategy, and the Strategy for Sustainable Farming and Food.

The purpose of the Scoping Study, which can be seen as a successor to the earlier Modelling Environmental Impacts of Land Use (MEILUC) study, was to guide the further development and implementation of the SURPLUS project by:

- confirming user requirements and refining objectives for the overall project;
- assessing the feasibility of using various modelling and other foresight approaches to achieve the objectives of the overall project; and
- developing technical specifications and determining funding arrangements for its implementation.

The Scoping Study was divided into three phases:

- consultation and literature review;
- critical evaluation of a variety of tools and approaches for meeting the objectives of the overall SURPLUS project, and
- technical specification and reporting.

Section 2 presents a conceptual framework for an eventual SURPLUS project. Section 3 looks at the interests of key SURPLUS project stakeholders, and reports the main results from the consultation phase. Section 4 summarizes currently or potentially available tools & techniques that might play a role in such a project.

Section 5 draws together the key conclusions, and provides recommendations for the next steps to be taken in developing the SURPLUS project.

2 A Conceptual Framework for Policy Appraisal

The starting point used here is the accepted and commonly used Driving force – Pressure – State – Impact – Response (DPSIR) framework laid out by the European Environment Agency (EEA) and others. This basic framework has been slightly modified: 1) to clarify more explicitly the distinction between those actions that are under the control of a particular stakeholder and those that are not; and 2) to recognize that actions of a stakeholder may be generated independently and not simply as responses to external forces.

As with the original conception of the DPSIR framework, we explicitly adopt a systems perspective, i.e. there is a particular system of interest. Given the remit of SURPLUS, it is presumed that land use will play a key role in any such system, but that it should also include natural processes such as water flows and social ones such as human population movements. The scale of the system is defined in two ways: by the Impacts of the system under study (e.g. a river basin or the entire UK) and by the Driving forces and Responses, which may be at a different scale (e.g. CAP reform, or lake pollution). Land use (change) is seen as either a Pressure or State, depending on whether it is external or internal to the system.

As part of an expanded DPSIR framework, the SURPLUS project should allow the inclusion of tools to extract or aggregate data in preparing inputs. It should also contain indicator sets related to policy goals, recognizing the normative aspect in the choice of indicators; it is a matter for judgement to what extent this should be made by the tool developers or left to the user.

3 Stakeholder Interest in SURPLUS

The consultation phase was intended "*to confirm user requirements for and interest in the SURPLUS project*". Specifically, it aimed to provide answers to the following questions:

1. What should be the policy, temporal, and geographic scopes of the project?
2. Should Defra's initial objectives for the project be refined and, if so, how?

This phase consisted of three related components: a review of the literature; targeted interviews with policy makers and technical experts; and a one-day workshop. In addition to the focus on evaluating and refining the draft objectives of the SURPLUS project as a whole, this phase was also used to identify the key tools & techniques to be evaluated in the next phase of the Scoping Study.

A wide range of social, economic, environmental and policy Driving forces and Responses of interest were identified. These can be grouped around a number of main themes, including policy initiatives, globalisation and liberalisation, changing political and institutional structures, the changing rural economy, demographic changes, changes in social attitudes, and environmental shifts. Because of the varying nature of the persons consulted, it was not possible to draw a clear line between Driving forces and Responses. Policies and actions under the control of one stakeholder are often not under the control of others. Thus, what is a Response for one actor can be a Driving force for another. Consultees tended not to be particularly specific about policy initiatives beyond a few cases. A few of those cited include the reform of the Common Agricultural Policy and Water Framework Directive of the

European Union, Environment Agency regulations for England and Wales, UK targets for farmland bird populations, and Scotland's Land Reform Act and Biodiversity Strategy.

A large number of environmental Impacts were identified. These include acidification, climate change, flood risk, water quantity and quality, soil quality and erosion, resource use, biodiversity loss, landscape and visual amenity, and noise. There was generally less clear indication with regard to social and economic Impacts. Those mentioned included changing employment opportunities, the loss of traditional agricultural skills, and broader impacts on the social cohesiveness of rural communities.

As regards temporal scale, the 5-20 year time scales specified for the SURPLUS project were agreed to in general, but some concerns were raised. A number of persons felt that 5 years might be too short to allow for Impacts to be clear. It was also indicated that looking as far out as even 20 years might be ‘brave’ or ‘speculative’ and that it might be difficult to find persons interested in such a time horizon. At the same time, others noted that key issues such as climate change have impacts that go well beyond this period.

There was little or no consensus on the most appropriate spatial scale for a project such as SURPLUS. Stakeholders’ Impact interests ranged from a single field to the UK as a whole, and even internationally in some instances. With respect to Driving forces and Response, there was a widespread recognition of the increasing importance of regional and local policy-making, but with the acknowledgement that many Driving forces operate at the European or even global level. Furthermore, there was no clear correlation between the scale of Impacts and that of Driving forces and Responses considered relevant to particular stakeholders.

There was broad agreement that no single method would be appropriate, and that seeking a toolbox of approaches was a better way to proceed, even though this raises the challenge of how to integrate the use of different types of models and tools in a robust manner. An appropriate toolbox would involve improved methods of sustainability appraisal with respect to changes in the rural economy and land use. It would also be capable of dealing with a much wider range of Driving forces and Impacts than ‘traditional’ models of land use. The importance of enhancing the availability of and access to existing data and expert knowledge was also highlighted. Specific recommendations were also made, such as the development of a simulation game to help build a broader understanding of land use change and its impacts or a common set of national and regional land use scenarios that could be used to inform the work of a number of government departments and agencies.

In discussing the desirable components in any SURPLUS toolbox, a few recurring themes were highlighted. These are reflected in the challenges a SURPLUS toolbox will face:

- improving the ability to integrate economic, environmental and social models and data across spatial and geographical scales;
- developing robust approaches to modelling the behaviour of farmers and land owners under novel socio-economic conditions;
- developing spatially disaggregated models of land use and land cover change with a high enough level of resolution to allow the investigation of local environmental and biodiversity impacts;
- reconciling policymakers’ need for quantitative indicators with the research community’s ability to deliver robust numbers;

- developing more transparent and effective approaches to handling and communicating uncertainty;
- improving the conceptualisation, modelling and appraisal of social impacts;
- testing and validating appraisal tools and techniques, given that changes in 'external' conditions are likely to mean that it is not possible to rely upon historic data for this purpose.

In addressing these challenges, several consultees drew attention to the role of IT in reducing the cost and complexity of data collection and processing, to the increasing sophistication of modelling approaches, and to advances in the use of GIS for handling and representing large amounts of spatial data. At the same time, it was suggested that greater attention should be paid to exploring the potential of qualitative and combined quantitative-qualitative approaches.

4 Critical Evaluation of Available Models, Tools & Techniques

A choice was made for breadth over depth in the evaluation of existing and potential tools to be potentially included in a SURPLUS toolbox. Thus, a wide range of tools was evaluated, including economic and land-use models, simulation models and games, and participatory approaches and process methods. Decision methodologies such as cost-benefit analysis were excluded, as likely being a user task rather than a 'processing' component of a SURPLUS toolbox. Evaluation criteria included: scope (extent and resolution, over space, time and sectors); content (scientific and policy issues potentially addressed); and usability (data requirements, availability, accessibility/compatibility, resource requirements).

The groups of tools evaluated were:

- sectoral economic models, e.g. SWOPSIM, AGLINK, and CAPRI
- general-equilibrium economic models, e.g. GTAP, MEGABARE, and FARM
- general land use change models, e.g. CLUE, IMPEL and ACCELERATES
- agent-based social simulation models in the context of land use change, e.g. CORMAC, FEARLUS, IMAGES, and the GIS-CA Toolkit
- economic agricultural land use and environmental impact models, e.g. NELUP, LUAM
- other environmental impact models and projects, e.g. UK-ADAPT, MAGPIE, MIRABEL, Biopress, Monarch
- scenario analysis, e.g. as used by the UK Foresight and Climate Impacts Programmes and EURURALIS
- role-playing exercises and games, e.g. STRATAGEM, FloodRanger, and PlayAgriPolis
- policy checklists, e.g. Rural Proofing and SPAM (the Cardiff methodology)

In addition, a number of other projects of potential interest, e.g. REGIS, REWARD, ESPON, INSIGHT, and some EU 6th Framework projects, were considered.

Overall, the range of potential tools for a SURPLUS toolbox is wide. Tools exist to meet most stakeholders' needs, but it is less clear whether they provide results at the desired geographical scale, and especially at more detailed scales such as regions and sub-regions. There is also a tension between stakeholders' wishes for simplicity, transparency and certainty vis-à-vis the inherent complexity and uncertainty of the real world. Most tools require a fair amount of technical expertise,

although efforts are being made towards greater user-friendliness. Furthermore, their development has often involved considerable scientific and data resources, but standard results are often not available, and little work has been done on integrating tools in a generic fashion.

5 Discussion

Based upon the analysis in this Scoping Study, the following can be concluded:

1. ***There is interest in a project along the lines of SURPLUS.***
   There is a substantial level of interest among a wide range of potential end users in a project that could achieve the objectives as laid out for SURPLUS. In particular, there is a desire to integrate economic, environmental and social models and data across spatial and geographical scales in ways that have not been done in the past.
2. ***No single tool or technique will be adequate to meet the needs and desires of the full range of potential end users.***
   The range of Driving forces, Responses, and Impacts, which such a project might address, is quite large and varied. In addition, there will be inherent trade-offs among some of the desires mentioned by potential users. Among these are the desire for quantitative indicators with high certainty versus the research community's ability to deliver robust numbers and the desire for transparency in the tools versus the complexity of the real-world issues being addressed; and the desire for outputs at a wide range of spatial scales. This, combined with the desire for integrated appraisals, points to the need for a suite of tools & techniques rather than a single generic tool or technique.
3. ***A wide range of tools & techniques appear to be available for inclusion in a SURPLUS toolkit. A key challenge will be their integration.***
   There is a wide range of tools, available or being developed, which touch on most elements identified in the proposed framework for SURPLUS. In addition, a number of recent and ongoing research projects could make contributions to an eventual SURPLUS toolkit. With a few exceptions, however, little work has been done on integrating tools in a standard fashion. Furthermore, it is not likely that individual stakeholders will be aware of the breadth of available tools.
4. ***Some of the current objectives specified for the SURPLUS project may not be achievable or are inappropriate given current scientific understanding.***
   In particular, the desire for forecasts cuts against the grain of current understanding in the futures literature, which would underpin most activities in a SURPLUS project. Similarly, given that changes in 'external' conditions are likely, it will not be possible to rely upon historic data for the purpose of testing and validating many appraisal tools & techniques.
5. ***A more detailed and targeted consultation process should be undertaken before any other activity in the further development of a SURPLUS project.***
   It is imperative that more specific and almost certainly more modest objectives be established for the SURPLUS project than those currently specified. This will require a much more extensive consultation than the one pursued in this Scoping Study, both in terms of the number of persons consulted and the depth

of the interaction with these persons. In addition, the needs and priorities of the funders of the consultation must be specified in much greater detail beforehand. In this way, the process can be designed to meet these wishes from the start. Otherwise, it will not be possible to identify and/or develop the most appropriate tools & techniques. The net result would more than likely be a toolkit that promises much to many potential users, but only minimally satisfies some, and fully satisfies none.

6. ***There are a few other activities that could make sense to pursue in parallel to the consultation process identified above.***
These have been chosen based upon their feasibility and recommendations by persons involved in the Consultation phase, but most importantly their ability to complement the primary recommendation, i.e. a more detailed and targeted consultation process, and lay the groundwork for later phases in the development of a project along the lines of SURPLUS. These include: 1) the development of a simulation game focussing on land use change and its impacts, e.g. a 'SimCountryside'; 2) the exploration of collaborations with one or more of the projects that are being funded in the EU's 6th Framework Programme that are directly related to Sustainability Impact Assessment, e.g. SENSOR and Sustainability A-Test; and 3) the encouragement of efforts to formally link more detailed tools with higher-level checklists, such as the Rural Proofing checklist.

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1. Introduction

This report presents the results of the Appraisal of Sustainable Rural Policy and Land Use (SURPLUS) Scoping Study, commissioned to guide the further development and implementation of the overall SURPLUS project. The Study forms part of the Defra Horizon Scanning Programme and is co-funded by the Treasury's Evidence-Based Policy Fund. Thus, in order to understand the purpose and goals of the Scoping Study, it is necessary to first present some background to the SURPLUS project.

1.1 Background to SURPLUS

Governments, including those of the UK and the devolved administrations, have set or agreed on ambitious targets for rural areas (DETR 2000c) and made specific commitments in such areas as sustainable development (Defra 2002a), farming and food production (Defra 2002b) and the protection of biodiversity (Defra 2002c). These have occurred in a policy context that also includes such developments as reform of the European Union's (EU) Common Agricultural Policy, introduction of the EU's Water Framework Directive and Rural Development Regulation, and entry into force of the Kyoto Protocol to the United Nations' Framework Convention on Climate Change.

At the same time, governments are facing an increasing demand for evidence-based policy appraisal, including more extensive and detailed forms of impact assessment (CEU 2001). Recent reviews of policy appraisal (Cabinet Office 2000; Bullock, Mountford et al. 2001; Etheridge 2003) and guidance documents (EC 2002a; EC 2002b; Cabinet Office 2003b; Cabinet Office 2003a; HM Treasury 2003) represent some of the attempts by the EU and UK governments to meet these demands.[1] Meanwhile, the issue of policy appraisal has also received increasing attention in the academic literature (Owens, Rayner et al. 2004). There is concern that the existing approach to rural policy is facing major challenges and the current evidence base for the appraisal of rural policy under these circumstances may be inadequate.

The Appraisal of Sustainable Rural Policy and Land Use (SURPLUS) project represents a specific effort by Defra to address these interlinked issues. Its aim is to improve the ability of Defra and other organizations to carry out policy appraisal based on a full assessment of future changes in land use, recreation, amenity and rural economic activity, and the impact of such changes on the rural environment and rural communities. Specifically, its focus is on appraising potential rather than evaluating past impacts. It hopes to do so by the use and development of tools to investigate and forecast the impacts of alternative policy scenarios and of external social, economic and environmental drivers on the rural environment. Its proposed objectives are to:

- Develop cost-effective tools for assessing trends as well as forecasting and anticipating future changes in direction in rural economic and social activity and land use and their environmental impacts and social consequences, over 5-20 year timescales.

[1] See also the website on Integrating Sustainable Development into Policy: http://www.sustainable-development.gov.uk/sdig/integrating/. This has, amongst other things, links to checklists for economic, social, and environmental appraisal, to which we will return in Section 5.2.9 of this report.

- Test and evaluate the tools with empirical data and provide measures of the uncertainty of forecasts and sensitivities with regard to input assumptions.
- Ensure that the tools are relevant and useful to policy customers in Government departments and agencies, nationally and regionally.
- Ensure that the tools build on or link with existing methods and experience and utilise existing data as far as possible; and
- Apply the tools to a range of policy issues, such as those identified in the Rural White Paper *Our Countryside: The Future*, the England Biodiversity Strategy and the Strategy for Sustainable Farming and Food and refined during consultations undertaken for the scoping study.

1.2 Purpose and Goals of the Scoping Study

The purpose of the current Scoping Study was to guide the further development and implementation of the SURPLUS project. Specifically, it sought to:

- Confirm the user requirements and refine the objectives for the overall project
- Assess the feasibility of using various modelling and other foresight approaches to achieve the objectives of the overall project, and
- Develop technical specifications and determine funding arrangements for its implementation.

This Scoping Study can be seen as a successor to the earlier Modelling Environmental Impacts of Land Use (MEILUC) study commissioned by the then Ministry of Agriculture, Fisheries and Food (Edwards-Jones, Oglethorpe et al. 1999). It was intended to update the results of this previous study to take into account recent modelling and scenarios work and increased data availability. At the same time, the remit of SURPLUS implied a broader reach for this Scoping Study.[2]

The MEILUC study took a fairly linear approach, focussing on the more or less direct influences of policy and other external drivers, e.g. climate changes, technological developments, demographic shifts and market movements, on land cover and management. In SURPLUS, the hope is to be more holistic by also including many of the indirect linkages and feedbacks, such as the effects of the changing social, economic, and environmental conditions on the external forces outside the control of policy-makers and their feedback via other factors. Secondly, the intention in SURPLUS is to consider social and economic, in addition to environmental impacts. Finally, in the MEILUC study, the emphasis was on models, preferentially quantitative computer models, although they did also examine the Countryside Survey and associated Countryside Information System, which is clearly a database and not a model in the classic sense. In SURPLUS, the hope is to go even further by also including more qualitative tools and techniques.

In taking a broader reach, it is not surprising that there had to be some sacrifice in terms of depth in this Scoping Study. This is a key issue to which we will return later. One key area in which this played out was that we were not able to evaluate any single tool or technique in great depth. We also had to limit the overall number of tools and techniques to evaluate. Thus, the choice was made to examine

[2] This Scoping Study also has a broader reach than the recent study by Williamson (2003), which emphasised data tools for spatial modelling of the environmental effects of agricultural land use and land use change.

more general categories of tools and techniques, highlighting their distinctive characteristics as exemplified by specific examples.

1.3 Phases of Scoping Study

The Scoping Study was divided into three phases:

- Consultation;
- Evaluation; and
- Technical specification and reporting

Consultation

The Consultation phase was broken down into three components: a review of academic and policy literature; targeted interviews with policy makers and technical experts; and a one-day workshop with similar persons. The review of academic and policy literature had as its primary purpose the identification of key contacts, policy and technical documents, and related projects that are of interest for the SURPLUS project. Doing so provided the basis for the selection of interviewees and invitees to the stakeholder workshop, as well as delimiting the range of material to be included in the Evaluation phase.

A list of more than 90 contact persons was drawn up. Of these, thirteen persons were chosen for in-depth, semi-structured interviews. These were conducted either face to face or via telephone, and lasted approximately 60 to 90 minutes. The purpose of the interviews was to elicit different perspectives on the proposed objectives of the SURPLUS project, key drivers and impacts associated with the rural economy and land use change, and appraisal tools and techniques. The interviewees were also asked to provide additional information on specific persons, tools and techniques, and projects with which we should be engaging in the Scoping Study, thus enhancing our original review. We also discussed the level of personal and institutional interest in the SURPLUS project, including the possibility of co-funding such an endeavour.

The third component of the Consultation phase, the stakeholder workshop, was held on March 24th 2004 at the Policy Studies Institute's Conference Centre in London. This brought together 24 stakeholders from government and academia. The aims of the workshop were to introduce the SURPLUS project and the Scoping Study to the stakeholders and to refine the project objectives. This was done through a set of presentations and then exploring the kinds of questions that any appraisal tools and techniques used or developed in the project should be able to address, and the kinds of tools and techniques that should be considered.

More detail on the methods used in the Consultation phase, including a list of those interviewed, the protocols used to structure the interviews, and a list of participants from the stakeholder workshop are presented in a separate Consultation and Background report (Rothman, Eames et al. 2004).

Evaluation

The intent of the Evaluation phase was to provide a critical evaluation, against an agreed set of criteria, of a variety of tools and approaches for meeting the objectives of the overall SURPLUS project. The wide range of tools and approaches available made this a daunting challenge and tough decisions had to be made. In all 12 general classes of approaches were identified, with 9 of these receiving more detailed exploration. As noted in section 1.2, even then we were not able to evaluate any single

tool or technique in great depth. Furthermore, it was decided not to specifically evaluate data and indicator sets, although these are often pre-requisites for the use of some of the tools and approaches reviewed. We also looked at recent, ongoing, and planned research projects that might be of interest for the further development of the SURPLUS project, even if they could not be classified as a specific tool or approach.

The decision was also made not to produce a separate Evaluation report. Rather the description of the process and the results of the Evaluation phase have been integrated into this report, particularly in Sections 4 and 5, and associated annexes.

Technical specification and reporting

The purpose of the Technical specification and reporting phase was to prepare a detailed report, together with (if appropriate) a technical specification and costing for proceeding with the full SURPLUS project. The current report represents the results from this phase.

1.4 Outline of Remainder of Report

The next section of this report presents a conceptual framework within which to understand the results of the Scoping Study and to think about the further development of the SURPLUS project. Section 3 looks at the interests of key stakeholders in the SURPLUS project using this perspective. Here the main results from the Consultation phase are reported. Section 4 expands on the framework set out in Section 2 and presents the evaluation of tools & techniques that are available or might be developed as part of the SURPLUS project. Finally, Section 5 draws together the key conclusions from the scoping study and provides recommendations for the next steps to be taken in developing the SURPLUS project.

2. A Conceptual Framework for Policy Appraisal

At its core, the SURPLUS project is about appraising the impacts of policy choices and external drivers on the rural environment and rural communities. The scope of impacts, policy choices, and external drivers is almost unlimited. The next section looks more closely at which of these are of most interest to the potential beneficiaries of the SURPLUS project. Before addressing these specifics, though, it is useful to lay out a framework within which to conceptualize these choices, as well as to place the potential tools and techniques for doing the appraisal. The Driving force – Pressure – State – Impact – Response (DPSIR) framework as laid out by the European Environment Agency (EEA) and others, is an accepted and commonly used framework. We will use this as our starting point, but go further to unpack and expand on this.

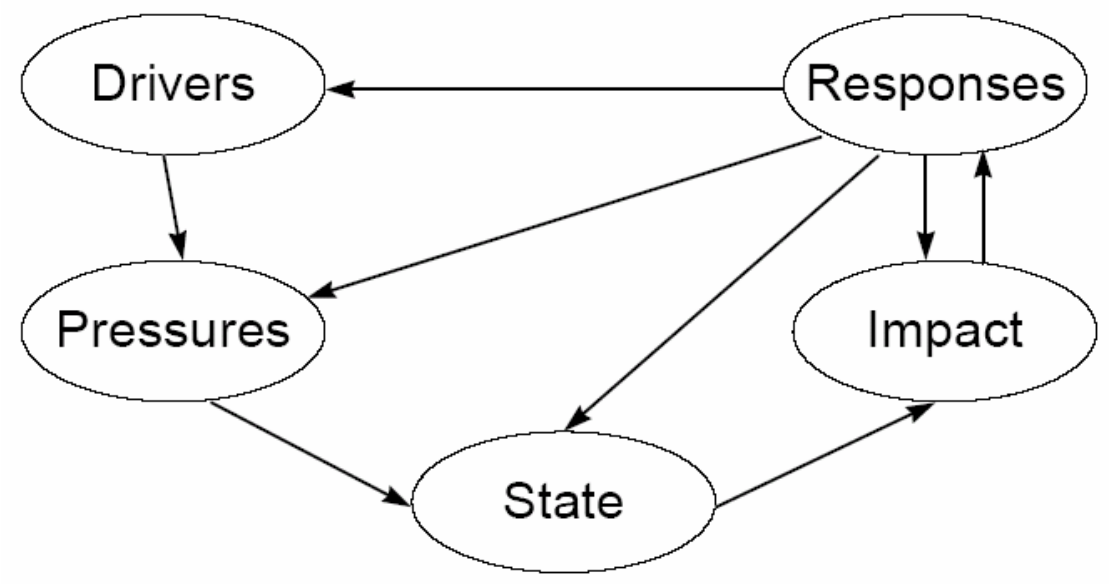

Figure 1: DPSIR Assessment Framework
Source: (Smeets and Weterings 1999)

2.1 An Initial Framework

Figure 1 presents the DPSIR framework at its most basic. Driving forces, in the form of social, environmental, or economic developments exert Pressure on the environment and, as a consequence, the State of the environment changes. Finally, this leads to Impacts that may elicit a societal Response that feeds back to the Driving forces, Pressures, State, or Impacts directly (EEA 2001). As an example, increased demand for food can lead to the intensification of agriculture via increased fertilizer use, resulting in the increase of nitrate runoff into nearby streams, leading to the eutrophication of downstream water bodies and subsequent impacts on aquatic life. One response to this could be to increase taxes on fertilizer; another would be to require changes in land management practices to reduce nitrate leaching.

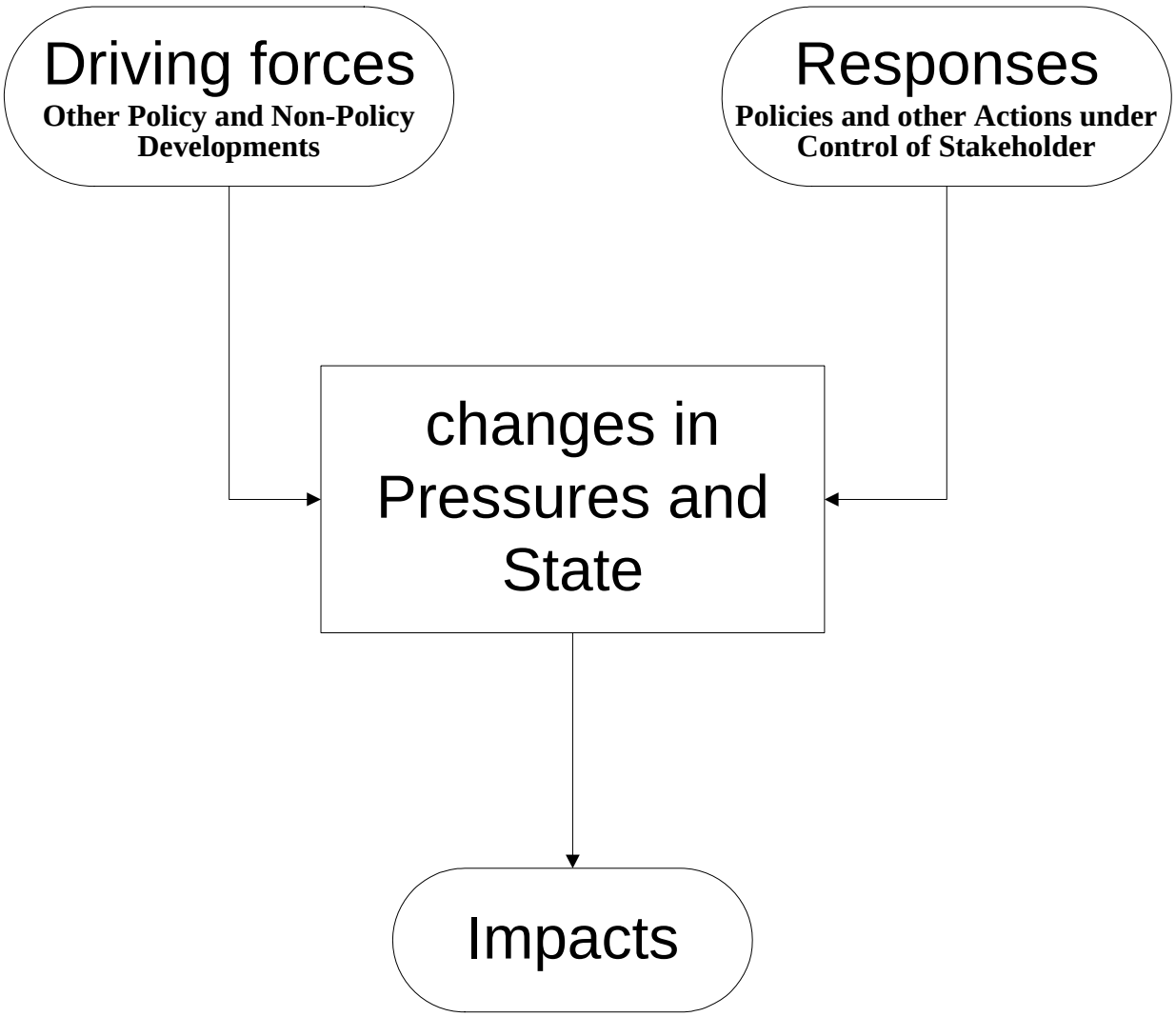

Figure 2: Modified DPSIR Framework for SURPLUS

Figure 2 presents a slight modification of the DPSIR framework to reflect better the goals of the SURPLUS project. The purposes for the modifications are: 1) to clarify more explicitly the distinction between those actions that are under the control of a stakeholder and those that are not, and 2) to recognize that actions of a stakeholder may be generated independently and not simply as responses to external forces. Not shown explicitly, but also to be understood given the remit of SURPLUS, it is presumed that land use will play a key role in any application, i.e. it will appear somewhere in our modified DPSIR framework.

We adopt the following specific definitions:

- R(esponses) = policies and other actions under control of stakeholder;
- D(riving forces) = 'external' policy and non-policy developments not under control of stakeholder;
- P(ressures) = (changes in) pressures impacting on system of interest;
- S(tate) = (changes in) the state of system of interest; and

- I(mpacts) = (changes in) specific aspects of system of interest - social, environmental, and economic.[3]

As with the original conception of the DPSIR framework, this explicitly adopts a systems perspective, i.e. there is a particular system of interest. This system is bounded in two ways. Firstly, it is bounded in terms of the scale at which the Impacts are defined, e.g. a single river up to the whole UK. Secondly, it is bounded in terms of the scale of the Responses and Driving forces affecting this system, e.g. local economic changes up to global environmental agreements. How these boundaries are drawn will be a function of the particular application. Furthermore, they will not necessarily coincide since Impacts at one scale will often be determined by Responses and Driving forces that act at a different scale.

The development and use of a SURPLUS toolkit should be seen as encompassing the whole of Figure 2. D and R (the inputs) feed into the 'processing' part of the toolkit; I (the outputs) are what come out. In between, the processing part of the toolkit determines the evolution of P and S, which can be viewed as intermediate outputs. The specification of D, R, P, S, and I will differ by application and will be related to the two dimensions of scale noted above, as well as the precise definition of the application. For the former, consider two applications looking at, *inter alia*, water quality within a lake. Depending on how the spatial boundary of the system is drawn, the inflow to the lake from a stream can either be a Driving force (external to the system) or a Pressure (internal to the system). For the latter, consider two applications in which the impact of interest is change in biodiversity. In one case a scenario of land use change may be taken as an input, i.e. it is a Driving force. In another case the land use change may be calculated as a function of a different Driving force, e.g. CAP reform implementation – here land use is more appropriately seen as either a Pressure or State.

Although D and R are inputs and, therefore, not inside the 'processing' part for a particular application, the toolkit should allow for some pre-processing. For example, it may include tools for the extraction of data for a particular region from a larger dataset or the aggregation of data at one scale of resolution for use in models that operate at a higher scale.

A final point to note in order to avoid confusion is that the changes in Pressures and States, and resulting Impacts may involve modelling the behaviour, i.e. responses, of certain actors within the system of interest. For example, in the case where part of the application involves modelling the changes in land use as a result of a particular approach to implementing CAP reform, it will be necessary to model the behaviour of land managers as they respond to this development. Since this behaviour is not that of the specific stakeholder implementing the policy, it is not a Response given the terminology laid out above.

2.2 An Expanded Framework

We can begin to expand Figure 2 in several ways. Firstly, as we noted above, the SURPLUS toolbox should allow for some means to extract or aggregate data in preparing inputs. It may also be the case that the tools used to estimate the changes in Pressures and States, and resulting Impacts, will rely on particular datasets. Thus, we need to indicate that the framework should also include key datasets. This is shown in Figure 3.

[3] Note that, using these definitions, Impacts are actually a subset of the State.

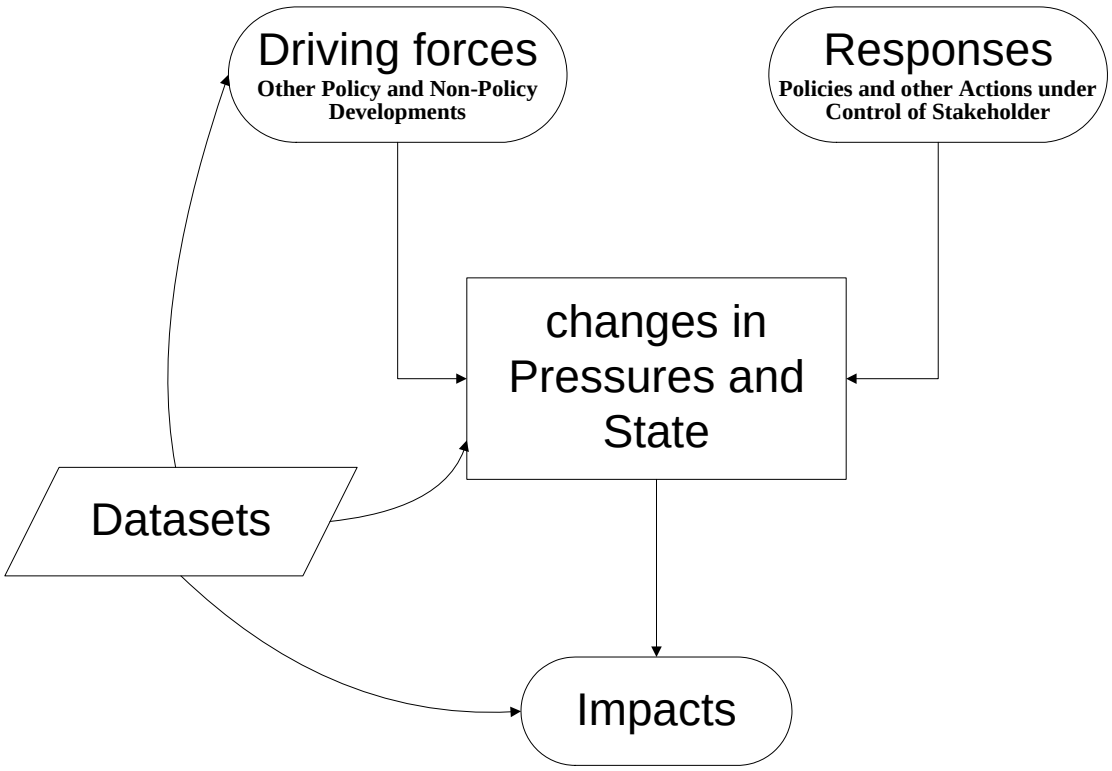

Figure 3: Expanded DPSIR Framework for SURPLUS

In a similar vein, the framework should also incorporate indicator sets. In many ways, these are a special type of dataset in that they generally have a normative element. The choice of indicators to include are usually related to some policy goal, and the value that the indicator takes at any point in time is meant to be compared against some benchmark, be it a change from an initial state, distance to a target, or proximity to a threshold.[4] Thus, Figure 4 adds indicator sets as a piece of supporting material, like the datasets, as well as a link between the indicator sets and the Impacts, pointing out that ideally the latter would be expressed using the indicators included in the indicator sets. The normative aspect of indicators also highlights the fact that it is not just the raw measures of economic, social, and environmental impacts that the users of SURPLUS are interested in, but ultimately the meaning attached to these Impacts. For this reason, Figure 4 implicitly adds a further step to the chain of analysis in that not only the Impacts, but also the meanings of these are determined in the 'processing' part of the SURPLUS toolbox. There is, of course, a question as to whether this latter step should be inside the toolbox itself, or kept apart as a job for the user. We will return to this issue in Section 4 of this report.

The next two sections of this report will concentrate on unpacking the various elements of this framework. Section 3 explores the key interests expressed by stakeholders in the SURPLUS project. In doing so, it will focus on the Driving forces, Responses, and Impacts, but will also say something about the targets that will be important to consider. It will also consider how the different stakeholders might see themselves interacting with the overall framework, which will have an impact on the nature of the tools that will make up the overall toolbox. Section 4 will emphasize the

[4] For example, the UK's Quality of Life Counts (Defra 2004b) use change against the baseline assessment made in 1999.

'processing' part of the toolkit, i.e. what specific tools and approaches might we consider for populating this 'black box'. Since the supporting materials, i.e. the data and indicator sets, are closely linked to these, they will also be addressed in this section.

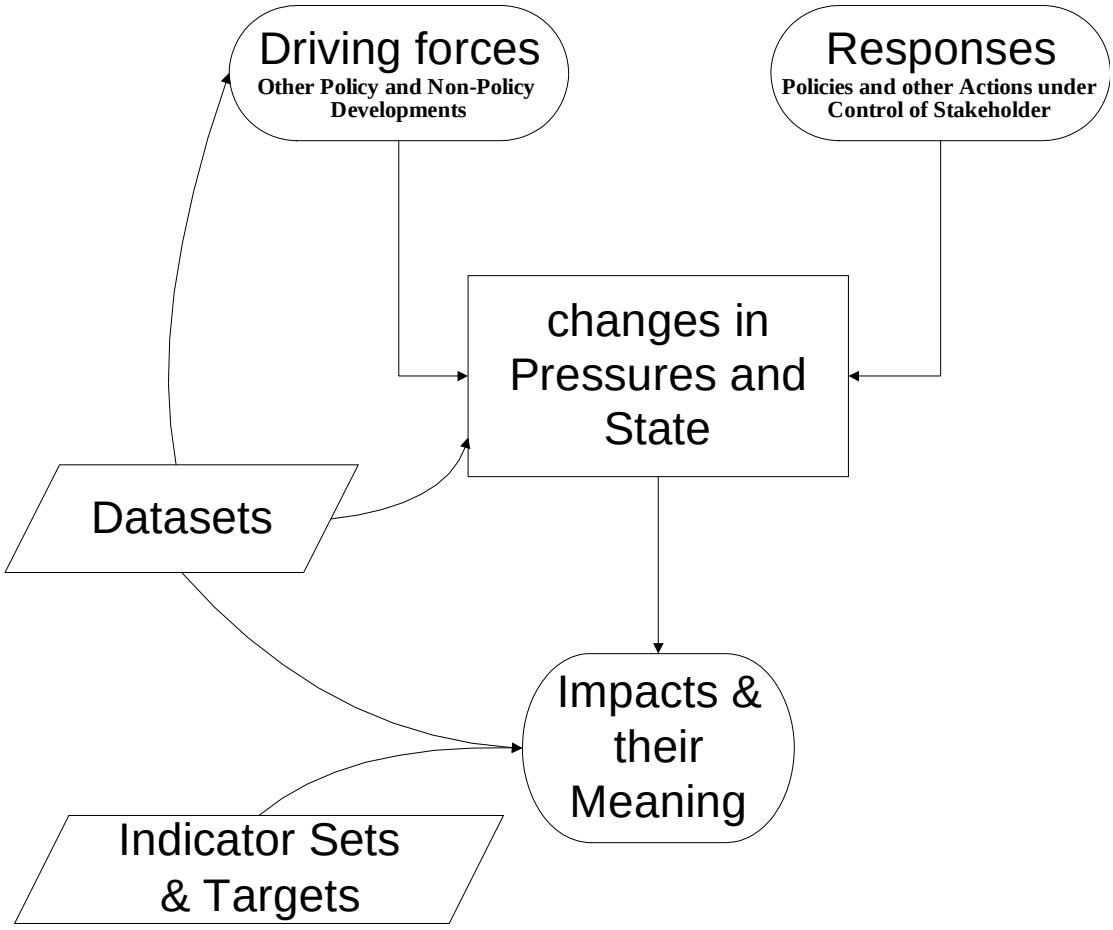

Figure 4: Final DPSIR Framework for SURPLUS

3. Stakeholder interest in SURPLUS

3.1 Introduction

As noted in Section 2, the scope of impacts, policy choices, and external drivers - Impacts, Responses, and Driving forces in our terminology - that could be considered in the SURPLUS project is almost unlimited. Given its terms of reference, the most that could be said at the start of this Scoping Study was that the scale of the Impacts and Responses considered should not go beyond England and Wales, or perhaps the whole UK, and land use should have a key role in any application. Any further specification of the scope was intended to be an outcome of the current Scoping Study, in particular the Consultation phase. This phase was also intended to identify the stakeholders' needs and desires with respect to the types of tools and processes they would like to see developed as part of the SURPLUS project. This section presents the key results of this work. More detail, including lists of the policy directives and documents reviewed and extended summaries of the interviews and stakeholder workshop are presented in a separate Consultation and Background report (Rothman, Eames et al. 2004).

Table 1: Persons Interviewed During Consultation Phase

Name	**Organisation**
Policy Experts	
Bob Roberts	Countryside Agency, Living Landscapes
Nigel Atkinson	Defra, Sustainable Agriculture Strategy Division
Robert Willows	Environment Agency, National Centre for Risk Analysis and Options Appraisal
James Curran	Scottish Environmental Protection Agency (SEPA), Environmental Futures
Sheila McCabe	Defra, Sustainable Land Use Division
Tom Coles	Defra, Sustainable Land Use Division
Technical Experts	
Andrew Moxey	Scottish Executive Environment & Rural Affairs Department (SEERAD), Analytical Services Division
Paul Ekins	Director ESRC Environment and Human Behaviour Programme, Policy Studies Institute
Jo Hossell	ADAS
David Harvey	The University of Newcastle upon Tyne, School of Agriculture, Food and Rural Development
Louise Heathwaite	University of Sheffield, Department of Geography
Philip Lowe	Director, ESRC RELU Programme, University of Newcastle, Centre for Rural Economy
Simon Shackley	UMIST, Environmental Management and Policy, and Tyndall Centre

The Consultation phase was intended "*To confirm user requirements for and interest in the SURPLUS project*". Specifically, it hoped to provide answers to the following questions:

1. What should be the policy, temporal, and geographic scopes of the project?
2. Should Defra's initial objectives for the project be refined and, if so, how?

The Consultation phase was broken down into three components: a review of the literature; targeted interviews with policy makers and technical experts (see Table 1); and a one day workshop with similar persons (see Table 2). The mechanics of undertaking these components were summarised in Section 1.3 of this report. This section will focus on the main results related to the desired content and form of an eventual SURPLUS project. It will conclude with some thoughts on the implications for developing such a project.

It is important to note that the original intention of this phase of the Scoping Study was to evaluate and refine the proposed objectives for the SURPLUS project as a whole, which were presented in section 1.1. Thus, it was designed to provide an overview of the key research needs and priorities for the project. As the study progressed, however, the steering committee expressed a desire for a more detailed analysis, particularly an indication of the needs and priorities for stakeholders operating at different spatial scales. To the extent possible, this has been done and is reflected in the results presented here. The lists of persons interviewed (Table 1) and those involved in the workshop (Table 2) point out an immediate limitation to how the consultation was undertaken, however. If the spatial scales are defined as UK & Above, National (e.g. England), Regional, and Local, only the first three of these are represented. Other factors, noted below, further limited our ability to satisfy fully the request of the steering committee.

Table 2: Attendees at Stakeholder Workshop	
Name	**Organisation**
Nicola Chissell	Defra
Kristina Dahlstrom	Policy Studies Institute
Malcolm Eames	Policy Studies Institute
Ian Holman	Cranfield University
Melanie Howard	Future Foundation
Richard Howell	Environment Agency
Robert Huggins	Environment Agency
Philip Lowe	University of Newcastle
Kate Parker	Defra
Bob Roberts	Countryside Agency
Dale Rothman	Macaulay Institute
Peter Samuels	Welsh Assembly
Kirsty Shaw	Countryside Agency
Carol Somper	Forum for the Future
Andrew Stott	Defra
Rohit Talwar	Defra
Kenneth Thomson	University of Aberdeen
Antony Williamson	Environment Agency
Robert Willows	Environment Agency
Sarah Gardner	ADAS
David Harvey	University of Newcastle
Les Firbank	Centre for Ecology and Hydrology
Jeff Waage	Imperial College
Caroline Wood	Department for Transportation

3.2 Stakeholder Needs and Desires – Content

The content of any eventual SURPLUS project refers to those Driving forces, Responses, and Impacts that it addresses. These should be those of most interest to its users. In addition, these should be dealt with at the temporal and geographical scales of most relevance to those same users. As noted in Section 2.1, the geographical scales may differ between Driving forces, Response, and Impacts, even within a single application.

Much of the information presented in this section was derived from the input provided by the interviewees and workshop participants in the Consultation phase. Table 3 summarises the responses provided by the interviewees. In addition, specific policy documents were reviewed. For example, in its most recent five-year strategy, Defra specifies nine public service agreement performance targets (PSAs), and identifies strategic outcomes sought under each of its strategic priorities (Defra 2004a).

Table 3: Stakeholder Interests in SURPLUS - Content				
	Responses (Policies and other Actions under Control of Stakeholder) and Drivers (Other Policy and Non-Policy Developments)		**Scope – Extent and Resolution of Impacts**	
Organisation		**Impacts**	**Temporal**	**Spatial**
Countryside Agency	• Biodiversity Policy • CAP • Home location • work location • transport • Geology • Climate Change • Human Intervention	• land and land use • diversity and homogeneity, in both environmental and cultural terms. • Environmental and Cultural interaction is not unidirectional. • Need full understanding of social, economic and environmental consequences.	• disagrees with proposed timescale; 5 years is too short. • 20 year proposal as "brave" in relation to the many predictions set.	• no specific comment
Environment Agency	• Climate change and subsequent policy responses. • Agricultural Technology • Social attitudes to the countryside.	• water quality and demand • nutrients • flood risk • fisheries • forestry • acidification • conservation.	• project timescale is appropriate.	• England and Wales as the main focus of the project. • desirable to have knowledge of the social and economic impacts on this national scale.
SEPA	• Land Reform Act • Common Agricultural Policy • Scottish Biodiversity Strategy. • Demography and land	• biodiversity	• 20 year time scale useful • 5 years is too close and offers no challenge.	• tend to work at the catchment scale or policy area scale. Latter is Scotland wide policies so, from their perspective, the relevant scales are

	tenure • generation of people not interested in agriculture, • climate change • tourism • communications and people moving to new areas.			approximately 1/10th of Scotland to all of Scotland.
Defra	• CAP reform. • Long term historical trends that have been in operation since the Industrial Revolution: e.g. falling agricultural employment; decline of agricultural output and greater environmental stress has occurred after industrialisation of agriculture.	• farming practices and the rural community. • Soil erosion • climate change • resource protection • landscape protection.	• the 5 to 20 timescale is appropriate.	• appropriate scale would depend upon which specific impacts were being observed – these may range from national to trans-boundary impacts down to farm scale ones.

	• Housing demand • ageing population in countryside • widening gap between rich and poor • climate change/flood management • increasing wealth driving up resource demand • earlier retirement • increasing "green" pressures from local communities • increasingly litigious society in regards to planning • greater demand for evidence upon which planning decisions are based.	• Focused on Key environmental impacts: climate change; flood management; water demand/stress; resource demands; diffuse pollution; soils erosion/quality and biodiversity.	• 5-20 year timescale is appropriate.	• Need to be able to look at the national scale as policy is now made at this level and not for UK as a whole. • For land use planning policy purposes also need to be able to look at local authority boroughs as this is the scale local planning strategies were drawn up. • Would want to be able to look at least nearest 1km sq
University Researchers	• housing • jobs • infrastructure	• Diffuse pollution • bio security (species invasion, disease propagation)	• 5-20 year time frame is right (sees problems with regards to finding a market for people who really want to think of medium term).	• no specific comment

	• Social Trends: people moving to the countryside or commuting to urban centres. • Economic Trends: CAP reform; falling farm incomes; increasing farm diversification into other businesses. • Environmental Trends: Water Framework Directive driving more integrated joined up approach to diffuse pollution and land use.	• Water Quality • Water Quantity and Supply • Changes in the use of marginal land.	• Agrees with 5 to 20 year timescale.	• Appropriate scale will depend on specific policy problems and outcomes being observed.
	• Drivers as interacting processes. • Social Drivers – Diversification of food, leisure and recreation markets • Environmental Drivers – climate change	• impacts will differ depending where we are in space and time. (e.g. in East Anglia should concentrate on water land use interaction; in the Lake District we should observe the impact of excessive tourism).	• happy with the 5-20 year time frame	• project should operate on all scales, from field boundary up to the country. • Believes there is a chain. For example, the interesting environmental findings occur at the field level, but exist only as a consequence of what occurs at the farm level. This can continue up to the international level.

	• trends in demographics • outmigration from urban areas to countryside • amount of new build in rural areas • Water Framework Directive • climate change • trends in bioenergy and other non food uses of crops • biotechnology and other technologies such as productivity of crops.	• farmland • general biodiversity • levels of nitrates and pollutants from farming.	• timescale should be extended (e.g. climate change becomes more obvious in the longer term)	• acknowledges the importance of issues at the national level but regional scale is becoming increasingly important.
Policy Studies Institute	• land is a good in itself and can act as a means to other goods • environmental policies act on land use demand in unanticipated ways.	• no specific comment	• no specific comment	• no specific comment
ADAS	• CAP reform • Climate change • house building in SE • ageing farm population • shift towards contract farm labour • diversification of farmers away from agricultural income. • Economic trends • Supermarkets now looking for local sourcing.	• biodiversity • soil biodiversity • soil and water quality	• no specific comment	• species don't respect national borders therefore care should be taken with regards to restricting the scope of the project to convenient national borders.
Scottish Executive Environment &	• WTO • CAP Reform	• biodiversity • clean water	• temporal scale of 5-20 years is suitable	• At the national level things can get lost in

Rural Affairs Department	• WFD • UK regional policy • the richer people become the demand for a good environment increases • ageing population. • Climate change • Views all drivers as interacting and overlapping.	• landscape amenity value • changes in land use patterns. • workforce in the primary sector	• environmental and ecological processes occur over a long period of time, but anything beyond the 20 years would be speculative.	averages. • agents interacting with people outside the region being focussed on can be problematic. • Can't assume that nothing changes in the wider world. • different natural scale units for economics, ecology, hydrology etc

These are summarised in Tables 4 and 5. Similar information can be extracted for other government departments such as the Department of Trade and Industry (DTI) and the Department for Transportation (DfT) (DTI 2003; DfT 2004), and non-departmental bodies such as the Countryside Agency (CA) and Environment Agency (EA) (EA; CA 2003a).

Table 4: Defra's Public Service Agreement 2005-2008 Performance Targets
PSA 1. To promote sustainable development across Government and in the UK and internationally, as measured by: • the achievement of positive trends in the Government's headline indicators of sustainable development; • the UK's progress towards delivering the World Summit on Sustainable Development commitments, notably in the areas of sustainable consumption and production, chemicals, biodiversity, oceans, fisheries and agriculture; and • progress towards internationally agreed commitments to tackle climate change.
PSA 2. To reduce greenhouse gas emissions to 12.5% below 1990 levels in line with our Kyoto commitment and move towards a 20% reduction in carbon dioxide emissions below 1990 levels by 2010, through measures including energy efficiency and renewables. Joint with DTI and DfT.
PSA 3. Care for our natural heritage, make the countryside attractive and enjoyable for all and preserve biological diversity by: • Reversing the long-term decline in the number of farmland birds by 2020, as measured annually against underlying trends; • Bringing into favourable condition by 2010 95% of all nationally important wildlife sites.
PSA 4. Reduce the gap in productivity between the least well performing quartile of rural areas and the English Median by 2008, demonstrating progress by 2006, and improve the accessibility of services for people in rural areas.
PSA 5. Deliver more customer-focused, competitive and sustainable farming and food industries and secure further progress via CAP and WTO negotiations in reducing CAP trade distorting support.
PSA 6. To enable at least 25% of household waste to be recycled or composted by 2005-06, with further improvement by 2008.
PSA 7. Eliminate fuel poverty in vulnerable households in England by 2010 in line with the Government's Fuel Poverty Strategy Objective.
PSA 8. Improve air quality by meeting the Air Quality Strategy targets for carbon monoxide, lead, nitrogen dioxide, particles, sulphur dioxide, benzene and 1,3 butadiene. Joint target with DfT.
PSA 9. To improve the health and welfare of kept animals, and protect society from the impact of animal diseases, through sharing the management of risk with industry, including: • a reduction of 40% in the prevalence of scrapie infection (from 0.33% to 0.20%) by 2010; • a reduction in the number of cases of BSE detected by both passive and active surveillance to less than 60 in 2006, with the disease being eradicated by 2010; • a reduction in the spread of Bovine TB to new parishes to below the incremental trend of 17.5 confirmed new incidents per annum by the end of 2008.
Source (Defra 2004).

Of additional interest for SURPLUS are the indicators against which different groups measure their success. As noted in Figure 4, indicator sets should be seen as a key component of a SURPLUS toolbox, and tools that can produce outputs that match these indicators would be of great value. The dominant indicator set in use in the UK at the moment is the Quality of Life Counts, to which a number of Defra's PSAs are specifically linked (Defra 2004b).[5,6]

[5] See also the website at http://www.sustainable-development.gov.uk/indicators/index.htm.
[6] There has been further development of regional and local versions of the national indicators ((DETR 2000a; Defra 2004c)

Table 5: Defra's Strategic Outcomes sought under each Strategic priority
Sustainable development promoted across Government, in the UK and internationally, as measured by: • the achievement of positive trends in the Government's headline indicators of sustainable development; • the UK's progress towards delivering the World Summit on Sustainable Development commitments, notably in the areas of sustainable consumption and production, chemicals, biodiversity, oceans, fisheries and agriculture; • progress towards internationally agreed commitments to tackle climate change; and • improved local environmental conditions and cleaner streets, city centres and countryside, with reduced levels of litter, flytipping and abandoned vehicles.
Climate change and energy • Meeting the challenge of climate change • Reduction in the UK's contribution to global climate change by cutting our greenhouse gas emissions • Reduction in global greenhouse gas emissions to avoid dangerous climate change, and international promotion of adaptation to unavoidable climate change • Every home adequately and affordably heated • UK successfully adapting to unavoidable climate change • Risk from flooding and coastal erosion managed in a way which furthers sustainable development • Cleaner air through meeting the targets in the National Air Quality Strategy
Sustainable consumption and production • Breaking the link between economic growth and environmental degradation and resource use through promoting and enabling more sustainable patterns of consumption and production • Programmes in place to decouple economic growth from environmental degradation and unsustainable resource use • Protection of human health and the environment by minimising amounts of waste produced and getting as much value as possible out of what is left by re-use, recycling or composting and the recovery of energy
Protecting the countryside and natural resource protection • Creating a robust policy framework and evidence base in order to promote the sustainable use and enhancement of the country's natural heritage and ecosystems • Protect and enhance the natural environment, now and for future generations, and establish a robust framework for future development decisions that respect environmental constraints • More and better access to the natural environment for recreation, especially for those who find it difficult to enjoy the health and well being benefits which access to nature can bring • Good water quality and a good water environment, with a sustainable balance between water supply and demand
• Sustainable Rural Communities • Encouraging sustainable regeneration in disadvantaged rural areas, promoting social inclusion and reducing deprivation. Ensuring higher quality, more accessible public services to rural communities • Vibrant enterprise across rural England, with resources better targeted to help reduce gap in productivity between least well performing quartile of rural areas and the English median; rural social exclusion tackled wherever it occurs, with fair access to services and affordable housing
• Sustainable Farming & Food, including Animal Health & Welfare • Helping to create a sustainable food and farming supply chain serving the market and the environment; putting in place systems to reduce risks of animal diseases, and being ready to control them when they occur • more customer focused, competitive and sustainable farming • more competitive and sustainable food industry • further CAP reform • animal health and the welfare of kept animals improved, and society, the economy and the environment protected from the impact of animal diseases, through sharing the management of risk with industry
Source (Defra 2004).

The Quality of Life Counts incorporates 163 indicators consisting of 15 Headline indicators, a further 132 core indicators grouped into 18 families, plus an additional 16 indicators providing further analysis of the relationship between economic, social and environmental issues. Table 6 lists the families grouped into 6 themes.

Table 6: Headline indicators for UK Sustainable Development
Maintaining high and stable levels of economic growth and employment
H1 Total output of the economy (GDP and GDP per head)
H2 Total and social investment as a percentage of GDP
H3 Proportion of people of working age who are in work
Social progress which recognises the needs of everyone
H4 Indicators of success in tackling poverty and social exclusion
H5 Qualifications at age 19
H6 Expected years of healthy life
H7 Homes judged unfit to live in
H8 Level of crime
Effective protection of the environment
H9 Emissions of greenhouse gases
H10 Days when air pollution is moderate or higher
H11 Road traffic
H12 Rivers of good or fair quality
H13 Populations of wild birds
H14 New homes built on previously developed land
Prudent use of natural resources
H15 Waste arisings and management
Source: (Defra 2004).

The Environment Agency has developed its own set of 70 indicators, which extends the coverage of environmental indicators included in the Quality of Life Counts (EA).[7] The topics covered by these indicators are shown in Table 7.

Table 7: Environment Agency Indicators
Headline: Rivers of good or fair quality, bathing water quality, pollution incidents and more
Air: Ozone depletion, greenhouse gases, air pollution and more
Business and industry: Freight transport, nuclear industry discharges, discharges to the sea and more
Climate: Temperature, rainfall, sea level change, floods and more
Land: Land use, derelict land, woodland, pesticide use, soils, landscape features and more
People and lifestyles: Beach litter, population density, transport, water use and more
Pollution: Pollution incidents, sewage treatment works discharges and more
Resources and waste: Energy consumption, water demand, recycling, radioactive waste stocks and more
Water: River quality, bathing water quality, nutrients in rivers and more
Wildlife: Wild birds, otters, fish, plant diversity and more
Source: http://www.environment-agency.gov.uk/yourenv/432430/?version=1&lang=_e.

In addition, the Countryside Agency presents its own State of the Countryside indicators covering rural demography and 20 other themes, including the recently developed countryside quality count (CA 2004b; Haines-Young, Martin et al. 2004).[8] These themes are shown in Table 8.

[7] See the website at http://www.environment-agency.gov.uk/yourenv/432430/?version=1&lang=_e.
[8] See also the websites at http://www.countryside.gov.uk/EvidenceAndAnalysis/dataHub/index.asp and http://www.countryside-quality-counts.org.uk/index.htm.

Table 8: Countryside Agency Indicators
People and communities
Rural demographic profile
Public concern for the countryside
Community vibrancy
Health and special needs
Rural crime
Services and lifestyle
Geographical availability of services
Access to affordable housing
Education and training
Rural childcare
Rural mobility
Traffic effects
Environment and recreation
Changes in countryside character and countryside quality
Natural resources
Biodiversity
Sustainable land management
How people use the countryside
Economy and enterprise
Business health
Market towns prosperity
Employment characteristics
Income levels and distribution
ICT in rural areas
Source: (CA 2004)

Based upon these sources, Table 9 presents a general overview of the key Driving Forces, Responses, and Impacts of potential interest for the SURPLUS project. Because of the varying nature of the stakeholders consulted, policies and actions under the control of one stakeholder are often not under the control of others. What is a Response for one actor can be a Driving force for another. Thus, it was not possible to draw a clear line between Driving forces and Reponses. The breadth of these, as discussed further below, highlights the challenge such a project will face. In addition, these have been separated by spatial scale.[9] For reasons to be discussed below in the section on Geographic Scales, it has not been possible to link the scale of Driving forces, Responses, and Impacts to the scale of specific decisionmakers.

[9] Drivers, Responses, and particularly Impacts may be significant at multiple scales, so it is not surprising that some of these appear at multiple places in Table 9.

Table 9: Summary of Key Concerns by Spatial Scale		
Spatial Scale	**Responses and Driving forces**	**Pressures and Impacts**
UK and Above	• WTO Negotiations • Reform of Common Agricultural Policy • Water Framework Directive • Climate Change mitigation policies	• GHG Emissions • Climate Changes – temperature, precipitation, sea level rise • Species Invasions and Disease Propagation Total Economic Activity • Employment • Trade
National (England, Scotland, Wales, N. Ireland)	• Land Reform Act of Scotland • Scottish Biodiversity Strategy • England Biodiversity Strategy	• GHG Emissions • Climate Changes – temperature, precipitation, sea level rise • Economic Activity • Investment • Employment
Regional	• UK Regional Policy • Tourism • Transport Infrastructure and Policies	• Water Quantity • Flooding Risk • Land Use • Land Cover • Number of Farmland Birds/Populations of Wild Birds/ Other species (BAP priority species) • SSSI Condition • Air Quality • Water Quality • Waste Production and Recycling • GHG Emissions • Economic Output • Investment • Employment • Poverty and Social Exclusion • Education • Health • Housing • Crime • Road Traffic
Local	• Housing Policy and Demand • Outmigration from cities to rural areas • “Green” pressures from local communities • Infrastructure developments	• Local Pollution – diffuse pollution, waste loadings and recycling (including radioactive waste stocks) • Water Quality (rivers, lakes, coastal waters, bathing waters) • Air Quality • Soil – physical properties, organic matter, acidification, erosion, biodiversity • Net Change in natural/semi-natural habitats • Numbers of selected characteristic species • Traffic volume • Local Population – including age distribution

		• Health and special needs, including mortality by cause • Employment – total and by sector • Social Inclusion • Community vibrancy • Community well-being • Social participation • Rural Crime and Fear thereof • Availability of services – ICT, education, childcare • Income level and distribution • Education and Qualifications of Population • Homelessness • Business Health
Non-Spatial	• Technological Developments, particularly in agriculture and communications • Trends in bioenergy and other non-food uses of crops • Diversification of food, leisure, and resource markets • Social Attitudes to the Countryside • Public Attitudes to Biodiversity • Trends in resource use and lifestyles, e.g. energy, water, water use, waste production	• NA

Driving Forces and Responses

A wide range of social, economic, environmental and policy drivers of change were identified. These can be grouped around a number of main themes, including policy initiatives, globalisation and liberalisation, changing political and institutional structures, the changing rural economy, demographic changes, changes in social attitudes, and environmental shifts.

The interviewees and workshop participants tended not to be particularly specific about policy initiatives beyond a few cases; nor were most of the policy documents reviewed. A few of those cited include the Common Agricultural Policy and Water Framework Directive of the European Union, Environment Agency regulations and UK targets for farmland bird populations, and the Scottish Land Reform Act and Biodiversity Strategy. More general policies related to climate change and biodiversity were also mentioned. In terms of globalisation and liberalisation, the key issues identified were trade and technological advances, particularly in agricultural products. Among the demographic changes noted were the ageing of the population, particularly the farm population, and housing demands as a result of out-migration from urban areas to the countryside. Key social trends identified were the diversification of food, leisure, and recreation markets, a widening gap between rich and poor, and an increased desire for 'greener' countrysides. Finally, climate change was the most commonly mentioned environmental change.

Impacts

A large number of environmental Impacts were identified. These include acidification, climate change[10], flood risk, water quantity and quality, soil quality and erosion, resource use, biodiversity loss, landscape and visual amenity, and noise. There was generally less clear indication with regard to social and economic Impacts. Those mentioned included changing employment opportunities, the loss of traditional agricultural skills, and broader impacts on the social cohesiveness of rural communities.

Temporal Scale

The initial objectives for the SURPLUS project specify a 5-20 year time scale. This was agreed to in general, although a number of persons felt that 5 years might be too short to allow for Impacts to be clear. At the other end, it was felt that looking as far out as even 20 years might be 'brave' or 'speculative' and that it might be difficult to find persons interested in such a time horizon. At the same time, it is clear that key issues such as climate change have impacts that go well beyond this period and may deserve some consideration.

Geographic Scale

There was little or no consensus on the most appropriate spatial scale for a project such as SURPLUS. This is not surprising as it should be expected that the answer to this question will depend very much upon the scale at which stakeholders operate and upon the specific policy questions and impacts with which they are concerned. Furthermore, 3 of the 13 persons interviewed made no specific comment on the appropriate geographic scale (see Table 3) and the issue of geographic scale did not come through clearly during the workshop.

Where geographic scale was discussed, there was not a clear connection between the scale of Impacts and that of Driving forces and Responses considered relevant. More significantly, the scale of interest cannot be clearly linked to the scale at which the stakeholder operates. Policymakers were somewhat more concerned with policies they could influence, i.e. national policymakers with national policies. At the same time there was a widespread recognition of the increasing importance of policymaking at other levels, both above and below their scale of influence. In addition, interviewees at all scales noted that many of the drivers of change come from the European or even global level. In terms of the scale of Impacts, it is important to distinguish between extent and resolution. The spatial extent of stakeholders' interests ranges from a single field to the UK as a whole, with some persons even expressing concern about international impacts. Even where the geographic extent of interest is the nation, though, the spatial resolution required can be a square kilometre or less.

Table 9 identifies how the key concerns that might be addressed in a future SURPLUS project differ across geographic scales. It is likely that some aspects of these can be linked to the scale at which specific decision-makers operate. Any conclusion linking the scale of Driving forces, Responses, and Impacts of interest to specific decision-makers cannot be justified based on the existing data, however. In addition, given the increasing understanding of the multi-scalar nature of environmental change, and the implications of this for environmental policy, such a conclusion would be misleading and undesirable.

[10] Climatic changes were identified as both drivers and impacts.

3.3 Stakeholder Needs and Desires – Form

In addition to the content of any eventual SURPLUS project, it is important to consider the form that this might take. This includes both the nature of the tools and approaches, as well as the form in which outputs are delivered to the user. A summary of the responses from the interviews is provided in Table 10. Additional information was gathered during the workshop and from the literature reviewed.

Table 10: Stakeholder Interests in SURPLUS – Output Delivery

Organisation	Nature of Outputs	Nature of Use
Countryside Agency	• difficulty in generalising the kinds of outputs/indicators they would use. • Landscape – Visual information accompanied by informed statements are preferred.	•
Environment Agency	• Most useful would be a set of future possibilities identifying the nature of the key drivers: largely qualitative scenarios grounded in a range of stakeholders, not just Agency people.	•
Defra	• Would like indicators for impacts on: energy; water demand; flood management/risk; biodiversity and aggregates. • Requires more quantitative outputs to make a difference to policy. • With regard to uncertainty provide different scenarios. • With regard to transparency outputs should be properly evidence based. • Outputs to be clearly linked to policy objectives, SD indicators and PSA targets.	• identified a tension between being able to use tools in-house and commissioning outside body. • Bear in mind increasing requirements for public access to environmental information. • With regards to the use of the SURPLUS tool outside experts would be commissioned. • It is felt that Defra is weak in looking forward in regards to using models and tools. With reform of CAP an emergence of more sustainability oriented policy policymakers now have to operate under greater uncertainty of the future.
University Researchers	• Feels that quantitative models will be too data hungry and would be suited to smaller scale work. Also, believes that tools should be as transparent as possible and should express the outputs as ranges so as to recognise uncertainty. • For short term analyses quantitative models are good. • Uncertainty of scenarios should be as transparent as possible. Ranges of numbers would be more effective than single numbers.	• For the long term public available scenarios, formulated by a broad range of experts, would be useful
ADAS	• quantitative approach would be data hungry and would run into validation problems with historical data. • we should focus on qualitative	•

	and semi quantitative approaches.	
SEERAD	• Would like a consistent, reasonably robust modelling framework.	•

The consultations revealed a substantial level of interest in the SURPLUS project and recognition of the need for improved methods. At the same time almost all consultees felt that the objectives for the SURPLUS project were very ambitious. Indeed, several persons doubted that they were doable given the 'current state of the art'. Some participants found it difficult to anticipate the variety of tools needed for appraising the drivers and impacts of land use change. There was broad agreement, though, that no single method or model of appraisal would be appropriate, and that seeking to develop or identify a toolbox of approaches was a better way to proceed. It was noted that a key challenge would therefore be how to link different types of models and tools in a robust manner.

Whilst it is not possible, on the basis of the consultations carried out, to map the detailed requirements of different groups of potential users, the consultation process did suggest some of the elements that would be useful in a SURPLUS toolbox. Most of these centred around the need for improved methods of sustainability appraisal with respect to changes in the rural economy and land use, capable of dealing with a much wider range of drivers and impacts than 'traditional' models of land-use. A few of those mentioned include:

- Screening and rapid appraisal tools of the sustainability of policies, programmes and projects;
- Integrated appraisal tools, incorporating environmental, economic and social impact assessment;
- Spatially disaggregated models of land use and land cover change, capable of incorporating a broad range of socio-economic drivers;
- Policy simulation tools to help policymakers, stakeholders and the public explore the land use and sustainability implications of a broad range of different policies, or the policy changes necessary to achieve improvement in relevant indicators or policy targets;
- Simulation games, e.g. a 'SimCountryside', in which users could engage more directly in developing visions of the future and exploring the steps required to achieve these;
- Participatory approaches for developing 'bottom-up' local and regional land use change scenarios; and
- Fairly simple checklist and decision-tree type tools.

Although more of a specific output than a tool, it was also suggested that it may be useful develop a common set of national and regional land use scenarios that could be used to inform the work of a number of government departments and agencies. This could possibly be done by extending existing scenario work, a topic to which we will return in Section 4.2.7 of this report.

In a related vein, it was noted there is a vast amount of available and relevant data as well as existing tools and techniques, but there is a lack of organised communication between groups of decision makers and makers of decision support tools. Also many data and tools tend to be lost in government reorganisations. Thus, a system for enhancing the availability of and access to data and expert knowledge

could be a valuable development. The Foot and Mouth crisis was mentioned as an example of an unanticipated event to which a speedy response was possible due to the availability of many different datasets. It was not clear that a project-based approach, which SURPLUS is meant to be, would be the most appropriate way to take such a system forward, though.

In discussing the desirable components in any SURPLUS toolbox, a few recurring themes were highlighted. These included the balance between quantitative and qualitative approaches, dealing with uncertainty, the need for transparency, and the difficulty of validating tools used for ex ante policy appraisal.

There is an unavoidable tension between policymakers' needs for quantitative outputs and the research community's ability to deliver robust numbers. A number of consultees expressed scepticism concerning the ability of quantitative modelling approaches to deliver robust, spatially disaggregated, policy relevant outcomes. Thus, it was suggested that greater attention should be paid to exploring the potential of qualitative and combined quantitative-qualitative approaches.

There was widespread recognition that changes in 'external' conditions meant that it could be impossible to test and validate tools and models. Related to this, the difficulties in representing uncertainty in a way that engaged policymakers were highlighted as a key concern. Several interviewees mentioned the need for both quantitative and qualitative tools to be transparent, i.e. understandable, if policymakers were to have confidence in and to use their results. At least one interviewee raised a concern about the trade-off between transparency and simplicity. Transparent models have to be quite simple, and simple models do not necessarily capture the complexity of reality. It was also pointed out that many complex quantitative models that do not satisfy this criterion are routinely used in different areas of environmental and economic policymaking, however. Finally, while ex-ante evaluation is important for evidence based policy, it was pointed out that we should not ignore tools designed for interim and ex-post evaluations.

3.4 Summary: Stakeholder Views and Implications for SURPLUS

In terms of meeting the needs and desires of eventual stakeholders in the SURPLUS project, both users and developers, it is clear that no single tool or approach will be adequate. A more appropriate goal will be to develop a toolbox. Among the challenges that such a toolbox will have to meet include the following:

- Improving our ability to integrate economic, environmental and social models and data across spatial and geographical scales;
- Developing robust approaches to modelling the behaviour of farmers and land owners under novel socio-economic conditions;
- Developing spatially disaggregated models of land use and land cover change with a high enough level of resolution to allow the investigation of local environmental and biodiversity impacts;
- Reconciling policymakers' need for quantitative indicators with the research community's ability to deliver robust numbers;
- Developing more transparent and effective approaches to handling and communicating uncertainty;
- Improving our conceptualisation, modelling and appraisal of social impacts; and

- Testing and validating appraisal tools and techniques, given that changes in 'external' conditions are likely to mean that it is not be possible rely upon historic data for this purpose.

Meeting these challenges is obviously a daunting task. Several consultees, however, did draw attention to the role of IT in reducing the cost and complexity of data collection and processing; the increasing sophistication of modelling approaches; and, advances in the use of GIS for handling and representing large amounts of spatial data. In the next sections of this report, we will take a look at some of these more closely, with an eye toward identifying those that appear most promising in meeting the objectives of the SURPLUS project.

Finally, this section started by stating it was hoped that the Consultation phase of the Scoping Study would provide answers to the following questions:

1. What should be the policy, temporal, and geographic scopes of the project?
2. Should Defra's initial objectives for the project be refined and, if so, how?

While the Consultation phase was able to clarify somewhat the policy, temporal, and geographic scopes of Driving forces, Responses, and Impacts that the SURPLUS project might attempt to address, it was not possible to narrow these down. Given the wide range of interests and responsibilities represented by the stakeholders, however, this should not be surprising. It does point, though, to the need for greater clarity about the specific objectives of any future SURPLUS project, particularly with respect to the stakeholders and issues of most interest to the funders of such a project. This will require a more detailed and targeted consultation process than was undertaken in this scoping study, beginning with the potential funders themselves.

4. Evaluation of Available Tools & Techniques

4.1 "Terms of Reference" for the Components of a SURPLUS Framework

As explained in Section 1 of this report, a key objective of the Scoping Study was to "*assess the feasibility of using various modelling and other foresight approaches to achieve the objectives of the overall project*". In carrying out this assessment, the term "approaches" was interpreted broadly to include computer models, other quantitative techniques, participatory processes, etc. This reflects both the mandate of the Scoping Study as well as the recent literature related to policy appraisal (Owens, Rayner et al. 2004). From this point on, we will use the generic term 'tools & techniques' as was adopted during the study.

The scope of the potential tools & techniques for a future SURPLUS project is quite broad. Thus, it was necessary to make a choice between breadth and depth in our evaluation. Given the range of interest found in the Consultation phase, as well as by the principal funder, the choice was made for the former. This allowed for the coverage of a wide range of tools & techniques. The tradeoff was that it was not possible to provide a full and comprehensive evaluation of all possible categories of tools & techniques, much less specific ones within these categories.

4.1.1 Categories of Tools & Techniques to be Evaluated

Table 11 presents a classification of tools & techniques for consideration in any future SURPLUS project.

Table 11: Classification of Tools & Techniques for Consideration for a SURPLUS Project
• Sectoral economic models* • General equilibrium economic models* • Regional economic models • General land use change models* • Agent-based social simulation models in the context of land use* • Economic agricultural land use and environmental impact models* • Non-economic based environmental impact models* • Social impact models • Exploratory scenarios and backcasting* • Policy simulation tools and games* • Checklists* • 'Soft' tools
* Classes dealt with in more depth in this report

This closely matches a general classification of socio-economic tools for sustainability impact assessment as recently laid out by the European Commission (Tamborra 2002), which is shown in Table 12.

Table 12: EC Classification of Socio-economic Tools for Sustainability Impact Assessment
• Quantitative Tools and Analytical Methods • Computable General Equilibrium models • Sectoral models • Macro-econometric models • System theory and system models • Impact Pathway Analysis • Participatory Approaches and Process Methods • Dialogue methods • Policy exercises • Mutual learning methods • Delphi method • Decision Methodologies • Cost-effectiveness analysis • Cost-benefit analysis • Multi-criteria analysis • Risk analysis
Source: (Tamborra 2002)

Given the nature of the SURPLUS project, there has been somewhat more emphasis on tools that consider physical impacts and explicitly deal with land use. The list considered here also does not include tools that fall under the classification of Decision Methodologies in the EC list. It was pointed out in Section 2.2 that the determination of the meanings of impacts could be included in the 'processing' part of a SURPLUS toolbox, but there might also be reasons for keeping this as a job for the user. Decision Methodologies are tools & techniques that focus very much on this aspect, thus making their inclusion somewhat questionable. Furthermore, these types of tools & techniques have received extensive attention elsewhere and were not highlighted in the Consultation phase of this Scoping Study.

There is a large amount of supporting material, specifically data and indicator sets, that is directly or conceptually associated with many of the tools & techniques included in Table 11. These will not be reviewed in depth here, but their importance in a SURPLUS toolkit has already been noted in sections 2 and 3 of this report. Data sets can provide basic information on any number of factors. For the purposes of a SURPLUS toolkit, the most significant ones are those on land use, land cover, and environmental pollution, at various scales. These include the CORINE Land Cover 2000 dataset, the Countryside Survey 2000 and the Countryside Information System (Haines-Young, Barr et al. 2000; EEA 2004).[11] Williamson (2003) provides a review of other data useful for considering the environmental effects of agricultural land use. Indicator sets combine information from a number of sources, including data sets, and generally have a more normative element in that they are often used to measure progress in achieving goals. The most comprehensive indicators try to capture economic, environmental, and social elements. Several of these were discussed in Section 3.2 and include the Quality of Life Counts, the State of the Countryside Indicators and the Environment Agency's environmental indicators (EA; CA 2004b; Defra 2004b).

[11] See also the websites at http://terrestrial.eionet.eu.int/CLC2000, http://www.cs2000.org.uk/ and http://www.cis-web.org.uk/home/.

Those categories denoted with '*' in Table 11 are treated in more detail in section 4.2. The choice was made based upon specific comments and recommendations received during the Consultation phase, availability of information, and the judgment of the researchers considering the potential applicability and acceptability by end users of particular tools & techniques. This indicates a bias towards Quantitative Tools and Analytical Methods, i.e. those tools that can provide quantitative estimates, particularly computer-based tools used to synthesise and calculate from statistical or parametric data. Consideration is also given, however, to Participatory Approaches and Process Methods, particularly in the form of policy simulation tools and games. Checklists, a number of which we will discuss in detail, fall somewhere between these categories.

4.1.2 Evaluation Criteria

In evaluating models and other tools, a large number of criteria can be envisaged, with the significance of each varying from model to model, and from appraiser to appraiser. For our purposes, these obviously need to follow on from the objectives of the SURPLUS project and the framework laid out in Section 4. In addition, Briassoulis (2000) provided guidance in an earlier review of land-use models.

Based on this, the following list of evaluation criteria was developed:

Scope

- Space: What is the extent of the spatial area covered – local, regional, national, a specific place, and at what resolution, e.g. sub-areas, 1-km squares, grid points? Does the tool or technique provide spatially explicit output, e.g. maps? What types of land use are considered as principal objects of analysis?
- Time: Is it a static (single-period), iterative/recursive or fully dynamic tool? Is it most appropriate for exploring short-term, mid-term, or long-term developments?
- Sectors: What economic sector(s), e.g. agriculture, manufacturing, services, is/are covered? What natural 'sectors(s)', e.g. forests, rivers, oceans? What social 'sector(s)', e.g. government, economy, civic society?

Content

- Science: What 'scientific' topics are directly addressed, e.g. biodiversity, land use, economic activity, employment, water pollution? What types of land use change processes are considered?
- Policy: What (and whose) 'policy/ies' and policy 'issues' are addressed, e.g. UK/English regulation, CAP reform, EU Directive(s), GATT/WTO, agreements? Was the tool or technique designed and used, to address the effects of a specific policy?
- Paradigm: What is the underpinning paradigm upon which the tool or technique is based, e.g. biological and/or economic equilibrium, stock/flow modelling? What are key underlying assumptions?

Use

- Data: What does the tool or technique require in terms of data – how much, how specific, at what spatial, temporal, and sectoral detail?

- Availability: Is the tool or technique (and/or its data, if separate) publicly available? If not, how would one go about making use of it, e.g. request, cost, re-programming?
- Accessibility and Compatibility: Who is meant to be the user, e.g. a technical expert, researcher, policy analyst, general public? How transparent are changes in outputs to changes in input assumptions? How transparent are uncertainties in outputs? Can it be used in combination with other tools?
- Resources: What are the resource requirements for its future use in terms of time, people (e.g. skills), and money? What are the possibilities/requirements for updating, extension, development?

While it would have been desirable to critically assess each tool and technique on this full set of criteria, this was not possible. Although specific tools and techniques were chosen, in part, based upon availability of information, this did not guarantee that complete information was available. In addition, for certain categories of tools and techniques, e.g. scenarios and backcasting and checklists, it made more sense to explore the category as a whole than to focus too closely on any single application. Finally, given the broad range of potential applications for a project such as SURPLUS, with its current objectives, measures of suitability beyond those that were used to choose the tools and techniques for evaluation, in particular relevance to one or more of the issues of potential interest, could not be established. Thus, what follows is more a description than critical evaluation of particular tools and techniques.

4.2 Component Evaluation

This section presents the results of our evaluation organised by the categories presented in Section 4.1. A number of these are summarized in Table 13 and further details can be found in the Annex I to this report.

4.2.1 Sectoral economic models

Economic models of particular sectors, especially agriculture, are a widely used tool for the simulation of appropriate policy – largely economic as opposed to environmental or social. Such models consider only a limited component of the total economy, e.g. farm products, or even a single product. This allows attention to be paid to commodity- or policy-specific details, such as farmer practices and aspects of the Common Agricultural Policy (CAP). Specific parameters can be used to simulate the effects of technological or climatic change, shifts due to external influences, etc.

Partial or market equilibrium models are the main type of sector models used for policy analysis. Such models focus on problems concerning markets in a selected sector and allow a detailed and differentiated description of one sector, e.g. the agricultural sector. Depending on the problem setting the most relevant markets (or in simple models only a single market) are covered. Hence, consequences of shocks and policy changes for various markets can be examined in some detail, with a relatively limited requirement for data (Francois and Reinert 1998).

Partial equilibrium models explicitly consider the economic balance of quantities and prices (and hence sales receipts and purchase expenditures) in production, consumption, trade, and perhaps stocks. Use of economic theory (and its assumptions) usually allows income or economic-welfare effects to be estimated up to a point (e.g. income from farming, though not usually total farm household income). The term ‘equilibrium’ implies the simplifying assumption that markets (whether in

products, services, labour, land and/or capital) always clear (i.e. balance). Phenomena such as temporary shortages, stockpiling, and other seasonal, cyclical or 'shock' unusual behaviour, are seldom considered, except as 'shocks' to be simulated. Achieving a new market balance requires producers and consumers to react to changed conditions signalled to them via market prices (and/or sometimes quotas etc.). Such reactions or responses can naturally be fast or slow, giving rise to different 'long-run' and 'short-run' outcomes respectively.

Analysis with partial equilibrium models is usually of the 'comparative static' type, i.e. the model is run (calculations are carried out) twice, once 'without' and once 'with' the 'new' policy to be considered (this may of course involve removal or alteration of an existing policy), and the differences taken as the "effect" or "impact" of the policy (change). Alternatively, an exogenous non-policy shock, e.g. a fall in yield, can be administered, and its effects considered, possibly within more than one policy scenario.

The 'static' nature of such analyses usually relates the work to a particular 'base period' (normally a year), and a compromise must usually be decided between the use of 'known' but historical data (often at least two years old for economic data, more for others) and the estimation of a data base for the 'current' or a future time period in which the policy decision-maker may well be more interested. Even a historical database is subject to controversy over whether it is sufficiently typical in all relevant respects, and, if not, what allowance should be made for any unusual features in interpreting the results. Projection to the present or into the future obviously raises still further issues, not only over trends to be assumed or estimated, but how far into the future is of interest. A sequence of recursive, quasi-dynamic, model runs (comparisons) from the past into the future may make behaviour clearer, but obviously complicates and extends the analysis and its presentation.

Multi-market, multi-region partial equilibrium models allow the inclusion of interactions across substitute and complementary markets, e.g. between (or within) the beef and pork markets. They also help to cover sector-wide effects, e.g. on incomes from farming. The multi-market, multi-region approach provides not only the opportunity to assess trade effects between different regions but it can also examine inter-regional spill-over effects of exogenous shocks and policy changes. Such a multi-market, multi-region partial equilibrium model can vary between a small and simple model and a large and complex model. The scope of the model is usually determined by the nature of the analytical problem at hand, the availability of data, the deadline for completion of the analysis, and the costs of construction (Schwarz and Gelan 2003).

There are a number of different applications that have been developed over the last 20 years. For example, econometric sector models have been built from scratch, but more recently international frameworks of data and model equations have been exploited. A few of the main examples are described in Annex I, specifically the Static World Policy Simulation (SWOPSIM) framework (Roningen, Sullivan et al. 1991), the Common Agricultural Policy Regional Impact Analysis (CAPRI) system, the Food and Agricultural Policy Research Institute (FAPRI) framework (Devadoss, Westhoff et al. 1989), the European Simulation Model (ESIM) (Münch and Banse 1999) and the Aglink model (OECD 1999).

Table 13: Characteristics of Selected Tools and Techniques

General		Scope		Content		Usability of Tools and Approaches	
Name	**Type**	**Spatial**	**Sectoral**	**Responses and Drivers**	**Pressures and Impacts**	**Data Requirements**	**Other Resource Requirements**
IMPEL: Integrated Model to Predict European Land Use	• Spatially explicit economic and land use model	• UK • National • Regional	• Agriculture	• Climate changes	• Land Use • Agricultural production	• geo-referenced databases of relevant environmental information • scenarios of climate and socio-economic changes	• specialist knowledge to run model
ACCELERATES: Assessing Climatic Change Effects on Land Use and Ecosystems	• Integrated Modelling Framework built from: crop model,farm based, decision model, species' distribution model, species' dispersal model. Integrated within a Geographical Information System (GIS)	• UK • National	• Agriculture • Biodiversity	• Habitats Directive	• Agricultural Land Use	• geo-referenced databases of relevant environmental information • scenarios of climate and socio-economic changes	• specialist knowledge to run model

CLUE: Conversion of Land Use Change and its Effects	• Integrated environmental modelling and GIS.	• UK • National • Regional	• Agriculture • Other Land Use Sectors	• Any policies affecting land use	• Land use	• geo-referenced databases of relevant environmental information • scenarios of climate and socio-economic changes	• specialist knowledge to run model
AgLink	• Sectoral Economic Model	• UK	•	• CAP Reforms • WTO negotiations	• agricultural production, supply, demand, prices	• Sectoral data; depending on level of disaggregation; commodity based; base year and time series data	• specialist knowledge to run model
MIRABEL: Models for Integrated Review and Assessment of Biodiversity in European Landscapes	•	• UK • National • Regional	• Biodiversity	•	• general indicators of pressures on biodiversity	•	• specialist knowledge to run model
LUAM: Land Use Allocation Model	•	• National • Regional	• Agricultural	• CAP Reforms	• Land Use • Agricultural production, e.g. livestock numbers • Agriculture related pollutants, e.g. nitrates, methane, carbon	•	• specialist knowledge to run model

MAGPIE: Modelling AGricultural Pollution and Interactions with the Environment	• spatially explicit environmental model	• Regional • Local	• Agriculture	•	• Diffuse pollution, esp. nitrates	• environmental and agricultural factors, including climate, soil attributes, land use data and satellite-derived land cover data	• specialist knowledge to run model
Cardiff methodology	• Checklist	• Flexible	• Flexible	• Flexible	• range of economic, social, and environmental impacts defined by application	• specifications of policies and local/regional conditions	• access to experts • other tools for specific evaluations

4.2.2 General equilibrium economic models

Going a stage beyond the above sectoral models, computable or applied general equilibrium (CGE or AGE) models cover the whole of the economy, though often with large parts (e.g. services) aggregated as one sector. However, their comprehensiveness assures balance at regional, national and/or global levels, and this can cover physical resources such as land as well as markets. These attributes, together with more powerful software, and the success of the Global Trade Analysis Project (GTAP) project (Hertel 1997)[12] have made this approach attractive to economists, and the EURURALIS project (see Section 4.2.10 below) has also used it. However, recent reviews of agricultural policy modelling in and for the UK and Europe have identified only a limited number of exercises using these tools (Salvatici, Anania et al. 2000).[13] These include MEGABARE (ABARE, 1996), FARM (Darwin et al., 1995), RUNS (Burniaux and van de Mensbrugghe, 1990), and MICHIGAN (Brown et al., 1996).

4.2.3 General land use change models

There have been a number of recent reviews evaluating current land use change modelling practice and research priorities (Briassoulis 2000; Agarwal, Green et al. 2002; Verburg, Schota et al. forthcoming). There have also been several special issues looking at various aspects of land-use and land cover modelling (Veldkamp and Lambin 2001; Nagendra, Munroeb et al. 2004; Verburg and Veldkamp 2004). These tools & techniques are generally integrated models, which consider interactions between environment, economy and society in a spatially explicit and multi-scale modelling framework. Three modelling frameworks that satisfy this criterion: the CLUE, IMPEL and ACCELERATES. These are described in more detail in the Annex I.

4.2.4 Agent-based social simulation in the context of land use change

These include both individual models of land use change, and modelling systems or frameworks intended to support the development of such models, although the distinction is a matter of degree: any non-trivial model can be given a range of parameters, and any framework has limitations. Nevertheless, one can distinguish models closely linked to specific cases (often constructed as part of a larger project), and those intended to be broadly applicable. All the tools are "spatially explicit", meaning that spatial locations and relationships are directly represented. A number of these are described in more detail in Annex I. This is not a comprehensive review: priority is given to models and modelling systems most relevant to agriculture in temperate industrialised regions. A recent and more detailed review is available (Parker, Manson et al. 2003), but it includes coverage of tools not relevant here, and does not include some that are relevant.

For the most part, agent-based models in areas as complex as land use change are not aimed at producing specific predictions of future events, but at broadening, deepening and revising understanding of how these systems work, and drawing attention to those assumptions on which forecasts of future events are most dependent. There is an increasing recognition that agent-based modelling, if it is to be useful in policy contexts,

[12] See also the GTAP website at http://www.gtap.agecon.purdue.edu.
[13] See also the website of the GTAP-EU Concerted Action at http://www.lei.dlo.nl/FPA_projects/gtap/.

may need to be integrated with other forms of modelling, with scenario development approaches, and/or with participatory methods; examples of all these possibilities are included here. The structure of this section is organised as: agent-based models themselves; modelling frameworks available for constructing specific models; and attempts to link agent-based modelling and geographical information systems (GISs). Most agent-based models start from the assumption by neoclassical economics of profit (or rent) maximisation or cost minimisation, but some go beyond this behavioural norm.

4.2.5 Economic agricultural land use and environmental impact models

These include models and model systems constructed with the primary purpose of examining the impact of changes in agriculture (usually policy changes or policy-driven changes), either on agricultural characteristics (incomes, farmland use, etc.) or on related land uses, e.g. water flows. Models (usually economic, but there may well be biological and agronomic ones too) with no or very little spatial dimension (e.g. operated only at national level and with little or no sub-national land use detail) have been ignored, as unlikely to have much interest from a SURPLUS point of view. The ones selected for description in Annex I, *NELUP: NERC-ESRC Land Use Programme and LUAM: Land Use Allocation Model*, are based on a mathematical programming (optimising) basis.

4.2.6 Environmental impact models

There has been substantial amount of research effort directed at modelling the environmental impacts of agriculture and land use more generally. Williamson (2003), for example, identifies a diverse range of environmental issues related to agriculture and other land uses, noting that simple, but robust models are available for most, but not all of these. He goes on to illustrate the types of models most likely to be useful, but does not specifically present a list of models. He does note, though, that the data requirements for these models tend to be substantial, including information on soils, hydrology, climate, weather, and land use within catchments of various scales.

Given the breadth of environmental issues, it is not possible to review more than a very limited set of models and projects. From the perspective of pressures on the environment, we have chosen to look at are diffuse pollution from agriculture; specifically UK-ADAPT - Agricultural Diffuse Aquatic Pollution Toolkit (Humphrey and Shepherd 2003) and MAGPIE - Modelling AGricultural Pollution and Interactions with the Environment (Lord and Anthony 2000). From the perspective of impacts, we have chosen biodiversity; specifically MIRABEL - Models for Integrated Review and Assessment of Biodiversity in European Landscapes,(Petit, Firbank et al. 2001), BIOPRESS[14], and Monarch – Modelling Natural Resource Responses to Climate Change also looks at biodiversity, but focuses more specifically on climate change (Harrison, Berry et al. 2001). Details are provided in Annex I.

4.2.7 Scenario Analysis

Scenario analysis has become a common and useful tool in future-oriented environmental studies and assessments, particularly where there is fundamental

[14] See the website at http://www.creaf.uab.es/biopress/.

uncertainty and prediction or forecasting is recognised as being impossible.[15] At their core, scenarios represent integrated, consistent and plausible histories of the future. They can be developed using a wide range of tools, including those discussed in this report. There are any number of references on scenario development, with good introductions provided by the Performance and Innovation Unit (2001) and the United Nations University's Millennium Project (Glenn and Gordon). Scenario exercises can differ along a number of different dimensions, e.g. exploratory vs. backcasting, quantitative vs. qualitative, expert vs. stakeholder driven (van Notten, Rotmans et al. 2003). There is also some inconsistency in how the word scenario is used, particularly in cases where quantitative models are used. Some use the term to represent simply the set of exogenous assumptions used in the model(s); i.e. the scenario is a subset of the modelling exercise. Others use it to refer to an entire assessment exercise, where the quantitative modelling is only one tool used to develop scenarios. There is no fundamental problem with these two uses of the term, but it is important to be clear when communicating with others.

In the UK, the two best know recent scenario efforts are probably the socio-economic scenarios developed as part of the UK Foresight Programme (DTI 2002) and the closely related UK Climate Impacts Programme's (UKCIP) climate change scenarios (Hulme, Jenkins et al. 2002), which trace their roots to the most recent emission scenarios of the Intergovernmental Panel on Climate Change (IPCC 2000). These scenarios have been used in various applications, including the Regional Integrated Assessment of Climate Change Impacts in the North West and East Anglia (REGIS) and Foresight Flood and Coastal Defence projects (Eames and Skea 2002; Evans, Ashley et al. 2004a; Evans, Ashley et al. 2004b).

As far as use of scenarios for rural issues, there was a symposium entitled Scenario Studies for the Rural Environment held in Wageningen, the Netherlands in 1994 (Schoute, Finke et al. 1995). In the UK, the Policy and Corporate Strategy Unit within the then Ministry of Agriculture, Fisheries and Food (MAFF) commissioned some scenario analysis to assist in strategic planning. Unfortunately, this work only resulted in an unpublished discussion paper (Defra 2001). A few years later, the Countryside Agency developed a set of four scenarios, presented in their State of Countryside 2020 report (CA 2003b). These have been picked up in a recent project as part of the Rural Economics and Land Use programme in order to scope social science research needs (IAF and IIR 2004). In parallel with this Scoping Study, Defra is supporting several scenario projects, including Rural Futures: Scenario Creation and Back-casting, which is developing both 20 and 50-year scenarios[16] and Agricultural Futures and Their Implications for the Environment (Morris 2004 and Iain Wright, personal communication). A separate business-as-usual scenario of agricultural outputs has been developed for the Environment Agency commissioned (CRER 2004) At the time of preparing this report, the Environment Agency was looking to support a project on Scenario-based Forecasts of Land-Use & Management Change, which will build upon this work (personal communication, Antony Williamson).

[15] Robinson (2003), however, is careful to point out that scenarios, particularly those that use quantitative models, do involve conditional projections.

[16] See the website at http://www.futurefoundation.net/ruralfutures/. Defra is also supporting a separate project, AFMEC-04 – Alternative Future Scenarios for Marine Ecosystems, which, for obvious reasons, is of less interest for this report.

4.2.8 Role-playing exercises and games

Role-playing exercises and games, often in the context of formal policy exercises (Toth 1988b; Toth 1988a), have a long tradition as decision aids. With these tools, participants are placed in a particular context and assigned particular roles. In single-player games, such as SimCity™, the user plays the role of a godlike city/regional planner; in multi-player games, such as STRATAGEM, "each player is assigned a role as minister for one of five government portfolios responsible for sustaining the growth of their country and for meeting the short-term needs of their people for food, goods, and energy."[17] Participants make specific decisions, e.g. about the use of economic or natural resources, and then a model, most often a computerised simulation, calculates the implications of these choices. This usually occurs in a sequential process, e.g. the implications are shown for the coming year or decade, at which time new decisions have to be made.

A key advantage to this class of tools is that they embed the users in the actual modelling and scenario development process. In this way they will, hopefully, gain a better understanding of the complex nature of many of the problems they wish to address in the real world. At the same time, in order to make the process understandable and to meet restrictions such as time and resources, the level of detail and realism in the underlying simulation models is generally less than in those developed for use by experts. Thus, there is a danger that the users will find the tools simplistic or not appropriate for real-world applications.

Perhaps the most widely known of the recent crop of such tools in the UK is FloodRanger. This was developed as part of the Office of Science and Technology's (OST) Foresight Flood and Coastal Defence (FCD) project. It is a computer-based educative tool that enables the user to explore the interaction of many issues relating to future flood defence – including climate change, planning, infrastructure provision and flood defences – for an imaginary part of the UK (Parke 2004).[18] Lonsdale (2004), van der Wal (2004), and Jonoski and Harvey (2004) describe similar tools that also look at issues related to flooding and coastal defence.

Tools have also been developed that are more closely related to agriculture and its potential environmental impacts. PlayAgriPolis is an enhancement of the AgriPoliS model, designed by Balmann and his colleagues, described in Section 4.2.4, which was originally constructed for analyzing structural change in the agricultural sector and estimating the effects of different policies. User interfaces were added to the model, allowing a user to play the role of minister of agriculture making PlayAgriPoliS suitable for introducing the complexity of dynamic systems (Kellermann, Balmann et al. 2002).[19] NitroGenius is a multi-player game designed to teach about integrated policy-making related to nitrogen in the Netherlands. It can also be used directly as a decision support system (van der Wal 2004)

[17] STRATAGEM is a fairly classic educational game developed by Dennis Meadows, one of the authors of Limits to Growth (Meadows, Meadows et al. 1972). It has been used for training and educational purposes throughout the world. More on STRATEGEM can be found at the website - http://www.unh.edu/ipssr/Lab/Stratagem.html.

[18] See also the website at www.discoverysoftware.co.uk/FloodRanger.htm.

[19] See also the website at http://www.iamo.de/PlayAgriPoliS/playagripolis_start.html.

4.2.9 Checklists

The final set of tools we consider here are often the first used in any policy appraisal. These generally consist of a relatively short list of questions that are to be 'checked' by policy makers when developing new or evaluating existing policies. These questions can be answered with a simple "Yes", "No" or "Not Applicable", but longer statements and/or quantitative and quantitative responses are possible and generally more useful (in deepening initial analysis) and informative. An important purpose of these tools is often to identify the need for and help to focus a longer and more thorough appraisal. A number of these tools exist and are regularly used in the UK.

The aim of the methodology is to aid the effective deliberation of policy by illustrating the trade-offs and synergies that affect policy outcomes. As such, the information presented serves as a 'telescope' into more detailed policy debates, reviews and evaluations. Thus, it provides a framework for the collection, collation and analysis of both primary and secondary data, as well as both quantitative and qualitative data on policy impacts and processes.

As part of the UK government's commitment to integrate sustainable development into policy making, the Regulatory Impact Unit of the Cabinet Office has produced sets of questions addressing potential economic, social and environmental impacts.[20,21] The environmental appraisal guidance, which consists of eight questions, is listed as being under review by Defra. Defra also provides a slightly different checklist of nine questions on environmental impacts at its website on policy appraisal and the environment.[22] The Environment Agency has spelled out guidance on appraisal for its policies[23] and the Scottish Environmental Protection Agency has experimented with a similar tool (pers. comm., Vanessa Kind).[24]

Rural Proofing, established in principle in the Rural White Paper (DETR 2000c) is a commitment by Government to ensure that all its domestic policies take account of rural circumstances and needs. There are twelve Government departments that are formally required to rural proof their policies. As part of this exercise, the Countryside Agency has developed a checklist to be used "as a screening tool, designed to help policy makers consider whether their policy is likely to have a different impact in rural areas. It is meant to be applied from the early stages of policy making, although it may also be used during implementation and evaluation." (CA 2002).[25] The fifteen questions in this checklist concern public and private services, communications, social impacts, and the effects on land-using industries and the environment. The Countryside Agency also undertakes an annual review of rural proofing at national and regional levels (CA 2004a).

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[20] See the website at http://www.cabinetoffice.gov.uk/regulation/economic/checklist/impacts.asp.

[21] A similar checklist, identified as Defra's modified integrated policy appraisal (IPA) template is described in Etheridge's pilot assessment of IPA (Etheridge 2003). The Welsh government has also developed its own integration tool - http://www.wales.gov.uk/subilocalgov/content/comstrat/160903/integration-tool-note-e.htm.

[22] http://www.defra.gov.uk/environment/economics/appraisal/.

[23] http://www.environment-agency.gov.uk/aboutus/512398/830672/831980/832188/?lang=_e. Please note that the actual policy appraisal checklist (Appendix 1) is currently not available at this website.

[24] An earlier, more targeted example is provided by the Green Ministers' Biodiversity Checklist (DETR 2000b).

[25] See also the Rural Proofing website at http://www.countryside.gov.uk/EssentialServices/ruralProofing/index.asp.

Somewhat similar to Rural Proofing in its focus on rural areas, but taking a more integrated approach, is the Sectoral Policy Appraisal Methodology (SPAM) or, as it is more commonly called, the 'Cardiff Methodology'. This procedure was initially applied to the evaluation of rural development policies in Scotland (Marsden and Bristow 2000; Bristow, Cowell et al. 2001). The methodology is a policy analysis framework for assessing progress towards the goals of rural development across different policies and sectors. It involves four broad and related tasks (Farrington, Shaw et al. 2003):

- Policy Description and Mapping: identification of the principal policy instruments to be studied, and a description of key features of their design and delivery. This includes the political scale at which they are designed and implemented, the institutions or agencies involved in this process, and the degree to which they provide blanket coverage of rural areas and people.
- Policy Impacts (1): Sustainable Development: identification of the negative and positive sustainability impacts of policy instruments, and their ability to deliver all three sustainability objectives simultaneously.
- Policy Impacts (2): Integrated Rural Development: comparison of policy performances according to the principles and processes considered to be important in achieving integrated and sustainable rural development (as upheld by the Cork Declaration).
- Policy Limits and Potentials: assessment of policies against a series of integrated and sustainable development 'tests', in order to highlight the key potentials and limitations of different policies for the progression of rural development objectives.

4.3 Overview

Stepping back from the evaluation of specific tools, the obvious questions at this point are: how well do these cover the framework set out in Section 2 (see Figure 4) and how well do they meet the needs of stakeholders as set out in Section 3?

The short answer to the first of these questions is that there is a wide range of tools available, touching on every element identified in the framework other than Responses (i.e. policy reactions and feedbacks are not often included, being left to analysts and decision-makers to determine). Sometimes, fundamental driving forces (e.g. changing technology or consumer/citizen preferences) are left rather undefined, with more attention paid to the resultant direct pressures and how these alter the state of the economy or environment. However, most tools at least enforce clarity as to alternative states, impacts and (if only by exclusion) policy responses, and thus the relationships between these different components, all of which should assist more careful, consistent, and sometimes more comprehensive policy appraisal. A few examples of potential applications are shown in Table 14.

Table 14: Example Applications Under a SURPLUS Project	
Issue	**Approach**
Biodiversity Change in the UK	• Use UK-wide land use change scenarios from EURURALIS or those to be developed as part of the Environment Agency was looking to support a project on Scenario-based Forecasts of Land-Use & Management Change. • Apply MIRABEL or similar modelling tool to assess specific impacts on biodiversity
Social Impacts of CAP Reform at a regional or local scale	• Use AgLink or similar tool to estimate sectoral level change in economic activity • Undertake analysis of social impacts using expert assessment following guidelines in Cardiff Methodology or Rural Proofing
Changes in Diffuse Pollution from Agriculture at regional scale	• Use AgLink or similar tool to estimate sectoral level change, particularly in agricultural activity, including management practices • Use CLUE or similar tool to translate changes in economic activity into changes in land use patterns • Apply MAGPIE or similar tool to estimated changes in diffuse pollution resulting from changes in land use and management

The range of driving forces, pressures and states/impacts covered by potential SURPLUS tools is quite wide, but appears too focussed on policy-driven economic parameters such as CAP policies (rather than long-term commodity market fundamentals) and the more "fashionable" environmental drivers and pressures such as climate change (rather than say countryside "quality"). However, a few modellers have attempted to incorporate a wide range of both inputs and outputs (see remarks on attempts at integration below). Some models (e.g. economic ones) offer a large number of outputs (impacts on market quantities, prices, incomes, etc.) rather than a wide range as such, and although many input datasets and parameters might be selected for use in policy simulation, only a few have been so utilised.

It is clear from the evidence in the literature, on websites and from personal communications that the development of many potential SURPLUS tools has involved a considerable amount of research and/or official resources, and some have resulted in a large and sometimes complex (e.g. in data or software terms) structure which may reduce routine use, including updating of data and/or policy settings. Standard results or examples are not always readily available, making it difficult for potential new users to judge the relevance of the tools, and authors seldom seem to have much effort to promote the applicability of their tool or its underlying methods to potential users beyond their sponsors (and sometimes not even there).

With a few exceptions, though, little work has been done on integrating tools in a generic fashion. Some projects have attempted to integrate various tools and approaches[26].The REGIS project was commissioned by Defra and UK Water Industry Research under the UK Climate Impacts Programme (see Annex II for more details on

[26] See also Bouman et al. (1999; 2000)

REGIS). The purpose of Phase 1 was to investigate the impacts of climate and socio-economic change, using computer modelling and stakeholder discussion. Phase 2 will focus on the development of a meta-model tool for regional integrated climate change management.

Elsewhere the INSIGHT project was undertaken by a consortium of groups in Australia (see Annex II for more details on INSIGHT). The concept was to develop a spatially explicit modelling system capable of exploring the implications of land use policy alternatives under plausible price and climate scenarios for the next 20 years. This involved the development of a simulation model of natural resource use in the Lachlan catchment in central New South Wales. It is unclear to what extent this project has been deemed a success, but a number of key lessons were learned to which we will return in the final Section 5 of this report.

But neither these nor the NELUP project represent the development of an all-purpose toolbox, such as is the aim of SURPLUS (see Annex I for more details on NELUP). The INSIGHT project set out to do something along these lines, but it was not able to fully accomplish what it set out to do. In the process, however, an important trade-off was recognized in the attempt to reach full integration in a single model – "the focus on interactions and system effects means that the model is not suited for detailed analysis of specific issues and policies" (van Ittersum and Gorddard 2001). This seems to be a general conclusion and reinforces the notion of putting together a toolbox rather than a single tool. The set of projects currently being funded in the EU's 6th Framework Programme noted above represents an attempt to develop such a toolbox at the European level (Deybe 2004). As most of these projects have just started and have a number of years to run, however, it is too early to tell to what extent they will succeed.

Turning to the second question above (meeting stakeholder needs), there is no straightforward answer, given the breadth of interests expressed by the stakeholders. In terms of the key driving forces, responses, and impacts, it would seem that there exist tools to address almost all of these components. It is less clear whether they provide results at the desired geographical scale, however, and especially at more detailed scales such as regions and sub-regions for which many officials have responsibilities. It may be able to determine this with a more detailed evaluation of these tools & techniques and, in a more general vein, points to the need for geographic flexibility in a SURPLUS toolkit.

The variety of tools available reflects the tension between the stakeholders' wish for simplicity, transparency and certainty on the one hand *vis-à-vis* the inherent complexity and uncertainty of the real-world situations (including the need to communicate the results of policy appraisal to non-specialists and the general public), on the other.

Finally, it should be noted that most of the tools & techniques, even those initially conceived of as being directly usable by decision-makers, still require a fair amount of technical expertise for their use and interpretation of their results. Still, as seen by the projects currently being funded in the EU's 6th Framework Programme, notably SENSOR and IQ-TOOLS, efforts are being made to push tools in a more user-friendly direction. These in addition to other integrated projects of potential interest for SURPLUS, are described in more detail in Annex II of this report.

5. Discussion

The previous sections of this report have described the intended purpose of the SURPLUS project and this Scoping Study, presented a framework for conceptualising any future SURPLUS project, reviewed the potential stakeholder interest in such a project, and considered a number of tools & techniques that might play a key role in such a project. In this final section, we highlight the major conclusions from this Scoping Study and make recommendations concerning the further development of the SURPLUS project.

5.1 Conclusions

1. ***There is interest in a project along the lines of SURPLUS.***
   There is a substantial level of interest among a wide range of stakeholders and potential end users in a project that could achieve the objectives as laid out for SURPLUS. In particular, there is a desire to integrate economic, environmental and social models and data across spatial and geographical scales in ways that have not been done in the past.
2. ***No single tool or technique will be adequate to meet the needs and desires of the full range of potential end users.***
   The range of Driving forces, Responses, and Impacts, which such a project might address, is quite large and varied. In addition, there will be inherent tradeoffs among some of the desires mentioned by potential users. Among these are the desire for quantitative indicators with high certainty versus the research community's ability to deliver robust numbers and the desire for transparency in the tools versus the complexity of the real-world issues being addressed; and the desire for outputs at a wide range of spatial scales. This, combined with the desire for integrated appraisals points to the need for a suite of tools & techniques rather than a single generic tool or technique.
3. ***A wide range of tools & techniques appear to be available for inclusion in a SURPLUS toolkit. A key challenge will be their integration.***
   There is a wide range of tools, available of being developed, which touch on most elements identified in the proposed framework for SURPLUS. In addition, a number of recent and ongoing research projects could make contributions to an eventual SURPLUS toolkit. With a few exceptions, little work has been done on integrating tools in a generic fashion. Furthermore, it is not likely that individual stakeholders will be aware of the breadth of available tools.
4. ***Some of the current objectives specified for the SURPLUS project may not be achievable or are inappropriate given current scientific understanding.***
   In particular, the desire for forecasts cuts against the grain of current understanding in the futures literature, which would underpin most activities in a SURPLUS project. Similarly, given that changes in 'external' conditions are likely, relying upon historic data for testing and validating appraisal tools & techniques poses difficulties that should not be underestimated.

5.2 Primary Recommendation

Based upon the above conclusions, it appears appropriate to move forward with the concept of a project along the lines of SURPLUS. As a first step, however, it is imperative that more specific and almost certainly more modest objectives be established. Otherwise, it will not be possible to identify and/or develop the most appropriate tools & techniques. The net result would more than likely be a toolkit that promises much to many potential users, but only minimally satisfies some and fully satisfies none.

In the current Scoping Study, it was possible to clarify somewhat the policy, temporal, and geographic scopes of Driving forces, Responses, and Impacts that a SURPLUS project might address. It was not possible to narrow these down, however. Nor was it possible to link these (or the tools & techniques) to specific potential end users at various spatial scales to the extent desired.

It is therefore recommended that ***a more detailed and targeted consultation process be undertaken before any other activity in the further development of a SURPLUS project***. The consultation will need to be much more extensive than the one pursued in this Scoping Study, both in terms of the number of persons consulted and the depth of the interaction with these persons. In addition, the needs and priorities of the funders of the consultation must be specified in much greater detail beforehand. In this way, the process can be designed to meet these wishes from the start.

5.3 Secondary Recommendations

There are a few other activities that could make sense to pursue in parallel to the consultation process identified above. These have been chosen based upon such factors as feasibility and recommendations by persons involved in the Consultation phase, but most importantly their ability to complement the primary recommendation and lay the groundwork for later phases in the development of a project along the lines of SURPLUS.

1. ***Development of a simulation game focussing on land use change and its impacts, e.g. a 'SimCountryside'***
   This was recommended by a number of the consultees. Such a tool would allow users to engage more directly in developing visions of the future and exploring the steps required to achieve these. It would serve more as a discussion and learning tool than a predictive model. The apparent success of Flood Ranger as part of the Office of Science and Technology's (OST) Foresight Flood and Coastal Defence (FCD) project indicates the value of such a tool – it is being used in schools and universities, by local authority planning departments, the Environment Agency, and engineering companies, and has been sold to members of the public, and used in 'team competition' at a number of conferences. The project was instigated by the Foresight programme at the DTI who put up funding of £30-35K. This paid for about a third of the development time. In terms of staff days the development took about 180-200 days (Dr. Kevin Morris, Discovery Software, personal communication, 6 May 2004).
2. ***Explore collaborations with one or more of the projects that are being funded in the EU's 6th Framework Programme that are directly related to Sustainability Impact Assessment (see Section 4.2.10)***

A number of these projects, e.g. MATISSE, SENSOR, IQ-TOOLS, and SEAMLESS, are intending to develop tools of the sort that closely match those specified in the objectives for the SURPLUS project, with the SENSOR project perhaps being the most germane.[27] The work of Sustainability A-TEST is also of great interest as it key object is the development of a consistent and comprehensive evaluation framework. A number of UK researchers and institutes are involved in these projects, but it is not clear if there is a strategy for Defra and other UK organisations to benefit from the knowledge being developed therein.

3. ***Support efforts to link formally more detailed tools with Checklists***
   The simple checklists described in Section 4.2.9 are among the most commonly used tools for appraisal during the process of policy development. They provide a valuable framework for ensuring that a broad range of impacts are considered in evaluating any new policy or other driver. At the same time, there is justifiable concern that as currently used the resulting appraisals are subjective and not reproducible. As noted with the Cardiff Methodology, these checklists should be used in conjunction with other, more detailed tools. Defra could contribute in this area by formalising this combination of tools & techniques.

[27] The lead author of this report would like to note, for purposes of full disclosure, that he is receiving funding as part of the SENSOR project.

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Annex I – Further Details on Selected Tools & Techniques

Sectoral economic models

SWOPSIM

SWOPSIM was developed by the US Department of Agriculture (Roningen, Sullivan et al. 1991). It was designed to simulate effects of changes in producer and consumer support policies on production, consumption, and trade. It has been used and further developed in many places and forms, e.g. the World Agricultural Trade SImulation Model (WATSIM) at the University of Bonn (von Lampe 1998; Kuhn 2003)[1].

SWOPSIM is characterised by simple (Cobb-Douglas) supply and demand equations, which correlate price and quantity on each commodity market as well as interdependencies between the various markets. It is static and, therefore, does not model time paths of endogenous variables. The model is assumed to be in equilibrium in the initial state. After a simulation of an exogenous shock, like a demand shock or a policy intervention, the model finds a new equilibrium by establishing a new set of prices such that market supply equals market demand for all commodities and, thus, world markets for all products are balanced.

Several models and model extensions have been constructed including single product models, multi-product net-trade models, and Armington-type bilateral trade flow models. For example, Schwarz (2003) developed extensions for the analysis of different demand patterns and CAP and WTO policy scenarios. The model covers 12 agricultural commodities for each of the model regions including several EU member states, the EU as a whole, and two Rest of the World regions. It quantifies changes in distributional and welfare indicators as well as in trade and transfer indicators in the agricultural sector. However, this more consumer-oriented modelling approach does not consider environmental aspects.

Also based on the SWOPSIM approach is the multi-market, multi-region Lincoln Trade and Environment Model (LTEM), which links agricultural trade through to environmental consequences (e.g. water quality and greenhouse gas emissions from agriculture) and segregates markets/commodities as conventional, organic or genetically modified (Saunders, Wreford et al. 2002; Cagatay, Saunders et al. 2003). It has the ability to model a large number of different policy instruments such as direct payments, production quotas, minimum prices and preferential access quotas with and without in-quota tariffs. The core trade model covers 18 countries and regions (e.g. Australia, EU, US, Canada, Mexico, Japan, New Zealand, Argentina and a Rest of the World region) and 16 commodities including three types of oil, beef and sheep, five dairy products, cereals, kiwi fruits and apples. It measures the impact of different policy scenarios on economic indicators such as producer returns and environmental indicators such as groundwater nitrates.

CAPRI

[1] See also the website at http://www.agp.uni-bonn.de/agpo/rsrch/watsim/wats_ov_e.htm.

The CAPRI modelling system was developed at the University of Bonn between 1997 and 1999 to assess CAP reform, primarily the Agenda 2000 proposals and decisions (IAP, University College Galway Department of Economics et al. 1999).[2] It consists mostly of data at regional (NUTS2) level, i.e. physical balances of agricultural areas, animals, animal feed, etc. and economic accounts, plus a detailed policy description (e.g. set-aside, quotas, etc., with OECD PSE/CSE data used for non-EU regions). Behavioural functions are based on welfare economics principles and elasticities derived from other studies. Programming models of regional supplies of (non-perennial) crops and of livestock enterprises based on gross margin maximisation are aggregated and calibrated to Member State levels. A supply and demand market module comprising the EU, Candidate Countries, and 10 other countries or blocs is then solved for prices, which then drive the supply module iteratively.

The main results for crop areas (individual cereals, individual oilseeds, other arable crops, permanent crops, fodder production, and set-aside and fallow) and livestock numbers (distinguishing young animals from breeding animals), and so output, input and farm income indicators, are therefore available at NUTS2 level, of which there are 30 in England, 2 in Wales, 4 in Scotland and 1 in Northern Ireland. However, data problems appear to have prevented publication of UK NUTS2 results except for Northern Ireland. The model also includes indicators for nutrient balances - nitrogen, phosphorus and potassium, greenhouse gas emissions, and water balances (LEI, IAP et al. 2003). The model is currently being updated and extended within two new EU-funded projects - CAP-STRAT and CAPRI-Dynaspat.

FAPRI

The FAPRI modelling framework (no particular link to CAPRI), developed at the Food and Agricultural Policy Research Institute between the University of Missouri and Iowa State University, is a set of non-spatial multi-market partial equilibrium models for major agricultural markets. The framework is used every year in the USA and elsewhere to develop baseline projections of world agricultural markets (Westhoff and Young 2000).[3]

The FAPRI model has been used in a number of modelling collaborations to develop country-specific modelling frameworks and applications. For example, the TEAGASC institute in Dublin, with associated work at Missouri and the Queen's University in Belfast, developed the FAPRI-Ireland recursive, dynamic, partial equilibrium model (Schwarz and Gelan 2003). The model encompasses interlinked sub-models of all the main commodities in Irish agriculture and consists of 200 econometrically estimated equations. The model-specific output is the generation of ten-year projections for the key variables of the main agricultural commodities in Ireland and the provision of a total income figure from agriculture. Generally, the model compares a baseline projection, which assumes that no economic or political shocks occur and that agricultural policy remains constant throughout the projection period, with different scenarios in terms of their deviation from the baseline (Binfield, Donellan et al. 2000).

The model has also been used to project GHG emissions from Irish agriculture and forestry under different CAP scenarios. The model provides projections of primary

[2] See also the website at http://www.agp.uni-bonn.de/agpo/rsrch/capri/capri_e.htm.
[3] See also the website at http://www.fapri.iastate.edu/.

agricultural data such as livestock numbers and fertiliser levels used to generate GHG emissions (Behan and McQuinn 2002). The FAPRI work at TEAGASC has involved at least 10 man-years, though some of this has been devoted to establishing TEAGASC as the EU leader in this work rather than being focussed on Irish problems as such.[4]

ESIM

ESIM is a spreadsheet-based, static, multi-commodity, multi-region net-trade partial equilibrium model, developed by USDA/ERS in co-operation with Stanford University and Göttingen University (Münch and Banse 1999). It is designed to calculate effects of changes in the CAP and of the EU enlargement on supply, demand, market prices and government budget expenditure. For example, Banse and Tangermann (1998) concentrated on market and trade implications of extending the CAP to Hungary.

It covers 13 countries or country aggregates and 28, mostly temperate zone, products, mostly commodities that have received substantial support from the EU. Since the purpose of the model is mainly to examine the effects of policy change in the context of EU Enlargement old and new (previous accession countries) EU member countries are covered and modelled in detail. The model contains an extensive list of policy instruments, both commodity specific instruments, policies that affect all commodities and non-commodity specific exogenous variables such as exchange rate and population growth rate. In principle the model is designed to simulate the large country case, where world prices endogenous. But it can also be used in a small country mode, based on the assumption that world prices are exogenous, in order to analyse the implication of domestic policy changes without feedback from world prices.

AGLINK

The AGLINK model (OECD 1999) is a dynamic, ex ante, simulation model and a demand-supply partial equilibrium model of the world agricultural sector. The model was developed by the OECD Secretariat in cooperation with member countries in 1993 and has been used to carry out the well-known OECD mid-term (or long-term) world agricultural outlook exercises, and to simulate the potential influence of agricultural policy on agricultural markets in the medium term.

AGLINK consists of complete modules for ten regions/countries (Australia, Canada, EU, Hungary, Japan, Korea, Mexico, New Zealand, Poland and the US) as well as three non-OECD countries/regions (Argentina, China and a Rest of the World region). The model includes a large number of different commodities that are of particular importance in the OECD countries. The model estimates supply, demand and prices in major OECD markets and certain non-OECD markets. Other sectors than agriculture are treated as exogenously to the model and does not take into account feedback to the macro-economy which can be a significant disadvantage for the Rest of the World countries as agriculture is often still an important part of the national economy. The different regional modules interact with each through world markets.

General land use change models

CLUE[5]

[4] See their website at http://tnet.teagasc.ie/fapri/.

[5] See website at http://www.dow.wau.nl/clue/.

The CLUE modelling framework has been developed at the Wageningen Agricultural University in the Netherlands to model land use changes as a function of their driving factors. It has been applied within the EURURALIS project (see 4.2.10 below) and to analyze land use/cover changes in several countries such as Ecuador, Costa Rica, Java, and China. Veldkamp and Fresco (1996) and Briassoulis (2000) provide detailed information about this model.

The CLUE model has been described as an integrated, spatially explicit, multi-scale, dynamic, economy-environment-society-land-use model. It makes a quantitative description of land-use changes through the determination and quantification of the most important bio-geophysical and human drivers of agricultural land use on the basis of the actual land use structure (Briassoulis 2000).

The CLUE methodology is based on the analysis of land use systems as complex, multi-level systems which operate at the interface of multiple social and ecological systems. The similarities between land use, social and ecological systems make it possible to use concepts that have proven to be useful for studying and simulating ecological systems in the analysis of land use change. The first of such concepts is connectivity: locations that are spatially distant influence each other as a consequence of direct processes (e.g. erosion/sedimentation), neighbourhood effects or feedback over higher-scale levels. The second one is hierarchical organization: higher-level processes can steer and constrain lower-level processes while, at the same time, higher-level features might emerge from lower-level dynamics. The third concept is related to stability and resilience: land use systems are able to absorb disturbances before the structure of the system is changed; for instance, farmers may not change land use immediately upon fluctuations in market prices of agricultural products. The fourth concept relates to the "driving factors", that is, a large set of socio-economic and biophysical forces can be seen as the 'drivers' of land use change, steering the rate and/or location of change.

The complex relationships between land use and its driving factors are modelled employing a combination of dynamic modelling and empirical quantification. This is implemented by analysing historical land use changes at various levels of spatial aggregation using multiple regression analysis to determine the most important bio-physical and socio-economic determinants of land use at each level of aggregation as well as the quantitative relationships between them and the area of various land use types. Results from analysing past and present land use trends are then used to explore possible land use changes in the near future under different development scenarios.

The CLUE model has a modular structure with four components: population module (change in population), demand module (demand for land cover type), yield module (change in yield of agricultural land use type), and allocation module (allocation of land cover changes). The demand module is non-spatial, incorporating economic models and/or existing projections and calculating the area of change demanded by the different sectors of the economy.

IMPEL[6]

IMPEL was developed at the Universite Catholique de Louvain between January 1996 and June 1999 in collaboration with nine other universities in Europe, and funded by the European Commission within the Environment and Climate Framework

[6] See website at http://www.geo.ucl.ac.be/LUCC/research/endorsed/02-impel/IMPEL.html.

Programme IV. The IMPEL team comprised over 30 researchers representing a wide range of disciplines from the biophysical sciences to agricultural economics.

The broad aim of this model was to develop a formal modelling framework for study of the impact of climate change on the spatial distribution of agricultural land use in Europe. IMPEL seeks to integrate biophysical and socio-economic factors affecting the land use change. Focusing on the processes of land use change, the modelling exercise has the flexibility to cope with a wide range of driving forces, including climate and policy change. The modelling framework also takes into account the requirement to represent the decision-making processes of individual land managers in models of land use change.

The overall aim of the modelling exercises was "to assess the impact of climate change, within the context of plausible socio-economic changes, on the distribution of agricultural land use and the potential for adaptation through land management at the farm and regional scales" (Rounsevell 1999, p. 2). IMPEL was developed in two phases, with the first phase of the work focussing on the development of a framework to assess climate impacts on land use at the regional scale, and the second phase applying the modelling framework in different, contrasting case study regions of Europe. Methodologically, IMPEL was guided by a range of basic principles and concepts including (Rounsevell 1999, p. 3):

Land use change is caused by the decisions made by individuals based on the opportunities and constraints within the basic spatial units of the land they manage. For agriculture, the decision-maker is the farmer and the basic spatial unit is the farm. Climate change will affect both the opportunities (e.g. crop yields) and constraints (e.g. timing of tillage operations) of the agricultural production system and these should, as much as possible, be represented by process-based models.
The assessment of regional land use change should be based on the extrapolation of decision-making models at the farm-scale to the broader region based on geo-referenced, spatially explicit data sets; in other words, a bottom-up approach.

The IMPEL modelling framework has a modular structure, and consists of a set of interlinked modules (Rounsevell 1999, p. 4):

- *A climate module* - down-scales baseline climate data (gridded to 0.5° Lat/Long) and GCM climate change scenario data sets, using a stochastic weather generator
- *A soil and crop module* - evaluates the soil-water balance and crop yields for a wide range of European crops at the scale of soil map units, that uses pedotransfer functions to estimate complex soil hydraulic properties, e.g. water retention, hydraulic conductivity (in the hydrology module)
- *A land degradation module* - evaluates the impact of soil erosion and changes in soil quality on crop productivity at the scale of soil map units. The module uses mechanistic approaches to simulate surface runoff and decision trees to accommodate the influence of management practices
- A *socio-economic module* - predicts changed land use and optimal management requirements at the scale of individual (generic) farms. The module is based on linear programming and assumes farmers make land use decisions that maximise profitability whilst averting risk. The module takes account of farm sizes, existing farm systems, and other demographic factors to enable predictions to be made of

the likely rate of change of land use, based on the difference in profit between existing and proposed systems caused by variations in yields, prices, soil workability and resources such as irrigation

IMPEL was developed employing key assumptions regarding the evolution of land use systems and their likely response to environmental change drivers. The hypotheses which the modelling framework aimed at testing may be classified into two groups (Rounsevell 1999, p. 7):

- Methodological hypotheses:
  - Land use decisions are driven by the goal of profit maximisation, moderated by aversion to risk
  - The spatial extrapolation of farm scale models to broader regions provides an appropriate description of regional land use because of a more complete representation of the decision-making process.
  - The uncertainties in using imprecise, spatially-distributed datasets when extrapolating site models to broader regions can be assessed and quantified and thus, do not form a barrier to the extrapolation process
- Hypotheses related to future land use change:
  - Elevated atmospheric CO2 concentrations will have a greater effect on crop yields, and thus land use, than changes in temperature or precipitation.
  - Climate change will affect the severity of soil erosion and this will have a significant impact on land use
  - Socio-economic change will be much more important than climate change in determining future agricultural land use in Europe

IMPEL was applied and tested in seven case studies in contrasting European regions including Eastern England, UK; Languedoc-Roussillion, France; Sevilla Province, Andalucia, Spain; the Venice Lagoon basin, Italy; representative sites in Denmark; the Plain of Thrace, Greece; and the Romanian Plain. Historical trends in these case study areas were analysed to enhance understanding of changes in the dynamics of European agriculture, and this has provided the basis for constructing the scenarios of future socio-economic change. The modelling framework employed the following future driving factors of EU agriculture:

- a consistent reduction in the protection of agricultural production
- a generally increased fluctuation of production costs and prices
- the extension of direct remuneration for farmers' environmental and social services
- increased restrictions on the use of polluting inputs

The scenarios were developed with respect to these driving forces using 1995-2000 as a reference for the current situation and then 2020 and 2050 for future scenarios

ACCELERATES[7]

This is an integrated modelling framework developed through an EU-funded project coordinated by Department of Geography, Université catholique de Louvain, in collaboration with seven other European universities(Rounsevell 2004).

The project concentrates on the problem caused by rapid changes in agricultural land use arising from developments in technology and management driven by socio-economic and political changes. The resultant intensification of agricultural land use has led to the fragmentation and loss of natural habitats and their associated species. On the ground that these trends are anticipated to continue, the ACCELERATES project seeks to employ a modelling approach to gain insight into the rates of agricultural land use change, focussing on the potential implications of this for biodiversity. In this context, the ACCELERATES modelling framework is developed to assess vulnerability of European agroecosystems to environmental change. This is achieved through an assessment of the rate, extent and dynamics of changes in agricultural land use arising from climate, policy and socio-economic pressures; the impact of agricultural land use and climate change on biological resources; and the vulnerability of agroecosystems based on economic and environmental considerations.

The integrated modelling framework has the following components: crop model, farm-based decision model, species distribution model, and species dispersal model. This is intended to lead to a better understanding of the rates and processes of changes in agricultural land use and species distribution and dispersal and the relationship between land use and species. Furthermore, the modelling procedure was suitable for identifying vulnerable agroecosystems and regions in terms of their sensitivities to environmental change and their ability to adapt to change, testing the feasibility of an integrated approach to conservation and sustainable development involving local stakeholders, and proposing policy mechanisms to mitigate undesirable changes in agroecosystems and biodiversity.

Scenarios of linked climate and socio-economic changes will be used to drive an integrated model of land use and species. The model is implemented considering alternative future scenarios: Common Agricultural Policy reform, EU enlargement, globalisation and international trade negotiations, technological and climate changes. The geographical scale of this model covers Europe as a whole, with regional case studies.

Agent-based social simulation models in the context of land use change

Models Closely Related to Neoclassical Agricultural Economics

Balmann et al.

Alfons Balmann and his colleagues at Humboldt University, Berlin (Balmann 1997; Balmann and Happe 2000; Balmann, Happe et al. 2003) have constructed a series of agent-based land use models representing land as a grid of rectangular plots, and focussing on issues including the level of land rents, sunk costs, and path-dependent structural change – showing, for example, that subsidies may affect the speed and direction of such change. Individual models differ in whether farmers are assumed to be economically rational, or are modelled as adaptive, learning via a genetic algorithm (GA) technique. In another variant, it is possible for users to take the role of a farmer in an interactive game, themselves making the decisions about buying or renting land, and on

[7] See the website at http://www.geo.ucl.ac.be/accelerates/.

what to produce. The approach has been applied to structural change in a specific region of Germany, Baden-Württemberg.

Thomas Berger initially worked with Balmann (he is now at the University of Bonn), and has adapted Balmann's model for application to problems of Chilean farmers' adaptation to tariff reductions (Berger 2001) by incorporating behavioural heterogeneity among farmers, and direct interactions between them; and also by including some information about soil and hydrology. Berger and a colleague hope to produce a multi-scale model (Berger and Ringler 2002) integrating socioeconomic and biophysical processes, with both aggregate and disaggregated agents.

Parker et al.

Work by (Parker and Meretsky 2004) uses agent-based modelling to explore the impact of edge-effect externalities on land-use pattern. The model simulates land-use decisions in a case where conflicts between urban and agricultural land uses: urbanites prefer not to be too close to each other (although transport costs pull in the opposite direction), while agriculture is not viable in areas surrounded by urban parcels. The net effect is an inefficient degree of urban sprawl. The paper describes metrics for the degree of this sprawl.

Modelling Frameworks

The systems described in this section are, by intention, sufficiently general to be used in constructing models of a wide range of cases.

CORMAS: Common-Pool Resources and Multi-Agent Systems

CORMAS (Bousquet, Bakam et al. 1998; Rouchier, Bousquet et al. 2001) is a modelling environment with a Cellular Automata structure, intended specifically for modelling the use and conservation of "Common-Pool Resources": such as groundwater or game animals which are "subtractible" – i.e., if one agent uses them, another has less to use, but are not readily protected from overuse. It has mainly been used in tropical contexts, but this reflects the interests of its developers (at CIRAD, the premier French centre for tropical agricultural research) and users, rather than any specific feature of the modelling environment. The developers are also particularly interested in participatory approaches: CORMAS has been used in conjunction with role-playing games (Bousquet, Barreteau et al. 2002), and to elicit stakeholder representations (Becu, Bousquet et al. 2003).

FEARLUS: Framework for Evaluation and Assessment of Regional Land Use Scenarios

FEARLUS (Polhill, Gotts et al. 2001; Gotts, Polhill et al. 2003) is a modelling system developed at the Macaulay Institute in Aberdeen. Land managers (the agents) get an economic return from land uses they select for the land parcels they possess. This return depends on local factors such as the condition of the land, and regional climatic and economic conditions. Those land managers receiving insufficient economic returns must sell land parcels to meet their costs, leaving the simulation if all their land is sold. This allows comparison of the success of different strategies for selecting land uses in various contexts, such as rapidly changing regional conditions or highly heterogeneous local factors; this has been a major focus of research. FEARLUS agents can make use of

their own and neighbours' past experience in selecting land uses, and can have multiple goals (e.g. maximising returns and retaining their neighbours' approval). Until recently FEARLUS has been used exclusively to support models at a high level of abstraction, but FEARLUS models able to use real-world data are now in prospect. One current project is to link a FEARLUS model to a hydrochemical model, in the context of a scenario development study of diffuse pollution in Scotland.

Approaches Focusing on the Take-up of Agroenvironmental Measures

IMAGES

The IMAGES project was an EU Framework V project (Deffuant, Huet et al. 2002) aimed at improving understanding farmers' adoption of agri-environmental measures. Agent-based modelling was an important part of the project, focussed on the processes of innovation diffusion. Data was collected from 400 farmers. The model finally produced was considerably simpler than originally intended, due to difficulties in generalising from the data collected, but still extended the classical approach to innovation diffusion by distinguishing between the effects of initial information passed to a subset of farmers from institutions, and subsequent discussion among farmers themselves. It was applied to a specific case with some success, producing plausible results, although it is admitted that their robustness is difficult to evaluate.

Integrating Agent-Based Models and GIS

This section describes projects which all stress integration (at various levels of intimacy) between agent-based models and GIS. All are described in (Gimblett 2002), along with a number of other, less relevant projects. The range of approaches described indicates that such integration is an active area of research, but no general solution to the problems arising has appeared. One researcher (Westervelt 2002) describes various levels of integration that may be attempted: "loose" in which the programs run independently and exchange data using ordinary text files, "moderate" where they run independently but exchange information using specialised files, and "tight", where the agent-based model and GIS are compiled into a single program. This is the fastest approach, but also the hardest to develop and modify.

The GIS-CA Toolkit (Box 2002), however, does not fit neatly into this categorisation: rather, it is an agent-based model of an unusual kind, in which cells (corresponding to elements of a GIS raster) are treated as agents. Communication with GIS programs occurs via specially written input/output modules.

An application of the moderate level integration approach is described in (Harper, Westervelt et al. 2002), where a GIS is used to produce initialisation files for a simulation of a species present in excessive numbers (the cowbird) and activities aimed at controlling it. Output maps are produced which can in turn be input to the GIS.

Finally, (Duke-Sylvester and Gross 2002) describe ATLSS, a "tightly" integrated system which includes several distinct agent-based models, each centred on one or more species at a particular trophic level, and treated at different levels of aggregation. ATLSS is described as having "a significant level of GIS functionality", but it is clear this is far short of what a conventional GIS would provide, and that the system may be difficult to scale up efficiently.

Economic agricultural land use and environmental impact models

NELUP[8]

This programme, carried out at the University of Newcastle between 1988 and 1995, established a "decision support system" (DSS) comprising a complex database and "three component sets of models" – agricultural-economic, ecological, and hydrological. As described by O'Callaghan (1995), in a special issue of the *Journal of Environmental Planning and Management*, the "prototype modelling system" was designed at six levels: geography (land use and water data), physical input-output, feedback control, open or self-maintaining systems, human individuals, and social organisations – and was constructed for the catchment area (about 3000 sq. km.) of the River Tyne in North-East England. Four sources of data were used: the 32-class ITE Land Classification of 1-km grid squares, classified by altitude, gradient, climate and geology, used to allocate the ecological results of ITE sample surveys in 1978, 1984 and 1990; the ITE Satellite Land Cover Map, based on 25 classes, but at lesser resolution; the annual MAFF (now DEFRA) Agricultural Census; and a 6% ground survey using the Nature Conservancy Council (NCC; now English Nature, EN) Phase 1 Vegetation Survey methodology, to act as a prediction check.

As described by Moxey *et al*. (1995), the economic component of NELUP comprises an aggregate linear programming (LP) model of 2740 variable columns by 1349 constraint rows, covering the 1800 farms in the Tyne area. The lack of spatial detail is mitigated to some extent by classifying land according to the MLURI agricultural land capability classification (Bibby, Douglas et al. 1991), and by the specific uses of certain types of farm assets (machinery, buildings, etc.), but nevertheless mobility of farm production factors between uses is likely to be over-stated by the LP method. Other modelling simplifications included: the exogeneity of farm input and output prices; linear technology (no returns to scale) though at different alternative levels of intensity using MAFF Farm Business Survey (FBS) data modified by the use of nitrogen response coefficients from a USDA soil erosion calculator (EPIC); the irrelevance of agricultural structure by farm size and other characteristics (e.g. ownership, indebtedness); and the primacy of profit maximisation in agricultural (and forestry) land use decisions. To reduce the over-flexibility of the LP structure, the model also included a set of (essentially arbitrary) adjustment-rate constraints based on resource availability and biological feasibility, and so could be run recursively for a number of years to simulate adjustment to a new policy-defined equilibrium.

Three types of ecological model were used: an associative model linking land cover to plants and invertebrates, a vegetation environment management model (VEMM), and a third for more mobile birds and mammals. The hydrological component of NELUP involved an aggregate model NUARNO and a more spatially detailed model (SHETRAN).

Validation of NELUP was approached at two levels: checking (by local experts) of model-produced yields and other input-output coefficients; and comparison of model runs for the period 1981-82 to 1987-88. The later exercise produced percentage absolute deviations (PADs) for major agricultural land uses (arable, temporary grass, permanent grass, and rough grazing) of around 10%, and rising over time. However, some of this

[8] See the website at http://www.ncl.ac.uk/wrgi/wrsrl/projects/nelup/nelup.html.

PAD may have been more apparent than real, due to uncertainties over census classification of grazing.

NELUP was specifically designed as a transferable system, and so was built with a user-friendly graphical interface. The economic model solved in less than 5 minutes (with 1990s software), but included a relatively narrow range of agricultural policy parameters. The development of the model required about 7 man-years, 5 to collate and verify data, and 2 to construct and verify the model. The model was applied to the River Cam basin in South-East England.

LUAM[9]

The Reading Land Use Allocation Model (LUAM) was constructed between at the University of Reading, with contributions from the University of Newcastle upon Tyne and the NERC Institute of Terrestrial Ecology (ITE) (Jones, Rehman et al. 1995). It was designed to assist policy-makers in the analysis of likely changes in farming practices, and of associated environmental impacts. It applied to agriculture in England and Wales, modelled as a single farm, but based on 15 land classes (using the ITE system) with up to four major agricultural land uses for each. Each of about 600 production activities was available at up to 3 levels of intensity, resulting in a typical matrix size of 1558 columns by 637 rows. Input-output coefficients specific to land classes were estimated from MAFF FBS and Departmental Net Income Calculation (DNIC) data, but replaced by 'constructed' data were appropriate and necessary. MAFF/DEFRA provided £20,000 towards a "LUAM Club" between 1996 and 2001.

MAFF/DEFRA funded a University College London (UCL) study "Economic Effects on Climate Change on Agriculture in England and Wales" (CC0320) between 1994 and 1997, linking a global model of world food trade (Basic Linked System, BLS) to a LUAM-based model, CLUAM (Defra 2003, p. 15). A consortium of the Universities of Reading and East Anglia and UCL subsequently undertook the study "Effects of Climate Change on Agricultural Land Use in England and Wales" between 1999 and 2000 (JEI 2000). According to the DEFRA evaluation (Defra 2003, p. 15), "CLUAM captured most of the historical levels of change at the national and regional scale, although regional scale effects were less adequately modelled for areas where the land-cover type under scrutiny was less extensive".

LUAM has also been used in the EU-funded Tools for evaluating EU agricultural policy at different decision levels EuroTools programme (EUROTOOLS 2000).[10] This project also made use of several other models. One of these, AROPAj, uses farm types and regions to calculate farmers' reactions to changes in the Common Agricultural Policy. Alongside agricultural results (livestock numbers, gross margins), it calculates some environmental outputs, such as nitrates, methane and carbon (sequestration).

Environmental impact models

UK-ADAPT

This is a resource for researchers and funders cataloguing projects that focus on managing catchments to decrease diffuse pollution from agriculture (Humphrey and

[9] See the website at http://www.rdg.ac.uk/agristrat/CAS/topic/luam.htm.
[10] See also the website at http://eurotools.stat.unibo.it/.

Shepherd 2003).[11] As of the time of this report, there were 136 projects in this database. Furthermore, Dilks (2003) summarises more than fifty models and decision support systems that focus on diffuse nutrient pollution, specifically nitrogen and phosphorus. These can operate at different scales, as stand-alone models or in combination with hydrological models, with different parameterisations for different climatic and soil characteristics, and so on.

MAGPIE

One such example of a decision support system is MAGPIE - Modelling AGricultural Pollution and Interactions with the Environment (Lord and Anthony 2000). This tool integrates nitrate leaching models with a national database covering environmental and agricultural factors, including climate, soil attributes, land use data and satellite-derived land cover data. The spatial scale of analysis can range from a field to a catchment, to which one of a number of embedded pollution models may be applied. MAGPIE feeds in to the Defra methodology for identifying Nitrate Vulnerable Zones. This is based partly on monitoring and partly on GIS modelling of relevant factors, e.g. loading, soil, and climate.

MIRABEL

Turning to biodiversity, MIRABEL, Models for Integrated Review and Assessment of Biodiversity in European Landscapes, is a tool based on the DPSIR framework aiming to model changes in European biodiversity which may arise from changes in a wide range of environmental pressures (Petit, Firbank et al. 2001). Separate calculations are conducted for thirteen ecological regions.

The ten pressures can be split into pollution pressures (eutrophication, nitrogen deposition, acidification, climate change) and land-use pressures (urbanization/transport, farming intensification, drainage/irrigation., land abandonment, afforestation, and habitat fragmentation). The evolution of each of these is predicted/forecasted using other model or scenario-building exercises. The thirteen ecological regions are a trimmed-down version of the twenty-eight DMEER (Digitised Map of European Ecological Regions) classes. Within each eco-region, a list of habitat types was developed and linked with the pressures in a matrix. Each cell consists of two entries covering the past and the predicted future impacts “of a specific pressure on the biodiversity of a single habitat type, using best available knowledge”. The matrix entries distinguish the strength of the impact and its spatial extent; it can also flag up missing information.

The results are very general indicators of the main pressures within particular regions. Farming intensification, drainage/irrigation and urbanisation/transport all feature as significant drivers of change across most regions, including “North Sea Atlantic” within which most of the UK falls. At the continental scale, MIRABEL is a useful means of synthesising a large body of knowledge, but as it stands its usefulness as a practical tool for guiding national policy or local management is probably limited. Within-region variations in policy and other characteristics can be substantial, and MIRABEL at the large scale does not pick these up. However, the model would be suitable for adaptation to different scales, and such an application within the UK might be profitable.

[11] See also the website at http://www.uk-adapt.org.uk/home/.

BIOPRESS

BIOPRESS, a 3-year project running from 2003, will further develop the MIRABEL concept.[12] Its focus is on land cover change and biodiversity, and falls within the GMES initiative, which aims for a 'European capacity for Global Monitoring for the Environment and Security' by 2008. BIOPRESS will produce information on historical (1950 – 1990 – 2000) land cover change in and around a large sample of Natura2000 sites and then extend/convert this information to develop a standardised historical (1950 – 2000) land cover change database at the pan-European level. This will be used to link measures of land cover change to pressures on biodiversity (intensification, abandonment, afforestation, and urbanisation) in combination with other biological, environmental and socio-economic data. MIRABEL will convert the quantified pressures into assessments of biodiversity at the pan-European level.

BIOPRESS therefore offers the promise of improving the spatial resolution and applicability of the MIRABEL model. There may remain scope to carry out more detailed work on implementing MIRABEL itself at smaller scales: it is not clear whether or not such work is envisaged as part of the BIOPRESS project, which still has 2 years to run. However, reading of the information suggests that BIOPRESS will focus on improving the land cover database, and probably the pressure database, but not necessarily the matrix which is central to MIRABEL.

MONARCH

Monarch – Modelling Natural Resource Responses to Climate Change also looks at biodiversity, but focuses more specifically on climate change (Harrison, Berry et al. 2001).[13] Also, its geographic emphasis is Britain and Ireland, with a second phase looking at more local areas. The project draws on climate projections from the UK Climate Impacts Programme. The second phase is building on this by developing generic methodologies for capturing changes in species' distribution, incorporating additional factors, such as land use/cover and dispersal capability.

The approach taken is to model responses of individual species, specifically to predict changes in distributions. This has been achieved through the development of complex computerised models, which are able to estimate changes in species distribution under climate change conditions, and detailed analysis of the model outputs. The study covers the impacts of climate change on a broad range of species (including plants, birds and amphibians) and geological features in terrestrial, freshwater, coastal and marine environments. The second phase is also exploring the consequences of such changes for ecosystem functioning In order to do so, the SPECIES model is used - a neural network modelling the change in "climate space" (suitable range) for a number of species (in this case, 50, in 12 habitats of conservation concern). This is supplemented with additional modelling in some cases, e.g. water availability and wetlands models for freshwater species. MONARCH identifies whether a suitable climate is likely to be available, but there is no guarantee that a species will be able to move to it. Thus, results include confirmation of problems associated with shifting ranges meeting barriers to migration, and differing rates of migration / range shift leading to likely changes in community

[12] See the website at http://www.creaf.uab.es/biopress/.
[13] See also the website at http://www.eci.ox.ac.uk/biodiversity/monarch.html.

composition. In the development of such an approach, it is obvious that land-use management may have an important role to play.

Annex II – Further Details on Selected Projects of Interest

There have been, and continue to be, a number of research programmes and specific projects that focus on issues of interest for the SURPLUS project. The most significant of these are described below, separated into previous and ongoing/future efforts at the UK and the EU/International levels:

- Previous UK:
  - *MEILUC (Modelling the Environmental Impact of Land-Change)*, funded by MAFF. This was, in effect the precursor to the current Scoping Study, but had a somewhat narrower focus.
  - *NELUP (NERC-ESRC Land Use Programme)*, funded by NERC and ESRC. This programme established a "decision support system" (DSS) comprising a complex database and "three component sets of models" – agricultural-economic, ecological, and hydrological. It focused on the environmental implications of agricultural land use.
  - *UK Foresight Futures 2020*: part of DTI's Foresight Programme. This project developed a set of four alternative scenarios of change in the UK over the next 20 to 30 years. These have been used intact or as the basis for further scenario development in a number of other studies, including many projects under the UK Climate Impacts Programme.
  - *UK Foresight Flood and Coastal Defence*: part of DTI's Foresight Programme and commissioned by Office of Science and Technology. This project aimed to use the best available science to provide a challenging vision for flood and coastal defence in the UK between 2030 and 2100 and so inform long-term policy.

- Ongoing and Future UK:
  - *MONARCH (Climate Change and Nature Conservation in Britain and Ireland)*: UK Climate Impacts Programme. Phase 1 investigated the potential impacts of climate change in Britain and Ireland on a range of species and habitats. Phase 2 aims to downscale this approach in order to provide a detailed understanding of impacts on ecosystem processes, which can then be applied to addressing nature conservation objectives within the context of climate change.
  - REGIS - Regional Integrated Assessment of Climate Change Impacts in the North West and East Anglia (Holman and Loveland 2002; Holman, Loveland et al. 2002)[1]: This project was commissioned by Defra and UK Water Industry Research under the UK Climate Impacts Programme. The purpose of Phase 1 was to investigate the impacts of climate and socio-economic change, using computer modelling and stakeholder discussion. Phase 2 will focus on the development of a meta-model tool for regional integrated climate change management.

[1] See also the websites at http://www.silsoe.cranfield.ac.uk/iwe/projects/regis/ and http://www.silsoe.cranfield.ac.uk/iwe/projects/regis/regis2.htm.

- *REWARD - Regional & Welsh Appraisal of Resource Productivity & Development*[2]: This project was undertaken by the Environment Agency and a number of region development agencies. This is a partnership project working to ensure that 'Regional and Welsh strategies are fully coordinated between economic development, resource productivity and environmental protection'. A key product of the project will be the development of regional economy-environment input-output model (REEIO). This will include estimates of environmental and resource pressures in four areas: the waste sector, energy sector, air emissions, and the water sector (Cambridge Econometrics 2003; CURE 2003).
- *Tyndall Centre Integrating Frameworks*: variety of projects to undertake policy analyses on climate change issues relevant to the UK in particular. A key objective is to advance the scientific methods used for the analysis of climate change.
- *Environment Agency project SC020036 "Environmental effect of agriculture and land"* (personal communication, Antony Williamson)

- Previous EU/International:
  - *ACCELERATES (Assessing Climate Change Effects on Land use and Ecosystems: from Regional Analysis to The European Scale)*: EC Fifth Framework project. Its purpose was to examine the relationship between agricultural land use responses to environmental change drivers and environmental protection, as reflected specifically in the management of biological resources. Past UK.
  - *IMPEL (Integrated Model to Predict European Land use)*: EC Fourth Framework project. This project focused on the development and application of modelling methodologies to assess agricultural land use change in a range of European demonstration regions.

- Ongoing and Future EU/International:
  - *ALARM (Assessing LArge-scale environmental Risks with tested Methods)*: EU Sixth Framework Integrated Project. This project will develop and test methods and protocols for the assessment of large-scale environmental risks in order to minimise negative direct and indirect human impacts. The research will focus on assessment and forecast of changes in biodiversity and in structure, function, and dynamics of ecosystems. In particular, risks arising from climate change, environmental chemicals, biological invasions and pollinator loss in the context of current and future European land use patterns will be assessed.
  - *BIOPRESS (Linking Pan-European Land Cover Change to Pressures on Biodiversity)* This is one of the thematic projects being carried out within the framework of the initial phase of the Global Monitoring for the Environment and Security (GMES) programme. It will provide decision makers with quantitative information on how changing land cover/use has affected the environment and biodiversity in Europe. The project is currently producing historical (1950–2000)

[2] See the website at http://www.reward-uk.org/reward_index.htm.

land cover change information in and around Natura2000 sites, which will be converted into information on pressures on biodiversity.

- *ESPON - European Spatial Planning Observation Network Programme*[3]: funded under the EU Community Initiative INTERREG III. This study programme contains a series of projects focussing on spatial development and planning seen from the national, regional and local points of view, and has generated some integrated tools and appropriate instruments (databases, indicators, methodologies for territorial impact analysis and systematic spatial analyses) to improve the spatial co-ordination of sector policies.
- *INSIGHT - Spatio-temporal effectiveness of natural resource and rural adjustment policies* (Gorddard 2001; Gorddard, Smyth et al. 2001; Gorddard and Walker 2001; van Ittersum and Gorddard 2001; Walker and White 2001; White, van Ittersum et al. 2001):..
- *SIMILOR – Simulation of Land Cover Dynamics* (Schotten, Heunks et al. 2001; Stillwell and Scholten 2001): This project was carried out in the framework of the National Remote Sensing Programme under responsibility of the National Remote Sensing Board. Its aim was the understanding of the future of Europe's urban and rural landscapes, with a focus on the urban-rural fringe. The project developed the EUROSCANNER land use model, which was an extension of the Dutch Land-Use Scanner (Hilferink and Rietveld 1999; Borsboom-van Beurden, de Regt et al. 2002).[4] The project used case studies in Lisbon, Portugal, and the Randstad in the Netherlands to test the methods employed.
- *EURURALIS*[5]: The goal of this project was to develop an interactive, user-friendly meta-model for a balanced discussion on the future of the European rural area from the perspective of sustainable development in the coming decades. Notably, it bills itself as a discussion, rather than decision support system. Four exploratory scenarios were used and a number of social, economic, and environmental indicators included. The analysis was carried out with an adapted version of the general equilibrium model of the Global Trade Analysis Project (described in Section 4.2.1 of this report), the Integrated Model to Assess the Global Environment - a dynamic integrated assessment modelling framework for global change (Alcamo, Leemans et al. 1998)[6], and the CLUE model (described in Section 4.2.3 of this report). The spatial resolution of the most detailed results was 1 square kilometre. There is currently discussion about a second phase of this project (Marcel Kok, RIVM, personal communication).
- *LUCC (Land-Use and Land-Cover Change)*: This is a programme element of International Geosphere-Biosphere Programme and International Human Dimensions Program on Global Environmental Change and supports various projects. It is an interdisciplinary programme aimed at improving the understanding of land use and land cover change dynamics and their relationships with the global environmental change.

[3] See the website at http://www.espon.lu/.
[4] A second, very similar model for the Netherlands has also been developed, the Environment Explorer (Engelen, White et al. 2003).
[5] See the website at http://www.dow.wau.nl/clue/europe/.
[6] See also the website at http://arch.rivm.nl/image/.

The following projects being funded in the EU's 6th Framework Programme are directly related to Sustainability Impact Assessment (Deybe 2004). They fall within the Sustainable Development, Global change and ecosystems Thematic Area, and more specifically, the Global Change and Ecosystems (GCE) thematic sub-priority. A number are of particular interest for the further development of the SURPLUS project:

- *Sustainability A-Test*[7]: This project will assist in improving both impact assessments and the sustainable development strategy definition by high-level validation of the tools using a consistent and comprehensive evaluation framework. The evaluation framework will include issues such as the pros and cons of the tools, what they can and cannot deliver, when they can be used, etc.
- *MATISSE - Methods and Tools for Integrated Sustainability Assessment*: The objective of this project is to achieve a step-wise advance in the science and application of Integrated Sustainability Assessment (ISA) of EU policies, with the core activity being to improve the tool kit available for conducting Integrated Sustainability Assessments.
- *SENSOR - Sustainability Impact Assessment: Tools for ENvironmental, Social and EcOnomic Effects of Multifunctional Land Use in European Regions*[8]: This project aims at delivering ex-ante Sustainability Impact Assessment Tools (SIAT) to support decision making on policies related to multifunctional land use in European regions. This tool, or set of tools, will be tested against a set of policy scenarios and at various scales across the region.
- *IQ TOOLS - Indicators and Quantitative Tools for Improving the Process of Sustainability Impact Assessment*[9]: This project aims to support the process of ex ante policy appraisal in the European Commission, in particular the process of IA. The tool to be developed by the project will allow desk officers to assess the potential effects of policy initiatives on the economic, environmental and social dimensions of sustainability and the significance of these impacts. It will consist of a quantitative modelling component and a qualitative tool.
- *SEAMLESS - System for environmental and Agricultural Modelling; Linking European Science and Society*[10]: This project hopes to develop an integrated framework (SEAMLESS-IF) which integrates approaches from economic, environmental and social sciences to enable assessment of the impact of policy and behavioural changes and innovations in agriculture and agroforestry. Contributions of agriculture to sustainable development and multifunctionality will be assessed at different spatial scales from farm to global, allowing consideration of both top-down and bottom-up approaches to land management change.

[7] See the website at http://www.falw.vu.nl/Onderzoeksinstituten/index.cfm?home_file.cfm?fileid=FF71450E-1835-47DD-BE3C63C09439D473&subsectionid=602C4835-C246-41FA-8DD706E7084B0D06.
[8] See the website at http://www.sensor-ip.org/.
[9] See the website at http://www.zew.de/en/forschung/projekte.php3?action=detail&nr=371&abt=umw.
[10] See the website at http://www.seamless-ip.org/index.htm.

Annex III - Consultation and Background Report

The material in this Annex was prepared as a separate unpublished report after the first phase of the Scoping Study. It is presented here in its entirety.

Executive Summary

The Appraisal of Sustainable Rural Policy and Land Use (SURPLUS) Scoping Study forms part of the Defra Horizon Scanning Programme and is co-funded by the Treasury's Evidence-Based Policy Fund. Its aim is to guide the further development and implementation of the SURPLUS project.

The SURPLUS project aims to improve the ability of Defra and other organizations to carry out policy appraisal based on a full assessment of future changes in land use, recreation, amenity and rural economic activity, and the impact of such changes on the rural environment and rural communities. It is driven by the increasing demand for evidence-based policy appraisal and concerns about the ability of existing approaches to satisfy this demand. Governments, including that of the UK and the devolved administrations, have set or agreed on ambitious targets for rural areas and have also made specific commitments in such areas as sustainable development[1], farming and food production[2] and the protection of biodiversity[3]. At the same time, the existing approach to rural policy is facing major challenges and the current evidence base for the appraisal of rural policy under these circumstances may be inadequate.

Following from the above, Defra's initial objectives for the SURPLUS project are stated as follows:

- Develop cost-effective tools for assessing trends as well as forecasting and anticipating future changes in direction in rural economic and social activity and land use and their environmental impacts and social consequences, over 5-20 year timescales;
- Test and evaluate the tools with empirical data and provide measures of the uncertainty of forecasts and sensitivities with regard to input assumptions;
- Ensure that the tools are relevant and useful to policy customers in Government departments and agencies, nationally and regionally;
- Ensure that the tools build on or link with existing methods and experience and utilise existing data as far as possible; and
- Apply the tools to a range of policy issues as identified in the Rural White Paper *Our Countryside: The Future, the England Biodiversity Strategy and the Strategy for Sustainable Farming and Food* and refined during consultations undertaken for the scoping study.

The current Scoping Study will specifically:

- Confirm the user requirements and refine the objectives for the overall project.

[1] *Foundations for our Future: Defra's Sustainable Development Strategy*, Defra, 2002
[2] *The Strategy for Sustainable Farming and Food; Facing the Future*, Defra, 2002
[3] *Working with the grain of nature: A biodiversity strategy for England*, Defra, 2002

- Assess the feasibility of using various modelling and other foresight approaches to achieve the objectives of the overall project, and
- Develop technical specifications and determine funding arrangements for its implementation.

The results will be used to guide any future development of the SURPLUS project. The final report from the study will include recommendations as to whether to proceed with the SURPLUS project, challenges and limitations to be addressed, and, if appropriate, a technical specification for the full project.

The Scoping Study is divided into three phases:

- **Consultation:** This phase will focus on a review of academic and policy literature; targeted interviews with approximately 10-12 policy makers and technical experts; and a one day workshop with 25-30 similar persons.
- **Evaluation:** A variety of tools and approaches for meeting the objectives of the overall SURPLUS project will be critically evaluated against an agreed set of criteria.
- **Technical specification and reporting:** A detailed report will be prepared, together with (if appropriate) a technical specification and costing for proceeding with the full project.

This report presents the results of the Consultation phase of the Scoping Study. The purpose of this phase has been to establish a context for the full SURPLUS project, including a preliminary revision of the stated objectives and, as such, sets the stage for the next, Evaluation and Technical specification and reporting, phases. The report discusses the results from the literature review, targeted interviews, and stakeholder workshop carried out during this phase. It then brings together the lessons drawn from these activities in order to provide some general insights relevant for the Scoping Study and the full SURPLUS project.

Review of Academic and Policy Literature

The review of academic and policy literature had, as its primary purpose, the identification of key contacts, policy and technical documents and related projects that are of interest for the SURPLUS project. Doing so provided the basis for the selection of interviewees and invitees to the stakeholder workshop, as well as delimiting the range of material to be included in the Evaluation phase of the Scoping Study. The detailed results of that work will be the primary focus of the forthcoming evaluation report.

In the process of identification, a list of more than 90 contact persons, who were or are associated with particular policies, project, or tools and techniques, was drawn up (see Appendix A). As to be expected, the actual interviews and the stakeholder workshop added to the number of contacts and the range of items for potential consideration, making this review an ongoing process.

Several policy drivers were identified at the EU level that need to be considered for the SURPLUS project. Those receiving the most attention recently have been the Common Agricultural Policy (CAP), its recent reforms, and the Water Framework Directive (WFD). However, other initiatives and directives also have important

influences on land use. Within the UK, there are general policies on sustainable development and rural development, as well as policies specific to particular issues or sectors. Among the latter are policies related to agriculture and the rural economy, biodiversity, the countryside, energy, environmental planning, forestry, and soils.

Not surprisingly, there have been, and continue to be, a number of research programmes and specific projects that focus on issues of interest for the SURPLUS project. The most significant of these, including previous and current/ongoing efforts at the UK and the EU/International levels are being reviewed as part of the Evaluation phase of the Scoping Study.

Quite a number of tools and techniques exist that may be of interest for the SURPLUS project. These run the gamut from qualitative to quantitative tools and from participatory to expert-based processes. The forthcoming evaluation report will provide more detail on specific tools and techniques. Associated with these tools and techniques, there is a certain amount of 'supporting material'. By this, we specifically refer to data and indicator sets. The former provide basic information on any number of factors, but for the purposes of the SURPLUS project, data on land use, land cover, and environmental pollution, at various scales, is most significant. Indicator sets combine information from a number of sources, including data sets, and generally have a more normative element in that they are often used to measure progress in achieving goals.

In-Depth Interviews

Thirteen persons were chosen for in-depth, semi-structured interviews. These were conducted either face to face or via telephone and lasted approximately 60 and 90 minutes. A list of those interviewed is included in Appendix B, which also includes the protocols used to structure the interviews.

The purpose of the interviews was to elicit information on the proposed objectives of the SURPLUS project, key drivers and impacts associated with the rural economy and land use change, and appraisal tools and techniques. The interviewees were also asked to provide additional information on specific persons, tools and techniques, and projects with which we should be engaging in the Scoping Study. We also discussed the level of personal and institutional interest in the SURPLUS project, including the possibility of co-funding such an endeavour.

The interviews revealed a substantial level of interest in the SURPLUS project and recognition of the need for improved methods. At the same time almost all felt that the draft objectives for the SURPLUS project were very ambitious. Indeed, several interviewees doubted that they be realistically achieved given the 'current state of the art'.

There was broad agreement that no single method or model of appraisal would be appropriate and that seeking to develop or identify a toolbox of approaches was therefore the right way to proceed. It was noted that a key challenge would be how to link different types of models and tools in a robust manner. There was general agreement on the 5-20 year time horizon. There was no consensus on the most appropriate spatial scale and it became clear that this was because the answer to this question would depend upon the specific policy questions or impacts with which one was concerned.

Whilst national level policymakers were predominately concerned with national policy, there was a widespread recognition of the increasing importance of regional and

local level policymaking. At the same time many interviewees noted that many of the drivers of change, even those manifesting themselves at a regional or micro-level (of the single field or 1km square), came from a European or even global level.

The interviewees drew attention to a wide range of social, economic, environmental and policy/political drivers of change. These grouped around a number of main themes including globalisation and liberalisation, changing political and institutional structures, the changing rural economy, demographic changes and changes in social attitudes. They identified a long list of fairly standard environmental impacts including acidification, climate change, flood risk, water quantity and quality, soil quality and erosion, resource use, biodiversity loss, landscape and visual amenity and noise. They were generally less forthcoming with regard to social and economic impacts; those mentioned included changing employment opportunities, the loss of traditional agricultural skills, and broader impacts on the social cohesiveness of rural communities.

Several persons mentioned the need for improved policy simulation tools to allow them to better explore the likely impacts of proposed policy changes, or the policy changes necessary to achieve improvement in relevant indicators or policy targets. The Environment Agency in particular was keen to see the development of a set of land-use scenarios that could be used to inform the work of a number of government departments and agencies.

The interviews highlighted an important tension between policymakers' needs for quantitative outputs and the research community's ability to deliver robust numbers. A number of interviewees expressed scepticism concerning the ability of quantitative modelling approaches to deliver robust, spatially disaggregated, policy relevant outcomes. Several drew attention to the difficulties of representing uncertainty in a way that engaged policymakers. There was also widespread recognition that changes in 'external' conditions meant that it could be impossible to test and validate tools and models.

Several interviewees mentioned the need for both quantitative and qualitative tools to be 'transparent' if policymakers were to have confidence in and to use their results. However, at least one interviewee raised a concern about a trade-off between transparency and simplicity. Transparent models have to be quite simple, but it should be noted that simple models do not necessarily capture the complexity of reality. Many complex quantitative models that do not satisfy this criterion are routinely used in different areas of environmental and economic policymaking, however. Several interviewees also drew attention to: the role of IT in reducing the cost and complexity of data collection and processing; the increasing sophistication of modelling approaches; and, advances in the use of GIS for handling and representing large amounts of spatial data.

It was suggested that greater attention should be paid to exploring the potential of qualitative and combined quantitative-qualitative approaches. One important theme here was the potential value of fairly simple checklist and decision-tree type tools.

Stakeholder Workshop

The third component of the Consultation phase of the Scoping Study was a stakeholder workshop. This was held on March 24th in the Policy Studies Institute's Conference Centre in London and brought together 24 stakeholders from government and

academia. The list of participants, along with the agenda and slides from the morning presentations, is included in Appendix C of this report.

The aims of the workshop were to introduce the SURPLUS project and the Scoping Study to the stakeholders and to refine the project objectives. This was done through a set of presentations and then exploring the kinds of questions that any appraisal tools and techniques used or developed in the project should be able to address and the kinds of tools and techniques that should be considered.

The discussions throughout the day covered a wide range of issues. A few specific themes were returned to over the course of the workshop. These included types of tools, the use of tools, concerns about data and the need to be prepared for both proactive and reactive behaviour.

Some participants found it difficult to anticipate the variety of tools needed for appraising the drivers and impacts of land use change. It was suggested that it may be useful to extend existing scenario work e.g. that of the UK Foresight programme, as these scenarios could be used by a variety of policy makers in conjunction with existing tools and models. One possible tool could be process-focused, such as participatory scenario building. Another possible tool would be a type of 'SimCountryside', in which users could engage more directly in developing visions of the future and exploring the steps required to achieve these.

The point was made that good tools do not equal good decision making and sophisticated tools can sometimes be more advanced than associated mental models. Also, many data and tools tend to be lost in government reorganisations. Better communications within and between groups of decision makers and makers of decision support tools was suggested as a means of tackling this problem. It was recognised, though, that there are a vast amount of available and relevant data as well as existing tools and techniques. Integrating this material in some way would be beneficial; however, a project-based approach, which SURPLUS is meant to be, may not be the most appropriate way to take such a system forward.

The issue of whether novel risks should be anticipated through specific modelling exercises or through improved availability of and access to data and expert knowledge was also touched upon. The Foot and Mouth crisis was mentioned as an example of an unanticipated event to which, nonetheless, a speedy response was possible due to the availability of many different datasets. Also, while ex-ante evaluation is important for evidence based policy, so are interim and ex-post evaluations.

Conclusions

The Consultation phase has revealed a substantial level of interest in the SURPLUS project and need for improved methods for appraising changes in the rural economy and land use. There was a broad agreement over the 5-20 years time horizon. The results reinforced the view that seeking to develop a toolbox of approaches, rather than a single model, is the right way to proceed. The tools and techniques selected or developed for the SURPLUS toolbox will, between them, need to be capable of dealing with a much wider range of drivers and impacts than 'traditional' models of land-use. At the same time it is clear that changes in 'external' conditions will mean that it will not be possible to test and validate many of the tools and techniques against historic data. Another key challenge will be the development of spatially disaggregated models of land

use and land cover with a high enough level of resolution to allow the investigation of local environmental and biodiversity impacts. Dealing with social impacts in a coherent and effective manner is also likely to require significant further attention.

All of this points to the fact that, in some cases, entirely new or radically revised, tools and techniques may be required. More work will also be needed on specifying how to link different types of tools and techniques. We have identified tools and techniques for consideration, as well as a number of projects in which related issues are being addressed, which may be able to provide important insights for the SURPLUS project.

The Environment Agency expressed a clear interest in providing collaborative funding to develop a set of land-use scenarios. We do caution against simply trying to adapt existing scenarios, such as those of the Foresight Futures 2020 project, for this purpose. It is important to ensure that the timeframes and policy drivers of concern in any scenario exercise are appropriate for their intended use. Opportunities for collaborative funding through the Rural Economy and Land Use programme should also be actively investigated. Other potential policy customers in Defra, other government departments, agencies, and the devolved administrations are likely to require much more specific proposals, which clearly add value to existing approaches and are likely to deliver usable results, before offering co-funding.

In light of the above, it is clear that a number of the objectives for the SURPLUS project, as currently drafted, lack clarity and may be too broad ranging to be effectively operationalised. Thus, they will need to be redrafted in a manner that more clearly circumscribes a specific set of challenges and (hopefully) achievable outcomes. For the moment, it was decided, in consultation with the Steering Committee, that the objectives of the SURPLUS project, should be slightly rephrased to read:

- Develop cost-effective tools and techniques for assessing trends as well as forecasting and anticipating future changes in rural economic and social activity and land use, and their environmental impacts and social consequences over 5-20 year timescales;
- Test and evaluate the tools and techniques and provide assessments of the uncertainty of forecasts and sensitivities with regard to input assumptions;
- Ensure that the tools and techniques are relevant and useful to policy customers in Government departments and agencies, nationally and regionally;
- Ensure that the tools and techniques build on or link with existing methods and experience and utilise existing data as far as possible; and
- Apply the tools and techniques to a range of policy issues as identified in the Rural White Paper Our Countryside: The Future, the England Biodiversity Strategy and the Strategy for Sustainable Farming and Food and refined during consultations undertaken for the scoping study.

This still leaves important questions about the breadth of the objectives. It also does not clearly address the concerns about the fundamental (in)ability to make forecasts and deal with uncertainty, using classical approaches, with respect to the complex issues that a SURPLUS toolbox is intended to address, or the ability to test and evaluate many of the tools and techniques. These issues will need to be revisited in the remainder of this Scoping Study. The next phase, Evaluation, is looking in detail at the available tools and

techniques in light of the conclusions of this Background phase. The final phase, Technical specification and reporting, will provide a number of options, including more detailed specifications, for moving forward with the full SURPLUS project.

1 Introduction

The Appraisal of Sustainable Rural Policy and Land Use (SURPLUS) Scoping Study forms part of the Defra Horizon Scanning Programme and is co-funded by the Treasury's Evidence-Based Policy Fund. Its aim is to guide the further development and implementation of the SURPLUS project. Specifically, it will:

- Confirm the user requirements and refine the objectives for the overall project
- Assess the feasibility of using various modelling and other foresight approaches to achieve the objectives of the overall project, and
- Develop technical specifications and determine funding arrangements for its implementation.

It is divided into three phases:

- **Consultation:** This phase will focus on a review of academic and policy literature; targeted interviews with approximately 10-12 policy makers and technical experts; and a one day workshop with 25-30 similar persons.
- **Evaluation:** A variety of tools and approaches for meeting the objectives of the overall SURPLUS project will be critically evaluated against an agreed set of criteria
- **Technical specification and reporting:** A detailed report will be prepared, together with (if appropriate) a technical specification and costing for proceeding with the full project.

The results from the scoping study will be used to guide any future development of the SURPLUS project. The final report from the study will include recommendations as to whether to proceed with the SURPLUS project, challenges and limitations to be addressed, and, if appropriate, a technical specification for the full project.

The SURPLUS project aims to improve the ability of Defra and other organizations to carry out policy appraisal, based on a full assessment of future changes in land use, recreation, amenity and rural economic activity, and the impact of such changes on the rural environment and rural communities. It will consider the interactions between policies related to, among other issues, agriculture, forestry, rural development, landscape and recreation, and biodiversity, as manifest in rural land uses and their environmental, economic and social attributes and impacts. In particular, it will focus on improving the assessment of sustainable land management options with respect to the delivery of biodiversity targets, enhanced economic and employment opportunity and quality of life indicators.

The SURPLUS project is driven by the increasing demand for evidence-based policy appraisal and concerns about the ability of existing approaches to satisfy this demand. Governments, including that of the UK and the devolved administrations, have set or agreed on ambitious targets for rural areas and have also made specific commitments in such areas as sustainable development[4], farming and food production[5],

[4] *Foundations for our Future: Defra's Sustainable Development Strategy*, Defra, 2002

and the protection of biodiversity6. At the same time, the existing approach to rural policy is facing major challenges in the face of, among other factors, trade liberalisation in agriculture, increasing population mobility, changing social expectations, concerns about food safety, animal welfare and biotechnology, and long term climate change.7 Furthermore, the current evidence base for the appraisal of rural policy under these circumstances may be inadequate. In general, the current approach relies heavily on historical trends and past experiences, and targets are essentially retrospective - seeking to restore or replace what has been lost in the recent past. It is unclear if tools are readily available to the policymaker to project forward current trends in an integrated way or to review the possible consequences of alternative policy scenarios.

Defra's initial objectives for the SURPLUS project are stated as:

- Develop cost-effective tools for assessing trends as well as forecasting and anticipating future changes in direction in rural economic and social activity and land use and their environmental impacts and social consequences, over 5-20 year timescales;
- Test and evaluate the tools with empirical data and provide measures of the uncertainty of forecasts and sensitivities with regard to input assumptions;
- Ensure that the tools are relevant and useful to policy customers in Government departments and agencies, nationally and regionally;
- Ensure that the tools build on or link with existing methods and experience and utilise existing data as far as possible; and
- Apply the tools to a range of policy issues as identified in the Rural White Paper *Our Countryside: The Future, the England Biodiversity Strategy and the Strategy for Sustainable Farming and Food* and refined during consultations undertaken for the scoping study.

This report presents the results of the Consultation phase of the Scoping Study. The purpose of this phase has been to establish a context for the full SURPLUS project, including a preliminary revision of the stated objectives. It has set the stage for the next phases of the Scoping Study, namely, Evaluation and Technical specification and reporting. The specifics of these phases are being modified to reflect the insights gained during the Consultation phase. This is being done by the study team in concert with the Scoping Study Steering Committee.

Following the tripartite nature of the work plan that has been followed, this report will discuss the results from the literature review, targeted interviews, and stakeholder workshop in turn. It will then bring together the lessons drawn from these activities in order to provide some general insights relevant for the Scoping Study and the full SURPLUS project.

[5] *The Strategy for Sustainable Farming and Food; Facing the Future*, Defra, 2002
[6] *Working with the grain of nature: A biodiversity strategy for England*, Defra, 2002
[7] *Our Countryside: The Future – A Fair Deal for Rural England*, Cm4909, DETR, 2000

2 Review of Academic and Policy Literature

The review of academic and policy literature has had, as its primary purpose, the identification of key contacts, policy and technical documents and related projects that are of interest for the SURPLUS project. Doing so provided the basis for the selection of interviewees and invitees to the stakeholder workshop, as well as delimiting the range of material to be included in the Evaluation phase of the Scoping Study. Although the Evaluation phase has started, it is not the purpose of this document to provide the detailed results of this work to date. That will be the primary focus of the forthcoming evaluation report.

This section will focus on summarising the policy background, projects, and tools and techniques identified. In the process of doing this identification, a list of more than 90 contact persons, primarily within the UK, who were or are associated with particular policies, project, or tools and techniques, had been drawn up (see Appendix A). As to be expected, the actual interviews and the stakeholder workshop have added to the number of contacts and the range of items for potential consideration, making this review an ongoing process.

2.1 Policy Background

The processes of land-use, land use change and their resulting impacts are driven by a wide range of factors, many with their ultimate origins in the policy arena. They can take the form of statements of general policy, including goals and objectives, legislation, action programmes, and specific projects. They can also originate from different levels of government, ranging from the very local to the global.

The original remit for the SURPLUS project highlighted issues of sustainable development[8] and rural development[9], with an emphasis on agriculture[10] and biodiversity[11], placing these in a UK, or more precisely English, context. As a result of the discussions during the First Steering Group meeting for the Scoping Study, it was decided to maintain this geographic focus, without ignoring some of the controlling factors at other spatial scales, particularly at the level of the European Union (EU). It is hoped that the resulting project will be of interest to governments elsewhere in the UK, if not further afield. It was clear, though, that the topic areas could and should be broadened

Several policy drivers have been identified at the EU level that need to be considered for the SURPLUS project. Those receiving the most attention recently have been the Common Agricultural Policy (CAP), its recent reforms, and the Water Framework Directive (WFD). However, other initiatives and directives also have important influences on land use. A number of these are listed below:

- Common Agricultural Policy (CAP) and CAP Reform.

[8] Defra (2002). Foundations for Our Future - Defra's Sustainable Development Strategy. London, Department of Environment, Food and Rural Affairs.
[9] DETR and MAFF (2000). Our Countryside: The Future - A Fair Deal for Rural England. London, Department of the Environment, Transport and the Regions, Ministry of Agriculture, Fisheries and Food.
[10] Defra (2002). The Strategy for Sustainable Farming and Food: Facing the Future. London, Department of Environment, Food & Rural Affairs.
[11] Defra (2002). Working with the Grain of Nature: A Biodiversity Strategy for England. London, Department for Environment, Food & Rural Affairs.

- Water Framework Directive: Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.
- Bathing Water Quality Directive: Directive 76/160/EEC Council Directive of 8 December 1975 concerning the Quality of Bathing Water (76/160/EEC)
- Drinking Water Directive: Council Directive 98/83/EC on the quality of water intended for human consumption.
- Habitats Directive: Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
- Birds Directive: Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds.
- Natura 2000: Council Directive 97/62/EC of 27 October 1997 adapting to technical and scientific progress Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.
- Nitrates Directive: Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources.
- European Spatial Development Perspective.
- EU Structural Funds:
- the European Regional Development Funds. (ERDF)
- the European Social Fund. (ESF)
- the European Agricultural Guidance and Guarantee Fund. (EAGGF - Guidance Section)
- the Financial Instrument for Fisheries Guidance. (FIFG)
- EU 6th Environmental Action Programme (Environment 2010: Our Future, Our Choice): Decision No 1600/2002/EC of the European Parliament and of the Council of 22 July 2002 laying down the Sixth Community Environment Action Programme.
- A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development. Brussels, European Commission.
- Cork Declaration: Towards an Integrated Rural Development Policy.
- EU Rural Development Regulation: Council Regulation (EC) No 1257/1999 of 17 May 1999 on support for rural development from the European Agricultural Guidance and Guarantee Fund (EAGGF) and amending and repealing certain Regulations.

Within the UK, there are general policies on sustainable development and rural development, as well as policies specific to particular issues or sectors. Among the latter are policies related to agriculture and the rural economy, biodiversity, the countryside, energy, environmental planning, forestry, and soils. A selection of the key documents related to these is noted below in order to give an idea of the range of policies that need to be considered. Further documentation, particularly related to the implementation of proposed strategies and reports on progress have also been gathered and are being reviewed, but are not listed here.

- Sustainable Development.
  - Defra (2002). Foundations for Our Future - Defra's Sustainable Development Strategy. London, Department of Environment, Food and Rural Affairs.
  - DETR (1999). A Better Quality of Life: A Strategy for Sustainable Development for the UK. London, Department of Environment, Transport and the Regions.
  - Rural Development:
  - England Rural Development Programme (ERDP), including various schemes.
  - Agriculture/Rural Economy:
  - Defra (2002). The Strategy for Sustainable Farming and Food: Facing the Future. London, Department of Environment, Food & Rural Affairs.
  - DETR and MAFF (2000). Our Countryside: The Future - A Fair Deal for Rural England. London, Department of the Environment, Transport and the Regions, Ministry of Agriculture, Fisheries and Food.
- Biodiversity:
  - Defra (2002). Working with the Grain of Nature: A Biodiversity Strategy for England. London, Department for Environment, Food & Rural Affairs.
  - DETR (2001). Sustaining the variety of life: 5 years of the UK Biodiversity Action Plan. London, Department of Environment, Transport and the Regions.
- Countryside:
  - CEH and DETR (2000). Accounting for nature: Assessing Habitats in the UK Countryside. London, Centre for Ecology & Hydrology, Department of the Environment, Transport and the Regions.
  - Tomorrow's Countryside - 2020 Vision: The future of the countryside and the Countryside Agency's role in shaping it. Wetherby, Countryside Agency.
- Energy:
  - Department for Transport and Defra (2003). Our Energy Future - Creating a Low Carbon Economy (Energy White Paper). London, Department for Transport, Department of Environment, Food & Rural Affairs.
  - Forestry:
  - Forestry Commission (1998). The UK Forestry Standard: The Government's Approach to Sustainable Forestry. Edinburgh, Forestry Commission.
  - Forestry Commission (1999). England Forestry Strategy - A New Focus for England's Woodlands: Strategic Priorities and Programmes, Forestry Commission.
- Soils:
  - DETR (2001). The Draft Soil Strategy for England - A Consultation Paper. London, Department of Environment, Transport and the Regions.
  - Projects

Not surprisingly, there have been, and continue to be, a number of research programmes and specific projects that focus on issues of interest for the SURPLUS project. The most significant of these are described below, separated in to previous and current/ongoing efforts at the UK and the EU/International levels:

- Previous UK:

- MEILUC (Modelling the Environmental Impact of Land-Change), funded by MAFF. This was, in effect the precursor to the current Scoping Study, but had a somewhat narrower focus.
- NELUP (NERC-ESRC Land Use Programme), funded by NERC and ESRC. This programme established a "decision support system" (DSS) comprising a complex database and "three component sets of models" – agricultural-economic, ecological, and hydrological. It focused on the environmental implications of agricultural land use.
- UK Foresight Futures 2020: part of DTI's Foresight Programme. This project developed a set of four alternative scenarios of change in the UK over the next 20 to 30 years. These have been used intact or as the basis for further scenario development in a number of other studies, including many projects under the UK Climate Impacts Programme.
- UK Foresight Flood and Coastal Defence: part of DTI's Foresight Programme and commissioned by Office of Science and Technology. This project aimed to use the best available science to provide a challenging vision for flood and coastal defence in the UK between 2030 and 2100 and so inform long-term policy.

- Ongoing and Future UK:
  - MONARCH (Climate Change and Nature Conservation in Britain and Ireland): UK Climate Impacts Programme. Phase 1 investigated the potential impacts of climate change in Britain and Ireland on a range of species and habitats. Phase 2 aims to downscale this approach in order to provide a detailed understanding of impacts on ecosystem processes, which can then be applied to addressing nature conservation objectives within the context of climate change.
  - REGIS (Regional Integrated Assessment of Climate Change Impacts in the North West and East Anglia): commissioned by Defra and UK Water Industry Research under the UK Climate Impacts Programme. The purpose of Phase 1 was to investigate the impacts of climate and socio-economic change, using computer modelling and stakeholder discussion. Phase 2 will focus on the development of a metamodel tool for regional integrated climate change management.
  - REWARD (Regional & Welsh Appraisal of Resource Productivity & Development): undertaken by the Environment Agency and a number of region development agencies. This is a partnership project working to ensure that 'Regional and Welsh strategies are fully coordinated between economic development, resource productivity and environmental protection'. It includes the development of regional economy-environment input-output model.
  - Tyndall Centre Integrating Frameworks: variety of projects to undertake policy analyses on climate change issues relevant to the UK in particular. A key objective is to advance the scientific methods used for the analysis of climate change.
- Past EU/International:
  - ACCELERATES (Assessing Climate Change Effects on Land use and Ecosystems: from Regional Analysis to The European Scale): EC Fifth Framework project. Its purpose was to examine the relationship between agricultural land use responses to environmental change drivers and

environmental protection, as reflected specifically in the management of biological resources.

- IMPEL (Integrated Model to Predict European Land use): EC Fourth Framework project. This project focused on the development and application of modelling methodologies to assess agricultural land use change in a range of European demonstration regions.

- Ongoing and Future EU/International:
  - ALARM (Assessing LArge-scale environmental Risks with tested Methods): EU Sixth Framework Integrated Project. This project will develop and test methods and protocols for the assessment of large-scale environmental risks in order to minimise negative direct and indirect human impacts. The research will focus on assessment and forecast of changes in biodiversity and in structure, function, and dynamics of ecosystems. In particular, risks arising from climate change, environmental chemicals, biological invasions and pollinator loss in the context of current and future European land use patterns will be assessed.
  - BIOPRESS (Linking Pan-European Land Cover Change to Pressures on Biodiversity) This is one of the thematic projects being carried out within the framework of the initial phase of the Global Monitoring for the Environment and Security (GMES) programme. It will provide decision makers with quantitative information on how changing land cover/use has affected the environment and biodiversity in Europe. The project is currently producing historical (1950–2000) land cover change information in and around Natura2000 sites, which will be converted into information on pressures on biodiversity.
  - ESPON (European Spatial Planning Observation Network Programme): funded under EU-Community Initiative INTERREG III. This contains a series of projects focussing on spatial development and planning seen from the national, regional and local points of view, some integrated tools and appropriate instruments (databases, indicators, methodologies for territorial impact analysis and systematic spatial analyses) to improve the spatial co-ordination of sector policies.
  - LUCC (Land-Use and Land-Cover Change): This is a programme element of International Geosphere-Biosphere Programme and International Human Dimensions Program on Global Environmental Change and supports various projects. It is an interdisciplinary programme aimed at improving the understanding of land use and land cover change dynamics and their relationships with the global environmental change.
  - MATISSE (Methods and Tools for Integrated Sustainability Assessment): EC Sixth Framework Integrated Project. The objective of this project is to achieve a step-wise advance in the science and application of Integrated Sustainability Assessment (ISA) of EU policies, with the core activity being to improve the tool kit available for conducting Integrated Sustainability Assessments.
  - SENSOR (Sustainability Impact Assessment: Tools for ENvironmental, Social and EcOnomic Effects of Multifunctional Land Use in European Regions): EU Sixth Framework Integrated Project. This project aims at delivering ex-ante Sustainability Impact Assessment Tools (SIAT) to support decision making on policies related to multifunctional land use in European regions.

2.2 Tools and Techniques

Quite a number of tools and techniques exist that may be of interest for the SURPLUS project. These run the gamut from qualitative to quantitative tools and from participatory to expert-based processes. The forthcoming evaluation report will provide more detail on specific tools and techniques. For the moment it is useful to sketch out the categories into which these fall:

- 'Meta'-Tools/Checklists: these often take the form of checklists that are meant to be gone through by a single expert or a small group in the process of developing a policy or programme; their primary purpose is to ensure that a wide range of potential impacts is considered.
- Exploratory scenarios and backcasting: these include qualitative, quantitative, and mixed scenario exercises. They can be self-contained, i.e. they embed important policy and planning decisions, or they can be used to explore the impacts of these decisions under alternative plausible futures. Exploratory scenarios and backcasting exercises fundamentally differ in that the former asks the question 'what if x happens?' and the latter 'how can we reach state y?'. Still, they are often used in conjunction within a single exercise.
- Policy simulation tools and Games: these tools, which are becoming increasingly computerised, are based upon underlying models of system behaviour. The user(s) is placed in a role playing situation where they are given the opportunity to learn more about the system and the effects of particular decisions and external events.
- 'Soft' tools: these include a variety of expert and participatory approaches e.g. Delphi and expert workshops. Their intent is to share and elicit information on particular aspects of issues of concern.
- Macro-level sectoral models: these primarily include partial or general equilibrium economic models, often with a focus on the agricultural sector; they are generally not spatially explicit in the sense of linking economic behaviour directly to land use, although they often separate out the economic activity by country or region.
- Regional economic models: these also include partial or general equilibrium economic models, but try to provide a comprehensive picture of the economy in a particular region, including various sectors, as opposed to emphasising a single sector across a number of regions.
- General land use change models: these include systems constructed with the primary purpose of examining general land use change as a result of a range of pressures; they are almost always spatially explicit, with a strong GIS component; the representations of macro- and micro-level behaviour are often highly simplified.
- Agent-Based Social Simulation models in the context of land use: these include more specific tools in which agent-based models are used to improve the representation of individual and collective behaviour in relation to land use.
- Agricultural land use and impact models: these include systems constructed with the primary purpose of examining the impact of changes in agriculture (e.g. policy

or market changes) either on agricultural characteristics (incomes and farmland use, etc.) and, in some cases, related land uses (e.g. water flows and diffuse pollution).

- Environmental Impact models: these are systems constructed with a primary focus on the environmental impacts (e.g. changes in biodiversity and water quality) of various pressures, including land use change; they tend to be spatially explicit.
- Social Impact models: these are systems constructed with a primary focus on the social impacts (e.g. community stability and gender effects) of various pressures, including land use change. To date very few, if any, such models actually exist, reflecting a basic lack of understanding of many of the underlying processes. Certain elements of social impacts are addressed in some other tools and techniques, however.

Associated with these tools and techniques, there is a certain amount of 'supporting material'. By this, we specifically refer to data and indicator sets. The former provide basic information on any number of factors, but for the purposes of the SURPLUS project, data on land use, land cover, and environmental pollution, at various scales, is most significant. In the UK, much of this data is available though the Countryside Information System, which includes, among other data, that from the Countryside Surveys. At level of the EU, the primary source is the CORINE (Co-ordination of Information on the Environment) land cover data base. Indicator sets combine information from a number of sources, including data sets, and generally have a more normative element in that they are often used to measure progress in achieving goals. The most comprehensive try to capture economic, environmental and social elements. In the UK, much of this is being pursued under the general auspices of the Quality Of Life Counts, which includes indicators at the national, regional and local levels. Moving up the geographic scale, there are the efforts of the European Environment Agency (EEA), Organization for Economic Cooperation and Development (OECD), and UN Commission of Sustainable Development (UN/CSD).

These tools and techniques should not be seen as exclusive and are commonly used in combination. Many of the economic models include environmental impact components and vice versa. Land-use change models are often intimately linked to specific land-use datasets. More or less detailed economic and environmental impact models are frequently used in filling out the checklists. Scenario development can make use of many of the modelling and participatory tools. Many of the more technical tools are used directly in participatory settings. Such existing and potential linkages will be explored further in the Evaluation phase of the Scoping Study, as this lies at the heart of the SURPLUS project.

3 In-Depth Interviews

From the list of key contacts, thirteen persons were chosen for in-depth interviews: six policymakers and seven academic and technical experts. These semi-structured interviews were conducted, either face to face or via telephone, between January and March 2004 by various members (Dale S. Rothman, Malcolm Eames and Kristina Dahlstrom) of the project team. Each interview lasted between approximately 60 and 90 minutes.

The purpose of the interviews was to elicit information from specific experts on the proposed objectives of the SURPLUS project, key drivers and impacts associated with the rural economy and land use change, and appraisal tools and techniques that have been or could be used to assess these drivers and impacts. In addition, the interviewees were asked to provide additional information on specific persons, tools and techniques, and projects with which we should be engaging in the Scoping Study. We also discussed the level of personal and institutional interest in the SURPLUS project, including, where appropriate, the possibility of co-funding such an endeavour.

A list of those interviewed is included in Appendix B to this report, which also includes the protocols used to structure the interviews with both the policy and technical experts. In this section we summarise the main findings from those interviews.

Objectives and purpose of the SURPLUS project

The interviews revealed a substantial level of interest in the proposed SURPLUS project and recognition of the need for improved methods of appraising the sustainability of policy with respect to changes in the rural economy and land use. A number of those interviewed, particularly from the policy side, drew attention to the increasing need for such tools given:

- The declining importance of agriculture.
- The shift in recent years towards a broader set of rural policy objects incorporating the environmental, social and economic dimensions of SD.
- The fact that the 'rules of the game' where being changed by CAP reform, and that there was therefore much greater uncertainty about agricultural land-use.
- The increasing pressure on the countryside from recreation and house building and economic development.

At the same time almost all of those interviewed felt that the draft objectives for the SURPLUS project were very ambitious. Indeed, several interviewees doubted that they would be realistically achieved given the 'current state of the art'.

There was broad agreement that no single method or model of appraisal would be appropriate, and that seeking to develop or identify a toolbox of approaches was therefore the right way to proceed. It was also noted that a key challenge would be how to link different types of models and tools in a robust manner.

There was also broad, although not universal, agreement on the 5-20 year time horizon identified in the SURPLUS objectives. A minority of those interviewed felt that this time frame would not be long enough to pick-up climate change impacts and other longer-term environmental changes.

There was no consensus on the most appropriate spatial scale of analysis for SURPLUS to focus upon. It rapidly became clear that this was because the answer to this question would depend upon the specific policy questions or impacts with which one was concerned.

In terms of geographical focus, whilst national level policymakers, for example those in Defra, were predominately concerned with national policy in England and Wales, there was a widespread recognition of the increasing importance of regional level policymaking. For other institutions, however, the relevant sub-national scales might be their organisational regions or water catchments. From the technical side several

interviewees suggested geo-climatic regions as possible foci. At the same time many interviewees noted that many of the drivers of change, even those manifesting themselves at a regional or micro-level (of the single field or 1km square), came from a European or even global level.

Finally, several interviewees drew attention to the need to distinguish between land use and land cover for assessing certain types of environmental impacts, particularly bio-diversity impacts.

Key drivers and impacts

Both the policy and technical interviewees drew attention to a wide range of social, economic, environmental and policy/political drivers of change. These grouped around a number of main themes:

- Globalisation, the liberalisation of trade in agricultural products and CAP reform.
- The historically declining importance of agricultural production as a proportion of GNP, falling agricultural employment and increased mechanisation.
- Policy and market incentives for the expansion of organic and less resource intensive agricultural systems.
- Changes in agricultural technology, such as continued mechanisation but also possible breakthroughs for GM crops.
- Continued diversification, away from agriculture, within the rural economy.
- The growing importance of recreational activities to the rural economy and associated pressures of greater public access, particularly in 'honey pot' sites such as national parks.
- The Government's planned expansion of house building and associated construction activity, particularly in the South East of England.
- Broader pressures on the rural environment resulting from continued economic growth.
- Demographic changes, particularly the ageing farming population.
- Changing social attitudes to the importance of landscape conservation and environmental protection.
- Climate change and climate adaptation policies, including the expansion of biomass for energy generation.
- Regulator pressures, such as tighter controls on diffuse pollution under the Water Framework Directive and possible changes in planning controls resulting in the spread of urban developments.

With respect to impacts, interviewees identified a long list of fairly standard environmental impacts including:

- Acidification and diffuse nitrogen and phosphorous pollution.
- Climate change, including secondary impacts such as the intrusion of alien species.
- Flood risk and management.
- Water quality and demand/stress.
- Demand for resources, particularly aggregates.

- Soils erosion and soil quality.
- Biodiversity loss.
- Landscape and visual amenity.
- Noise.

Interviewees were generally less forthcoming with regard social and economic impacts. Those mentioned included changing employment opportunities, the loss of traditional agricultural skills (such as dry-stone-walling), and broader impacts on the social cohesiveness of rural communities.

Appraisal tools and techniques

Several of the policy makers interviewed mentioned the need for improved policy simulation tools to allow them to better explore the likely sustainability impacts of proposed policy changes, or the policy changes necessary to achieve improvement in relevant indicators or policy targets.

The Environment Agency in particular was keen to see the development of a set of land-use scenarios that could be used to inform the work of a number of government departments and agencies.

A number of interviewees expressed scepticism concerning the ability of quantitative modelling approaches to deliver robust, spatially disaggregated, policy relevant outcomes. In particular, it was suggested that such approaches tend to be too data hungry and site specific. It was therefore suggested that greater attention should be paid to exploring the potential of qualitative and combined quantitative-qualitative approaches.

Another important theme was the potential value of fairly simple checklist and decision-tree type tools for many policymakers, particularly those working outside of central government and other stakeholders.

On the other hand, several interviewees also drew attention to: the role of IT in reducing the cost and complexity of data collection and processing; the increasing sophistication of modelling approaches; and, advances in the use of GIS for handling and representing large amounts of spatial data.

There was a widespread recognition by many of the interviewees that changes in ‘external’ conditions meant that it would be impossible to test and validate tools and models. The lack of consistent and long time series of historic data would also militate against this in some cases.

The interviews also highlighted an important tension between policymakers’ needs for quantitative outputs, matched to policy indicators and targets, and the research community’s ability to deliver robust numbers. On a related point several of the technical experts drew attention to the difficulties of representing uncertainty in a way that engaged policymakers.

Finally, several interviewees also mentioned the need for both quantitative and qualitative tools to be ‘transparent’ if policymakers were to have confidence in and to use their results. It should be noted, though, that many extremely complex quantitative models that do not satisfy this criterion are routinely used in different areas of environmental and economic policymaking. Furthermore, at least one interviewee raised a concern about a trade-off between transparency and simplicity. Transparent models

have to be quite simple and simple models do not necessarily capture the complexity of reality.

4 STAKEHOLDER WORKSHOP

The third component of the Consultation phase of the Scoping Study was a stakeholder workshop. This was held on March 24th in the Policy Studies Institute's Conference Centre in London and brought together 24 stakeholders from government and academia. In this particular instance, stakeholders were taken to mean the policy and decision makers potentially interested in funding the full SURPLUS project and/or using its results and the technical experts with knowledge related to the development of the set of tools that will likely comprise the outcome of the full project. Thus, it did not include members of the general public. The list of participants, along with the agenda and slides from the morning presentations are included in Appendix C of this report. As with the interviews, we focus here on the highlights from the workshop and their implications for the further progress of the Scoping Study and the full SURPLUS project.

The aims of the workshop were to introduce the SURPLUS project and the Scoping Study to the stakeholders and to refine the project objectives. The goal was to do so by exploring, through a series of brainstorming sessions, the kinds of questions that any appraisal tools and techniques used or developed in the project should be able to address and the kinds of tools and techniques that should be considered. In this way, it was very much designed as a complement to the interviews and literature searches also going on during this phase of the Scoping Study.

4.1 Presentations

Defra's Horizon Scanning and Futures Programme

Rohit Talwar introduced Defra's Horizon Scanning Programme, which, together with the Treasury's Evidence-Based Policy Fund, funds the SURPLUS Scoping Study. Horizon scanning is defined by Defra as "the systematic examination of potential threats, opportunities and likely future development which are at the margins of current thinking and planning". The goals of the programme are to improve Defra's resilience and capability to anticipate and prepare for new risks and opportunities; to challenge and extend Defra's thinking on future science and environmental challenges; and to engage staff from across Defra and encourage high quality external contributions.

The interdisciplinary programme currently has five research themes:

- Future Landscapes.
- Coping with Threats.
- Meting People's Future Needs.
- Re-Thinking the Food Economy.
- Environmental Constraints.

The SURPLUS Project

Andrew Stott from Defra and chair of the Steering Committee for the Scoping Study gave a brief presentation on the background to and current context of the SURPLUS project. He started by recalling a study in the late 1990s, Modelling

Environmental Impacts of Land Use Change (MEILUC), which pointed out a number of concerns about existing modelling capabilities, including their link to the needs of policy makers, data demands, etc. This study also suggested developing a model based on the work of the Countryside Survey.

He noted that this recommendation was not followed up on at the time, but other modelling and scenarios work has proceeded in the UK and the rest of Europe; in addition, data availability has been increasing. At the same time, the more recent policy context, including such aspects as the Defra's Sustainable Development Strategy and Sustainable Food and Farming Strategy, Quality of Life Indicators and Countryside Quality Counts, UK Biodiversity Action Plan, CAP Reform and Rural Development Strategies, and Water Framework Directive have all increased the need for such a tool or set of tools. Furthermore, Defra's Horizon Scanning Programme and the Treasury's Evidence Based Policy Fund have pointed toward the need for new forms of analysis.

He then introduced the SURPLUS project as a possible next step in this process. He cited its aims to improve the ability of Defra, and other organisations and policy makers, to carry out policy appraisal, based on a full assessment of future changes in land use, recreation, amenity and rural economic activity and the impact of such changes on the rural environment and rural communities. He noted it will consider the interactions between policies related to, among other issues, agriculture, forestry, rural development, landscape and recreation, and biodiversity, as manifest in rural land uses and their environmental, economic, and social attributes and impacts. He spelled the initial objectives for the SURPLUS project in this light.

He also pointed out a number of areas and initiatives the SURPLUS project might be expected to draw upon and contribute to. These include looking at the environmental effects of CAP reform, use of the Countryside Survey, and better understanding habitat and biodiversity throughout the UK change in recent years. He presented one idea of SURPLUS as developing scenarios focussing on the pressure, state, and impact components of the DPSIR framework[12]. He challenged the participants to think about our capacity to anticipate future changes in the countryside. What are the priorities? Is our understanding good enough? Do we have sufficient information? Do we have the right tools? Does SURPLUS offer a way forward?

SURPLUS Scoping Study

Dale S. Rothman introduced the SURPLUS Scoping Study and its objectives, noting that the results from the Scoping Study will be used to guide any future development of the SURPLUS project. He mentioned that the final report from the study will include recommendations as to whether to proceed with the SURPLUS project, challenges and limitations to be addressed, and, if appropriate, a technical specification for the full project.

He reviewed the tangible outputs and then noted the important intangible outputs from the study, which will include better communication within and between groups of tool users and tool makers, a better understanding of the strengths and limitations of existing tools and a broader perspective on appropriate tools for ex ante policy appraisal. He also reviewed the work plan of the scoping study and its progress to date, focussing on key challenges that emerged from the interviews and literature reviews.

[12] D stands for Driving Forces and R for Responses

4.2 Breakout Discussions

What Questions Would You Ask of a Surplus Toolkit?

After these introductions, workshop participants were asked to imagine that a 'SURPLUS toolkit' had been developed and was available for appraisal of sustainable rural policy and land use issues over the 5-20 year timescale. They were then asked to think of questions for which they would employ the SURPLUS toolkit to answer.

The questions were many and varied, demonstrating the range of interests and organisations represented at the workshop. The range of questions is displayed in Table 1. The questions raised can be classified into four broad categories, as reflected in the small group discussions. These are specifically: 1) questions of correlation or causality, e.g. what is the effect of x on y; 2) questions on how to achieve a policy goal; 3) questions regarding the prioritisation or ranking of different options; and 4) more specific questions on impacts, often with a predominantly spatial focus. Clearly, there is some overlap between these questions. Within each category some questions are more complex than others and data gaps may be considerable for some of the issues. It was also pointed out that the questions were hard to refine in the absence of knowledge about the precise tools available for their appraisal.

These four categories can be further aggregated into two overarching themes. The first and fourth are questions of the type 'what is happening'; the second and third are more of the type 'what would we like to happen'. It was recognized that these would require different sorts of tools. The latter, in particular, necessitate a clear vision of what a desired future state or states might look like. Another important message from the discussion was the need to identify the drivers which can be influenced, and the relationships between different variables.

Finally, there were a substantial number of questions which related to the nature of data and the processes of appraisal. Data questions were concerned with the robustness and transparency of data, as well as the issue of how to parameterise data for prediction. Process questions indicated a desire for better guidance on stakeholder involvement; communication of results across disciplines and users; and methodologies for realising the benefits of multi-functionality in land use in rural areas.

Table 1: Questions suggested for the SURPLUS toolkit

Effect of x on y: What?	• What is effect of changing farm payments rate on land use? • What is the effect of a change in land management on water quality? • What are the biodiversity impacts of growing bioenergy crops in the UK? • What is the impact on crop yields of a predicted climate change? • What are the impacts on regulatory activities of the Environment Agency from the environmental consequences of a certain land use change? • What is the change in land use if the demand for red meat increases/decreases over the next 20 years?
Achieving a policy goal: How?	• How do we achieve the Government's targets of halting or reversing the decline in farmland bird populations? • How can natural resource protection be ensured in areas of economic regeneration? • How can we manipulate land use to maintain or improve aquifer recharge and reservoir filling? • How can land use be changed to solve existing issues? How might such land use change cause new issues?

Prioritisation / ranking: Options?	• What is 'society' prepared to pay to preserve a particular type of land use? What are the second-best land use options? • What are the costs and benefits associated with a certain land use change? • What are the costs and benefits associated with social and environment impacts? • What are the most important drivers of land use change in the Lake District? • Which land uses are the most valued (stakeholder specific)?
Impacts, incl. Spatial Detail: Where?	• Where will be the key areas of social and economic need? • What percentage of land in x years will be classified as rural/urban/fringe? • How will the spatial pattern of social exclusion change in the future? • What is the extent of soil erosion?

How Could These Questions Be Answered?

In the afternoon, the participants were asked to select one or more questions from the previous session and consider a strategy for how these might be addressed. The facilitators provided a set of guiding points for this exercise. Specifically the participants were asked to think about the relevant geographical or institutional scale for analysis; tools or techniques that could be used; the data that would be needed; and the strengths and weaknesses of the proposed methodologies.

The discussion that followed pointed to a certain amount of confusion as to the purpose of the session. It was apparent that much of the SURPLUS terminology is confusing and could benefit from clarification; terms such as 'tools', 'models', 'scenarios' need to be better defined. Another source of confusion related to the fact that data, information and tools are more accurately represented as a continuum rather than separate entities. Similarly, the question of scale can become muddled, not only because drivers and impacts tend to work over different spatial scales, but also because the scale of the available data differs from the scale of the drivers and impacts.

In spite of these concerns, the groups did manage to provide some responses to the guiding points presented by the facilitators. Tables 2-4 show three examples for particular questions.

Table 2: Example question 1
Given the current understanding of drivers of change, will the decline of farmland birds be reversed by 2020?
Scale: National and regional.
Tools/approaches: Projection techniques and simplified models of bird population and habitat dynamics and co-dynamics. Data knowledge management systems for relating different sets of data.
Data/information: bird populations, land cover, land use, meteorological data, farmer attitudes and behaviour, land management, etc.
Strengths/limitations: Evidence based and with an explicit causality. It is data intensive, but a lot of the data exists, some responses would be unknown or uncertain.

Table 3: Example question 2
What are the most important drivers of land use change in the Lake District?
Scale: Many important drivers at the European (e.g. biosecurity; CAP) and national (trends in broadband access; leisure patterns; demographics) levels.
Tools/approaches: Key relationships and important processes need to identified, perhaps through expert workshops; landscape characterisation; ecosystem function model; DPSIR framework model; resource flow analysis.
Data/information: Historic data and baseline states (e.g. on land cover, population, pattern of development)

for developing any scenarios; knowledge about critical thresholds and best practice information.
Strengths/limitations: A suite of models of drivers and deliberative processes involving not just technocrats seen to help with rigour and robustness of appraisal. Weaknesses include cost, the risk of focusing on the wrong drivers or improperly identifying relationships.

Table 4: Example question 3
What factors should be considered for realising multiple land benefits in a local area?
Scale: Local administrative units, wards; parishes. Resource units of various scales.
Tools/approaches: Active stakeholder engagement; characterisation of resource units; optimisation; planning 'best practice'; consideration of time/space interactions (e.g. 24 hr use of woodland); multicriteria analysis (benefits/disbenefits); GIS.
Data/information: Several kinds, including local knowledge.
Strengths/limitations: Outputs would include better information and guidance to developers and others. Inclusive processes are costly and time consuming, and there would be a lack of access to integrated data.

4.3 General Discussion

The general discussion throughout the day, and particularly in the panel session at the end, covered a wide range of issues. Any attempt to capture all of the details will necessarily miss certain points, but it is possible to identify a few specific themes that returned to over the course of the workshop. These included types of tools, the use of tools, concerns about data, and the need to be prepared for both proactive and reactive behaviour.

Theme 1 – Types of Tools

Some participants found it difficult to anticipate the variety of tools needed for appraising the drivers and impacts of land use change. It was suggested that it may be useful to extend existing scenarios work, e.g. that of the UK Foresight programme, as these scenarios could be used by a variety of policy makers in conjunction with existing tools and models. One possible SURPLUS tool could be process-focused, such as participatory scenario building. Another possible tool that several people thought might be useful would be a type of 'SimCountryside', in which users could engage more directly in developing visions of the future and exploring the steps required to achieve these.

Theme 2 – Use of Tools

The point was made that good tools do not equal good decision making, and sophisticated tools can sometimes be more advanced than associated mental models. Also, many data and tools tend to be lost in government reorganisations. Better communications within and between groups of decision makers and makers of decision support tools was suggested as a means of tackling this problem.

Theme 3 – Data Issues

Related to the previous point, it was recognised that there are a vast amount of available and relevant data as well as existing tools, models and other appraisal approaches. Integrating the data and the associated knowledge in some way would be hugely beneficial. While there would be problems associated with turning the SURPLUS project into a data repository (data licensing, data confidentiality, etc.), systems of improved data knowledge management would be welcomed. Such systems would need to consider many

institutional aspects, such as the sharing of expertise, data, and outputs. However, a project-based approach, which SURPLUS is meant to be, may not be the most appropriate way to take such a system forward.

Theme 4 – Preparing to be both Proactive and Reactive
On a more fundamental note, the issue of whether novel risks should be anticipated through specific modelling exercises or through improved availability of and access to data and expert knowledge was touched upon. The Foot and Mouth crisis was mentioned as an example of an unanticipated event to which, nonetheless, a speedy response was possible due to the availability of many different datasets. Also, while ex-ante evaluation, through modelling or other approaches, is important for evidence based policy, so are interim and ex-post evaluations.

5 CONCLUSIONS

The Consultation phase of this Scoping Study has revealed a substantial level of interest in the SURPLUS project and need for improved methods for appraising the sustainability changes in the rural economy and land use. This task is all the more pressing given the level of uncertainty over how drivers such as globalisation, CAP reform, increased demand for housing and recreation, demographic changes and climate change will impact on the rural economy and land use over the medium to long-term future.

There was broad agreement over the 5-20 years time horizon envisaged in the SURPLUS objectives. The results reinforced the view that seeking to develop a toolbox of approaches, rather than a single model, is the right way to proceed. The tools and techniques selected or developed for the SURPLUS toolbox will, between them, need to be capable of dealing with a much wider range of drivers and impacts than 'traditional' models of land-use. At the same time it is clear that current changes in 'external' conditions will mean that it will not be possible to test and validate many of the tools and techniques against historic data. Another key challenge will be the development of spatially disaggregated models of land use and land cover with a high enough level of resolution to allow the investigation of local environmental and biodiversity impacts. Dealing with social impacts in a coherent and effective manner is also likely to require significant further attention. This is not surprising as work on social impact assessment is generally recognised as lagging significantly behind that on economic and environmental issues. It was telling that many of those consulted found it difficult to engage with the social dimension of sustainability agenda, although it should be noted that the need for further work on the spatial distribution of social and economic impacts was picked up in the workshop.

All of this points to the fact that, in some cases entirely new or radically revised, tools and techniques may be required. More work will also be needed on specifying how to link different types of tools and techniques in a robust manner. The review of the academic and policy literature, interviews, and workshops have helped to identify possible tools and techniques for consideration. In addition, we have identified a number of projects in which related issues are being addressed, which may be able to provide important insights for the SURPLUS project. The exploration of these is being undertaken in the Evaluation phase of this Scoping Study.

We identified a clear interest from the Environment Agency in providing collaborative funding to develop a set of land-use scenarios that could to inform the work of a number of government departments and agencies. We would caution against simply trying to adapt existing scenarios, such as those of the Foresight Futures 2020 project, for this purpose, however. It is important in these cases to ensure that the timeframes and policy drivers of concern in any scenario exercise are appropriate for their intended use.

Opportunities for collaborative funding through the Rural Economy and Land Use programme should also be actively investigated. Our impression is that other potential policy customers in Defra, other government departments, agencies and the devolved administrations are likely to require much more specific proposals, which clearly add value to existing approaches and are likely to deliver usable results before offering co-funding.

In light of the above, it is clear that a number of the objectives for the SURPLUS project, as currently drafted, lack clarity and are too broad ranging to be effectively operationalised. They will therefore need to be redrafted, taking into account further work to be undertaken in the later part of this project, in a manner that more clearly circumscribes a specific set of challenges and (hopefully) achievable outcomes. For the moment, it was decided, in consultation with the Steering Committee, that the objectives of the SURPLUS project, i.e. not the Scoping Study, should be slightly rephrased to now read:

- Develop cost-effective tools and techniques for assessing trends as well as forecasting and anticipating future changes in rural economic and social activity and land use, and their environmental impacts and social consequences over 5-20 year timescales;
- Test and evaluate the tools and techniques and provide assessments of the uncertainty of forecasts and sensitivities with regard to input assumptions;
- Ensure that the tools and techniques are relevant and useful to policy customers in Government departments and agencies, nationally and regionally;
- Ensure that the tools and techniques build on or link with existing methods and experience and utilise existing data as far as possible; and
- Apply the tools and techniques to a range of policy issues as identified in the Rural White Paper Our Countryside: The Future, the England Biodiversity Strategy and the Strategy for Sustainable Farming and Food and refined during consultations undertaken for the scoping study.

This still leaves some questions about the breadth of the objectives. It also does not clearly address the concerns about the fundamental (in)ability to make forecasts and deal with uncertainty, using classical approaches, with respect to the complex issues that a SURPLUS toolbox is intended to address, or the ability to test and evaluate many of the tools and techniques.

These issues will need to be revisited in the remainder of this Scoping Study. The next phase, Evaluation, is looking in detail at the available tools and techniques in light of the conclusions of this Background phase. The final phase, Technical specification and reporting, will provide a number of options, including more detailed specifications, for moving forward with the full SURPLUS project.

APPENDIX A: CONTACTS

Name	Organization
Allan Buckwell	Chief Economist, Country Land and Business Association
Andrew Jackson	Office of Science and Technology Foresight Programme
Andrew Jordan	University of East Anglia, Centre for Social and Economic Research on the Global Environment
Andrew Moxey	Scottish Executive Environment and Rural Affairs Department, Analytical Services Division
Andrew Watkinson	University of East Anglia, School of Biological Sciences
Bill Sutherland	University of East Anglia, School of Biological Sciences
Bob Crabtree	CJC Consulting
Bob Roberts	Countryside Agency
Bronwen Jones	Department for Environment Food and Rural Affairs, Sustainable Development Unit
Carol Somper	Forum for the Future
Claire Craig	Office of Science and Technology Foresight Programme
Cliff Hague	University of Edinburgh, School of the Built Environment
David Baldock	Institute for European Environmental Policy
David Harvey	University of Newcastle, School of Agriculture, Food and Rural Develpoment
David Oglethorpe	Scottish Agricultural College, Economics and Social Sciences
David Thompson	Department for Environment Food and Rural Affairs, Economics and Statistics Directorate
David Wilkes	Office of the Deputy Prime Minister
Derrick Wilkinson	National Farmer's Union - England and Wales
Eunice Lord	ADAS, Land Research Centre
Fiona Bryant	East of England Development Agency
France Gerard	Centre for Ecology and Hydrology, Section for Earth Observation
Frans Berkhout	University of Sussex, Science Policy Research Unit
Gareth Edward Jones	University of Bangor, School of Agriculture & Forest Sciences
Gillian Bristow	Cardiff University, School of City and Regional Planning
Havard Prosser	Welsh National Assembly
Helmut Geist	University of Louvain, Department of Geography
Ian Coates	UK Prime Minister's Strategy Unit
Ian Hodge	Cambridge University, Department of Land Economy
Ian Holman	Cranfield University, Institute of Water and Environment
Ian Miles	University of Manchester, Policy Research in Engineering, Science & Technology
Irene Lorenzoni	University of East Anglia, Centre for Social and Economic Research on the Global Environment, Centre for Environmental Risk
James Curran	Scottish Environmental Protection Agency, Environmental Futures
Jane Goodwin	Department for Environment Food and Rural Affairs
Janet Dwyer	Rural Studies, University of Gloucestershire
Jim Munford	National Biodiversity Network
Jo Hossell	ADAS
Joe Ravetz	University of Manchester, Planning and Landscape
John Adams	Department for Environment Food and Rural Affairs, Rural Development Service
John Custance	Department for Environment Food and Rural Affairs, Environment Protection Statistics & Information Management

John Faulkner	Northern Ireland Environment and Heritage Service
John Graham	Land Use Consultants
John Osmond	Department for Environment Food and Rural Affairs, Conservation Management Division
Jonathan Kohler	Cambridge University and University of East Anglia, Tyndall Centre
Jules Pretty	University of Essex, Centre for Environment and Society
Julie Collins	Forestry Commisson
Kasper Kok	University of Wageningen, Laboratory of Soil Science and Geography
Kate Parker	Department for Environment Food and Rural Affairs
Ken Roy	Countryside Agency
Kevin Morgan	University of Cardiff, City and Regional Planning
Kevin O'Carroll	Department of Trade and Industry, Oil and Gas
Kieron Flanagan	University of Manchester, Policy Research in Engineering, Science & Technology
Kirsty Shaw	Countryside Agency
Laura Polverari	University of Strathclyde, European Policies Research Centre
Les Firbank	Centre for Ecology and Hydrology, Institute of Terrestrial Ecology
Lisa Dobbins	Welsh Assembly Government, Strategic Policy Unit
Louise Heathwaite	University of Sheffield, Department of Geography
Mark Felton	English Nature
Mark Rounsevell	University of Louvain, Department of Geography
Mark Shucksmith	University of Aberdeen, Department of Land Economy
Martin Capstick	Department for Environment Food and Rural Affairs, European Wildlife Division
Matthew Cook	Cranfield University, Institute of Water and Environment
Melanie Howard	Future Foundation Group
Nick Hanley	University of Glasgow, Department of Economics
Nigel Atkinson	Department for Environment Food and Rural Affairs, Sustainable Agriculture Strategy Division
Nigel Dotchin	Department for Transport, Regional Policy and Regeneration Unit
Patricia Mandeville	Department for Culture, Media and Sport, Strategy Unit
Paul Ekins	Policy Studies Institute
Paula Harrison	Oxford University, Environment Change Institute
Peter Mehlbye	European Spatial Planning Observation Network, Coordination Unit
Peter Redfern	Environment Agency
Peter Schön	German Federal Office for Building and Regional Planning
Philip Lowe	University of Newcastle, Centre for Rural Economy
Phillip Jones	Reading University, Centre for Agricultural Strategy
Phillipa Swanton	Department for Environment Food and Rural Affairs
Rachel Warren	University of East Anglia, Tyndall Centre
Richard B Tranter	Reading University, Centre for Agricultural Strategy
Richard Howell	Environment Agency
Robert Huggins	Environment Agency
Robert Willows	Environment Agency, National Centre for Risk Analysis and Options Appraisal
Roger Vickerman	University of Kent, Centre for European, Regional and Transport Economics
Sarah Dunn	Macaulay Institute, Environmental Sciences
Sheila McCabe	Department for Environment Food and Rural Affairs, Sustainable Land Use Division
Simon Bilsborough	Countryside Council for Wales, Chief Economist
Simon Pryor	Forestry Commission
Simon Shackley	Manchester School of Management, Centre for Research in Organisations, Management and Technical Change

Sophie Spencer	Campaign to Protect Rural England
Steve Anthony	ADAS
Terry Barker	Cambridge University, Department of Applied Economics
Terry Marsden	Cardiff University, School of City and Regional Planning
Tim Allen	Department for Environment Food and Rural Affairs, Rural Policy Directorate
Tom Oliver	Campaign to Protect Rural England
Tom Veldkamp	University of Wageningen, Laboratory of Soil Science and Geography
Victoria Read	Department for Environment Food and Rural Affairs, Sustainable Development Commission

APPENDIX B: INTERVIEWS

This Appendix provides material related to the twelve interviews undertaken during the Consultation and Background phase of the SURPLUS Scoping Study. The table below lists the persons interviewed. The following pages then provide copies of the guides used by the interviewers during the process of the interviews. These, along with the summary of the project, also included in this appendix, were shown to the interviewees prior to the actual interviews.

Persons Interviewed During Consultation Phase	
Name	**Organisation**
Policy Experts	
Bob Roberts	Countryside Agency, Living Landscapes
Nigel Atkinson	Defra, Sustainable Agriculture Strategy Division
Robert Willows	Environment Agency, National Centre for Risk Analysis and Options Appraisal
James Curran	Scottish Environmental Protection Agency (SEPA), Environmental Futures
Sheila McCabe	Defra, Sustainable Land Use Division
Tom Coles	Defra, Sustainable Land Use Division
Technical Experts	
Andrew Moxey	Scottish Executive Environment & Rural Affairs Department (SEERAD), Analytical Services Division
Paul Ekins	Director ESRC Environment and Human Behaviour Programme, Policy Studies Institute
Jo Hossell	ADAS
David Harvey	The University of Newcastle upon Tyne, School of Agriculture, Food and Rural Development
Louise Heathwaite	University of Sheffield, Department of Geography
Philip Lowe	Director, ESRC RELU Programme, University of Newcastle, Centre for Rural Economy
Simon Shackley	UMIST, Environmental Management and Policy, and Tyndall Centre

Guide for Interviews with Technical Experts

OBJECTIVES AND PURPOSE OF THE SURPLUS PROJECT

The SURPLUS project is intended to focus on the integrated assessment of the multiple drivers of land use change and multiple impacts of such change.

The specific objectives of the SURPLUS project are set out in the project outline supplied. They are to:

- Develop cost-effective tools for assessing trends as well as forecasting and anticipating future changes in direction in rural economic and social activity and land use and their environmental impacts and social consequences, over 5-20 year timescales.
- Test and evaluate the tools with empirical data and provide measures of the uncertainty of the forecasts and sensitivities with regard to input assumptions.
- Ensure that the tools are relevant and useful to policy customers in Government departments and agencies, nationally and regionally.
- Ensure that the tools build on or link with existing methods and experience and utilise existing data as far as possible; and
- Apply the tools to a range of policy issues as identified in the Rural White Paper Our Countryside: The Future, the England Biodiversity Strategy and the Strategy for Sustainable Farming and Food and refined during consultations undertaken for the scoping study.

Q.1. Do you think these objectives should be refined or changed, and if so how?

Q.2. Is the 5-20 year timescale suggested in the SURPLUS objectives about right? If not, what would you suggest and why?

Q.3. What spatial or geographical scale or scales do you think the SURPLUS project should focus upon?

KEY DRIVERS AND IMPACTS

Q.4 What do you see as the key direct (generally more local and short-term) and indirect (generally more distant and long-term) drivers of changing land-use in the UK? In terms of:

- Policy initiatives
- Social trends
- Economic trends
- Environmental trends

Can you say something about how these various drivers interact?

Note: You may want to distinguish between drivers that you consider controllable (if so by whom?) and those that are not.

Q.5. Given the above, which key pressures on land use would you like to be able to better appraise?

Q.6. What do you see as key direct and indirect impacts of changing land use in the:

- Environmental;
- Economic; and
- Social spheres?

Can you say something about how these various impacts interact?

Q.7. Which of the impacts identified above are of most relevance to you in your work?

APPRAISAL TOOLS AND TECHNIQUES

Q.8. What would you consider to be the most feasible approaches for developing the types of tool(s), for modelling/appraising land use change and its drivers and impacts, envisaged under the SURPLUS project? In terms of for example:

- Quantitative models
- Qualitative models
- Combined qual-quant frameworks

Q9. What would you consider to be the main strengths/weaknesses of these different approaches?

Q.10. What key outputs or indicators do you think any future tool(s) developed under the SURPLUS project could provide? And should such outputs be quantitative or qualitative?

Q.11. How do you think uncertainty could be handled and represented?

Q.12. What appraisal tools/models are you or your organisation currently using, and for what purpose(s)?

Q.13. What appraisal tools/models have you used in the past?

Q.14. What are/were the strengths and weaknesses of these approaches?

Q.15. What do you think are the main existing modelling/appraisal tools, or current research projects that we should be reviewing within the SURPLUS scoping study?

OTHER INFORMATION

In light of your answers to the questions above and what you have learnt about the SURPLUS project

Q.16. Would you be able to attend the SURPLUS scoping study workshop at PSI, in London, on the 24 March?

Q.17. Who else would you suggest that we should be interviewing/inviting to our forthcoming workshop? In terms of:

- Policy makers
- Technical experts
- Private sector interests
- Others

Q.18. Is there anything else you would like to add, or questions you might have about the project at this stage?

Guide for Interviews with Policy Experts

Please note that the first two sections of the Interview Guides, Objectives and Purpose of The Surplus Project and Key Drivers and Impacts, were the same for the Technical and Policy Experts. Therefore, these have not been repeated here.

APPRAISAL TOOLS AND TECHNIQUES

Q.8. In terms of any future tool(s) that might be developed under the SURPLUS programme for modelling/appraising land use change and its drivers and impacts, what sort of information would you want such a tool to generate for you? For example:

A. What outputs or indicators would be most useful to you?
B. Do you need quantitative indicators? Or how far is information on qualitative trends sufficient for your needs?
C. How important are issues of uncertainty to you, and do you have any thoughts on how uncertainty should be represented?
D. How important is the issue of transparency – of being able follow- through how the outputs have been generated – to you?

Q.10. A. How would you like to be able to interact with such a tool(s)?
B. Who would you actually see using such a tool(s): you, a member of your staff or a technical expert?

Q.11. What appraisal tools/models are you or your organisation currently using, and for what purpose(s)?

Q.12. What appraisal tools/models have you used in the past?

Q.13. What are/were the strengths and weaknesses of these approaches?

OTHER INFORMATION

In light of your answers to the questions above and what you have learnt about the SURPLUS project

Q.14. Are there other key:

-
- Policy documents
- Existing modelling/appraisal tools, or
- Current research projects, which haven't yet been mentioned, that you think we should be reviewing as within the SURPLUS scoping study?

Q.15. Would you be able to attend the SURPLUS scoping study workshop at PSI, in London, on the 24 March?

Q.16. Who else would you suggest that we should be interviewing/inviting to our forthcoming workshop? In terms of:
Policy makers
Technical experts
Private sector interests
Others

Q.17. Is there anything else you would like to add, or questions you might have about the project at this stage?

Project Outline Provided to Interviewees

Introduction

The SURPLUS Scoping Study forms part of the Defra Horizon Scanning Programme and is co-funded by the Treasury's Evidence-Based Policy Fund. Government departments have set or agreed on ambitious targets for rural areas for the next 5-20 years.[13] Departments are also committed to Defra's Sustainable Development Strategy[14] and to measuring general progress towards sustainable development with a set of sustainable development indicators.[15] Defra's farming and food strategy sets out key principles also plus a strategy for sustainable farming and food production.[16] The protection of biodiversity remains paramount with Defra's new biodiversity strategy for England[17] aiming to ensure that biodiversity considerations become embedded in the main sectors of activity by Defra and others.

At the same time, the post-war approach to rural policy is facing major challenges in the face of, among other factors, trade liberalisation in agriculture, increasing population mobility, changing social expectations, concerns about food safety, animal welfare and biotechnology, and long term climate change.[18] However, the current evidence base for the appraisal of rural policy under these circumstances is inadequate. This relies heavily on historical trends and past experiences, and targets are essentially retrospective - seeking to restore or replace what has been lost in the recent past. It is unclear if tools are readily available to the policymaker to project forward current trends in an integrated way or to review the possible consequences of alternative policy scenarios.

The SURPLUS project aims to address these issues and, in turn, improve the ability of Defra and other organizations to carry out policy appraisal based on a full assessment of future changes in land use, recreation, amenity and rural economic activity and the impact of such changes on the rural environment and rural communities. It will consider the interactions between policies related to, among others, agriculture, forestry, rural development, landscape and recreation, and biodiversity, as manifest in rural land uses and their environmental, economic, and social attributes and impacts. In particular, it will focus on improving the assessment of sustainable land management options with respect to the delivery of biodiversity targets, enhanced economic and employment opportunity and Quality of Life indicators.

Aims and Objectives

Defra's initial objectives for the SURPLUS project are to:

- Develop cost-effective tools for assessing trends as well as forecasting and anticipating future changes in direction in rural economic and social activity and

[13] *e.g.* Defra Public Service Agreement targets (2003-2006); UK Biodiversity Action Plan (1995-1999) targets
[14] *Foundations for our Future: Defra's Sustainable Development Strategy*, Defra, 2002
[15] *Quality of Life Counts*, DETR, London, 1999
[16] *The Strategy for Sustainable Farming and Food; Facing the Future*, Defra, 2002
[17] *Working with the grain of nature: A biodiversity strategy for England*, Defra, 2002
[18] *Our Countryside: The Future – A Fair Deal for Rural England*, Cm4909, DETR, 2000

land use and their environmental impacts and social consequences, over 5-20 year timescales.

- Test and evaluate the tools with empirical data and provide measures of the uncertainty of forecasts and sensitivities with regard to input assumptions.
- Ensure that the tools are relevant and useful to policy customers in Government departments and agencies, nationally and regionally.
- Ensure that the tools build on or link with existing methods and experience and utilise existing data as far as possible; and
- Apply the tools to a range of policy issues as identified in the Rural White Paper *Our Countryside: The Future, the England Biodiversity Strategy and the Strategy for Sustainable Farming and Food* and refined during consultations undertaken for the scoping study.

The overall aim of the current scoping study, funded by the Treasury's Evidence Based Policy Fund (EBPF) and Defra Horizon Scanning Programme, is to guide the further development and implementation of the SURPLUS project. Specifically, it will:

- Confirm the user requirements and refine the objectives for the overall project
- Assess the feasibility of using various modelling and other foresight approaches to achieve the objectives of the overall project, and
- Develop technical specifications and determine funding arrangements for its implementation.
- Perhaps most importantly, it will advise on the desirability of continuing with the full project.

Methodology

The scoping study is divided into three phases:

- **Consultation:** This phase will focus on a review academic and policy literature; targeted interviews with approximately 10-12 policy makers and technical experts; and a one day workshop with 25-30 similar persons.
- **Evaluation: A** variety of tools and approaches for meeting the objectives of the overall SURPLUS project will be critically evaluated against an agreed set of criteria.
- **Technical specification and reporting:** A detailed report will be prepared from the scoping project, together with (if appropriate) a technical specification and costing for proceeding with the full project.

Timescale

The SURPLUS scoping study is being undertaken between December 2003 and September 2004.

Outcomes

The results from this scoping study will be used to guide any future development of the SURPLUS project. The final report from the study will include recommendations

as to whether to proceed with the SURPLUS project, challenges and limitations to be addressed, and if appropriate a technical specification for the full project.

Research Team

The SURPLUS scoping study is being undertaken by a multidisciplinary team led by Dr Dale Rothman, and is a collaboration between the Macaulay Institute, the Policy Studies Institute (PSI) London and the University of Aberdeen.

Steering Group

A broadly based Steering Group has been established comprising representatives from Defra, Just Ecology, Countryside Agency, English Nature, and the Environment Agency.

Contacts

For further information concerning the SURPLUS scoping study, contact: Dr Dale Scott Rothman, The Macaulay Institute, Tel: +44 (0)1224 498200, Email: d.rothman@macaulay.ac.uk; or, Dr Malcolm Eames, Policy Studies Institute, Tel: +44 (0)20 74680468, Email: m.eames@psi.org.uk.

For more information on the Defra Horizon Scanning Programme, please contact Rohit Talwar (Programme Manager) or Emily Holmes (Programme Coordinator), Tel: +44 (0)20 7238 1816, http://www.escience.defra.gov.uk/horizonscanning.

APPENDIX C: STAKEHOLDER WORKSHOP

This Appendix provides material related to the stakeholder workshop undertaken during the Consultation and Background phase of the SURPLUS Scoping Study. The workshop took place on 24 March 2004 in London at the offices of the Policy Studies Institute, on one of the groups participating in the Scoping Study. Specifically, it contains the agenda, list of participants, and morning presentations.

Stakeholder Workshop Agenda

10.30am – 4.00pm, 24 March 2004
Policy Studies Institute (PSI)
100 Park Village East
London, NW1 3SR

10.00 Arrival and coffee

10.30 Welcome, introductions and outline of day
Malcolm Eames, Senior Research Fellow, PSI

10.45 Defra Horizon Scanning Programme
Rohit Talwar, Programme Manager, Defra Horizon Scanning Programme

10.55 Introduction to the SURPLUS Project
Andrew Stott, SURPLUS Steering Group Chairman, Defra

11.05 Introduction to the Scoping Study
Dale Rothman, SURPLUS scoping study project leader, Macaulay Institute

11.15 Small breakout groups: What questions would you ask of the SURPLUS toolkit?

12.15 *Reporting Back and Discussion*

12.45 Lunch

1.30 Small breakout groups: How can we answer these questions?

2.30 *Reporting Back and Discussion*

3.00 Tea

3.20 Panel and discussion: Reviewing the objectives of the SURPLUS project and next steps

4.00 Close

Attendees at Stakeholder Workshop	
Name	**Organisation**
Nicola Chissell	Defra
Kristina Dahlstrom	Policy Studies Institute
Malcolm Eames	Policy Studies Institute
Ian Holman	Cranfield University
Melanie Howard	Future Foundation
Richard Howell	Environment Agency
Robert Huggins	Environment Agency
Philip Lowe	University of Newcastle
Kate Parker	Defra
Bob Roberts	Countryside Agency
Dale Rothman	Macaulay Institute
Peter Samuels	Welsh Assembly
Kirsty Shaw	Countryside Agency
Carol Somper	Forum for the Future
Andrew Stott	Defra
Rohit Talwar	Defra
Kenneth Thomson	University of Aberdeen
Antony Williamson	Environment Agency
Robert Willows	Environment Agency
Sarah Gardner	ADAS
David Harvey	University of Newcastle
Les Firbank	Centre for Ecology and Hydrology
Jeff Waage	Imperial College
Caroline Wood	Department for Transportation

Presentation of Rohit Talwar

Slide 1

Defra's Horizon Scanning & Futures Programme

Rohit Talwar - Programme Manager

March 22nd 2004

Horizon Scanning
Science Strategy Team

rohit.talwar@defra.gsi.gov.uk
www.escience.defra.gov.uk/horizonscanning
Tel 020 7238 1816 / 07973 405 145

Slide 2

Defra's HS Definition & Goals

DEFINITION

The systematic examination of potential threats, opportunities and likely future developments which are at the margins of current thinking and planning.

GOALS – New Risks, New Opportunities, New Ideas

To improve Defra's resilience and capability to anticipate and prepare for new risks and opportunities

Challenge and extend Defra's thinking on future science and environmental challenges

Engage staff from across Defra and encourage high quality external contributions

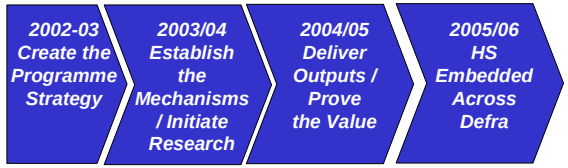
Slide 3

Programme Fundamentals

- Encompass all scientific disciplines
- Reports to Howard Dalton – Chief Scientific Advisor
- Located in the Science Directorate's Science Strategy Team
- £2M annual budget
- 5 current research themes
- Run by the Horizon Scanning Unit:
  - Programme manager
  - Programme co-ordinator
  - Part time research assistant
  - Internal and external project managers
  - Projects specified in consultation with science and policy staff across Defra
  - Services delivered by external contractors
  - Independent Advisory Panel

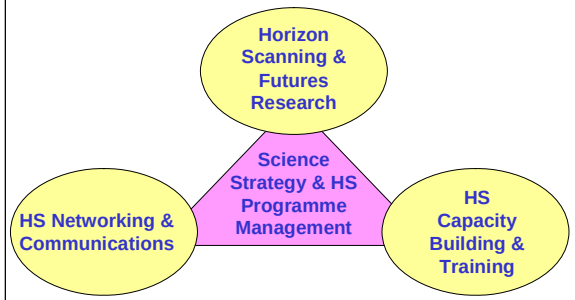
Slide 4

HS Programme Roadmap



Slide 5

HS Programme Components



Slide 6

Research Activity - 1

- **Future Landscapes**
  - Development of Models for Sustainable Rural Policy and Land Use (SURPLUS) – *Contract awarded*
- **Coping with Threats**
  - Scoping study to investigate the potential of alternative strategies for national biosecurity against introduced diseases, pests and alien species – *Contract awarded*
- **Meeting People's Future Needs**
  - Rural Futures: Scenario Creation and Back Casting - *Contract awarded*
- **Re-thinking the Food Economy**
  - *Future of the Food Chain* – joint funding from DoH – invitation to tender issued

Slide 7

Research Activity - 2

Environmental Constraints – *contracts awarded for:*

- Development of a Virtual Fisheries Model (VFM) to be used to test future fisheries management and industry scenarios
- Greenhouse Gas Stabilisation
- Alternative Scenarios for Marine Ecosystems
- Impact of Future Energy Policy on Biodiversity
- The Future of Healthy Ecosystems
- Integrated Knowledge Management of Environmental Datasets for Future Environmental Analysis
- Future Environmental Effects of Non-Synthetic Chemical Use

Presentation of Andrew Stott

Slide 1

appraisal of SUstainable Rural Policy and Land USe (SURPLUS)

Defra Horizon Scanning
HMT Evidence Based Policy Fund

Andrew Stott
Land Use and Rural Affairs Science Unit

andrew.stott@defra.gsi.gov.uk

Slide 2

Background

- Modelling Environmental Impacts of Land Use Change (MEILUC), 1999
  - Existing modelling capabilities do not fully meet the needs of policy users
  - Spatially explicit models have very demanding data requirements therefore limited to small areas
  - Generalised national/regional models difficult to relate to site specific environmental impacts
  - Build model based on Countryside Survey
- Many other ongoing modelling and scenarios work in UK and Europe
- Increasing data availability

Slide 3

Policy Context

- Defra Sustainable Development Strategy and Quality Of Life Counts indicators
- Defra Sustainable Food and Farming Strategy
- UK Biodiversity Action Plan and England Biodiversity Strategy
- CAP reform and Rural Development Strategies
- Water Framework Directive
- Climate Change Programme
- Rural White Paper and Countryside Quality Counts
- Horizon scanning and evidence based policy making

Slide 4

SURPLUS draft objectives

- Develop cost-effective, policy relevant tools to assess and forecast trends in rural land use and environmental impacts and social consequences, over 5-20 year timescale.
- Test and evaluate tools.
- Build on existing methods and use existing data.
- Apply to current policy issues.

Slide 5

Environmental effects of CAP reform - biodiversity

Set aside and energy crops		Scale	Intensity
Reduction in total set aside area and loss of rotational set aside	Reduction in over-wintering habitat for a range of associated vertebrate and invertebrate species, particularly over-wintering birds.	med	Low -ve
Permanent, environmental set aside across 10% of eligible arable area.	Increase in quality of semi-natural habitat. Range of benefits to flora and specific vertebrate and invertebrate species.	large	Med +ve
Energy crops no longer permitted on set aside but carbon credit payable. Subject to other factors, this may lead to slow and gradual increase in the area of energy crops including short rotation coppice, miscanthus and oilseeds for biofuels.	Limited increase in heterogeneity of farmland through the creation of different habitats in relatively small areas	small	Low -ve

GFA RACE, 2002

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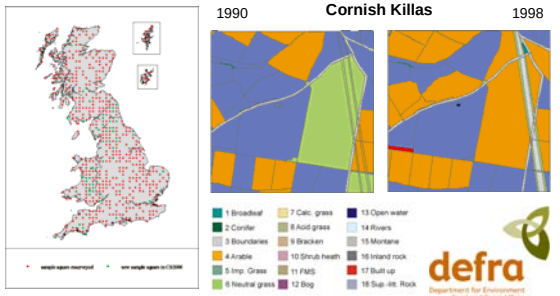
Department for Environment Food and Rural Affairs

Slide 6

Countryside Survey



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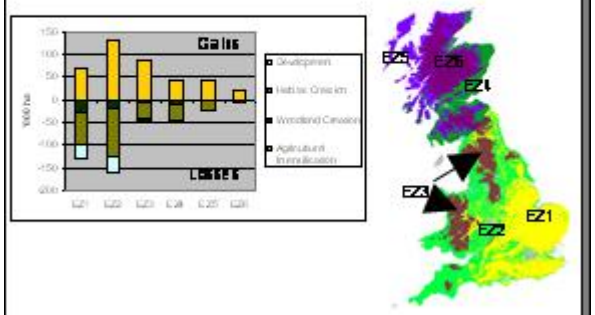
Slide 7

Broad habitat change matrix for England, 1990 -98

'000 ha	1998						
1990 BH Aggregate	Intensive Agriculture	S-N Grass	Other S-N	Develop-Ment	Wood-land	Other	1990 Total
Int. Agric	8010	153	22	54	44	1	8284
S-N Grass	157	501	83	17	17	1	777
Other S-N	12	39	694	1	11	0	758
Development	23	14	6	1305	13	0	1362
Woodland	20	17	18	11	1149	1	1216
Other	2	0	0	1	0	279	282
Total 1998	8224	724	823	1389	1216	282	
Net Change 1990-98	-60	-53	65	27	0	0	
% Net Change 1990-98	-0.1	-6.8	8.6	2.0	0	0	

Slide 8

Transfers to and from intensive agriculture by Environmental Zones, 1990-98

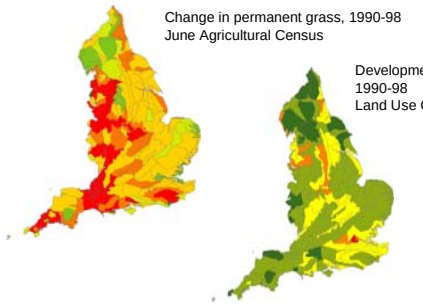


Slide 9

Countryside Quality Counts

Change in permanent grass, 1990-98
June Agricultural Census

Development in rural areas
1990-98
Land Use Change Statistics

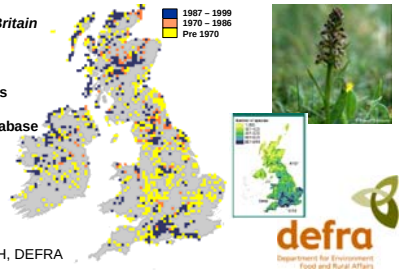


Slide 10

Changes in biodiversity

10 km sq records of Frog Orchid *(Coeloglossum viride)*

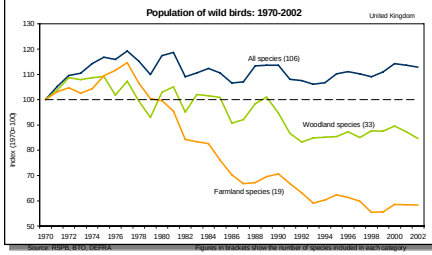
New Plant Atlas of Britain and Ireland (2002)
- **survey 1995–99**
- **1600 volunteers**
- **3880 10 km squares**
- **2,951 species**
- **Vascular Plant Database**



Source: BSBI, CEH, DEFRA

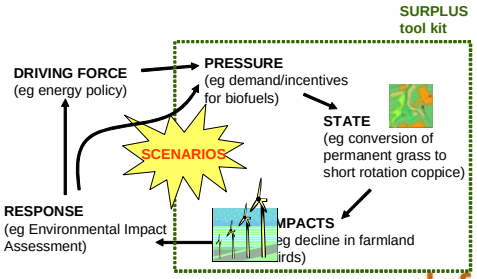
Slide 11

Wild birds headline indicator



Slide 12

DPSIR Framework



Slide 13


Questions for today
• Do we need to improve our capacity to anticipate future changes in the countryside? – What are the priorities?
• Is our understanding good enough?
• Is their sufficient information?
• Do we have the right tools?
• Can we make better use of our knowledge, information and tools to inform policy?
• Does SURPLUS offer a way forward?
defra

Presentation of Dale S. Rothman

Slide 1

Appraisal of Sustainable Rural Policy and Land Use (SURPLUS) Scoping Study An Introduction

Stakeholder Workshop
24 March 2004
London

Slide 2

Steering Group and Staff

Name	Role	Organisation
Dr Andrew Stott	SG Chairman	DEFRA
Dr Jeff Kirby	Project Manager	Just Ecology
Rohit Talwar	SG member	DEFRA
Nicola Chissell	SG member	DEFRA
Steve Preston	SG member	English Nature
Richard Lloyd	SG member	Countryside Agency
Antony Williamson	SG member	Environment Agency
Dr. Dale S. Rothman	Project Leader	Macaulay Institute
Dr. Ayele Gelan	Project Member	Macaulay Institute
Prof. Clive Spash	Project Member	Macaulay Institute
Dr. Gerald Schwarz	Project Member	Macaulay Institute
Dr. Kevin Urama	Project Member	Macaulay Institute
Dr. Nick Gotts	Project Member	Macaulay Institute
Dr. Rob Tinch	Project Member	Macaulay Institute
Dr. Malcolm Eames	Project Member	Policy Studies Institute
Kristina Dahlstrom	Project Member	Policy Studies Institute
Prof. Kenneth J. Thomson	Project Member	University of Aberdeen

Slide 3

Objectives of the Scoping Study

- To confirm user requirements for and interest in the SURPLUS project
- To identify potential model frameworks and approaches, models, scenario building and other foresight approaches, and datasets for critical evaluation
- To critically evaluate model frameworks and approaches, models, scenario building and other foresight approaches, and datasets
- To provide a recommendation as to whether Defra should proceed with the implementation phase of SURPLUS (yes, no, under what conditions?)
- To specify a detailed implementation plan for the overall SURPLUS project

Slide 4

What Will We Produce?

- Tangible Outputs
  - Consultation and Background Report
  - Interim Evaluation Report
  - Final Report
- Intangible Outputs
  - Better communication between tool users and tool makers and within these groups
  - Better understanding of strengths and limitations of existing tools
  - Broader perspective on what are appropriate tools for ex ante policy appraisal

Slide 5

Phases of the Scoping Study

- **Phase 1: Consultation and Background:** This phase will focus on establishing the context for the overall SURPLUS project, including a preliminary revision of the objectives, and setting the stage for the evaluation phase.
- **Phase 2: Evaluation:** This phase will critically evaluate a variety of tools and approaches for meeting the objectives of the overall SURPLUS project.
- **Phase 3: Technical Specification and Reporting**: This phase will involve preparing the final report and recommendations

Slide 6

Timeline

Study Phases	03	04							
	D	J	F	M	A	M	J	J	A	S
Consultation and Background	■	■	■	■						
Evaluation			■	■	■	■	■	■		
Technical Specification and Reporting								■	■	■
Primary Milestones										
Consultations via interviews		X	X							
Workshop				X						
Consultation and Background Report					X					
Interim Evaluation Report							X			
Final Report										X
Secondary Milestones										
First Steering Group Meeting	X									
Completion of Literature Review		X								
Second Steering Group Meeting					X					

Slide 7

Activities and Milestones

Type	Reference	Title	Description	Milestone Target Date	Activity Start Date	Activity Finish Date
Activity	Surplus 01	Consultation and background work	Consultation with SG on preliminary objectives and background to SURPLUS, including 1st SG meeting	n/a	1-Dec-03	12-Dec-03
Activity	Surplus 02	Consultation and background work	Review of academic and policy literature	n/a	1-Dec-03	30-Jan-04
Activity	Surplus 03	Consultation and background work	Carry out targeted interviews with key stakeholders	n/a	5-Jan-04	27-Feb-04
Activity	Surplus 04	Consultation and background work	Run workshop with policy makers and technical experts	n/a	24-Mar-04	24-Mar-04
Milestone	**Surplus 05**	**Consultation and background work**	**Deliver consultation and background report in draft**	**23-Apr-04**	**n/a**	**23-Apr-04**
Activity	Surplus 06	Consultation and background work	Discussion of above report at 2nd SG meeting	n/a	23-Apr-04	23-Apr-04
Activity	Surplus 07	Consultation and background work	Revise and finalise above report after comments have been received	n/a	30-Apr-04	14-May-04
Activity	Surplus 08	Evaluation work	Critically evaluate tools and models for SURPLUS	n/a	2-Feb-04	18-Jun-04
Milestone	**Surplus 09**	**Evaluation work**	**Deliver evaluation report in draft, including recommendations on future options for SURPLUS**	**18-Jun-04**	**n/a**	**18-Jun-04**
Activity	Surplus 10	Evaluation work	Discussion of above report with SG, possibly at 3rd SG meeting	n/a	18-Jun-04	2-Jul-04
Activity	Surplus 11	Evaluation work	Revise and finalise above report after comments have been received	n/a	2-Jul-04	30-Jul-04
Activity	Surplus 12	Technical specification	Prepare full technical specification for SURPLUS project	n/a	2-Jul-04	10-Sep-04
Activity	Surplus 13	Technical specification	Identification of research groups with potential to deliver SURPLUS project	n/a	2-Jul-04	10-Sep-04
Milestone	**Surplus 14**	**Overall reporting**	**Deliver full draft project report, including refined objectives and technical specification for SURPLUS**	**10-Sep-04**	**n/a**	**10-Sep-04**
Activity	Surplus 15	Overall reporting	Revise and finalise above report after comments have been received	n/a	10-Sep-04	29-Sep-04
Milestone	**Surplus 16**	**Overall reporting**	**Deliver final reports and electronic outputs to Defra**	**30-Sep-04**	**n/a**	**30-Sep-04**

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Where do We Stand?

- Key policy makers and technical experts have been identified
- Policy maker and technical expert interviews have been undertaken
- Key policy documents, technical documents, data sets, related projects, etc. have been identified and are being assembled for analysis

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Persons Interviewed

Name	Organisation
Andrew Moxey	Scottish Executive Environment & Rural Affairs Department (SEERAD), Analytical Services Division
Bob Roberts	Countryside Agency, Living Landscapes
David Harvey	The University of Newcastle upon Tyne, School of Agriculture, Food and Rural Development
James Curran	Scottish Environmental Protection Agency (SEPA), Environmental Futures
Jo Hossell	ADAS
Louise Heathwaite	University of Sheffield, Department of Geography
Nigel Atkinson	DEFRA, Sustainable Agriculture Strategy Division
Paul Ekins	Policy Studies Institute, Environment
Philip Lowe	University of Newcastle, Centre for Rural Economy
Robert Willows	Environment Agency, National Centre for Risk Analysis and Options Appraisal
Sheila McCabe & Tom Coles	DEFRA, Sustainable Land Use Division
Simon Shackley	UMist, Environmental Management and Policy, and Tyndall Centre

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Key findings from interviews – Points of general agreement

- Interest in what SURPLUS is trying to achieve from both policy and research communities
- Consensus that current SURPLUS objectives are very ambitious given 'state of the art'
- No single method available - need to look at toolbox of approaches
- 5-20 year time horizon appropriate

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Key findings from interviews – Major challenges

- Recognition that moving into 'uncharted waters' – problems with testing & validation
- Appropriate spatial scale dependent on questions asked
- Transparency vs. complexity
- Need for certainty (e.g. quantitative indicators) vs. ability to provide

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Key findings from interviews – Areas for further exploration

- Private sector representation
- Other drivers of land-use change – especially housing
- 'non-traditional' methods for policy appraisal