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# Sustainability Assessment for Agriculture Scenarios in Europe's Mountain Areas: Lessons from Six Study Areas

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**Abstract** Sustainability assessment (SA) is a holistic and long-range strategic instrument capable of assisting policy-making in electing, and deciding upon, future development priorities. The outcomes of an SA process become more relevant and strengthened when conducted with multi-stakeholder engagement, which provides for multiple dialogues and perspectives. This was the object of research of the SA team in the context of BioScene (*Scenarios for Reconciling Biodiversity Conservation with Declining Agriculture Use in Mountain Areas in Europe*), a three-year project (2002–2005) funded by the European Union 5th Framework Program, which aimed to investigate the implications of agricultural restructuring and decline for biodiversity conservation in the mountain areas of Europe, using three distinct methodological streams: the ecological, the socio-economic, and the SA approaches. The SA approach drew on the previous two to assess the importance for biodiversity management of different scenarios of agri-environmental change and rural policy in six countries (France, Greece, Norway, Slovakia, Switzerland, and the United Kingdom), develop causal chains, include stakeholder views, and identify potential contributions for, or conflicts with, sustainability. This article tells how SA was used, what sustainability meant in each study area through different objectives of sustainability considered, discusses the methods used in SA, and the benefits arising. The SA was conducted by a team independent of any study area, who developed and oversaw the application of the SA methodology, assisting national teams, and developing a cross-country understanding of the sustainability of proposed scenarios in the different geographical and social contexts, and their implications for policy-making. Finally, it reflects on the persistent challenges of interdisciplinary research, compounded by multi-cultural teams, and concludes on the BioScene's lessons for the further development and application of SA.

**Keywords** Sustainability assessment · Agriculture · Participatory approaches · Multi-stakeholders · Interdisciplinarity · Biodiversity · Mountains · BioScene

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## Introduction

Environmental assessment is "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made."[1] It has been one of the major instruments of environmental policy since the late 1960s, and has been

[1] http://www.iaia.org/Members/Publications/Guidelines_Principles/Principles%20of%20IA.PDF.

primarily applied at project level (e.g. for infrastructure developments).[2] In the last two decades, there has been an increasing interest in applying the principles and methods of environmental assessment to more strategic initiatives, such as plans and policies, and in broadening out the scope of assessment to embrace all three dimensions, often called the pillars of sustainability: social, economic, and environmental.

In the European context, four major initiatives reveal these trends: (1) the European Union has adopted a Directive on the environmental assessment of Member State's plans and programs (European Commission 2001b), (2) the European Commission has established a new Impact Assessment tool which looks at all three elements of sustainability for its major policies (European Commission 2002), (3) the European Spatial Development Perspective has promoted Territorial Impact Assessment as a method of evaluating whether development policies (like agriculture) contribute to the EU's objectives of social and economic cohesion, environmental sustainability, and polycentric development (ESPON 2004), and (4) the United Nations Economic Commission for Europe has launched a Protocol on Strategic Environmental Assessment (UNECE 2003).

Sustainability Assessment (SA) is a version of these instruments. It is a process which can help inform and improve strategic decision-making. More specifically it is a systematic process for the assessment of the likely economic, social and environmental consequences of different strategic options, such as development scenarios, and the combinations of management activities contained in them (SA team 2004). The aim of the assessment is to understand the potential impacts of each option on wider sustainability objectives and identify changes that will increase desirable, and reduce undesirable, consequences. In other words, identifying the most sustainable policy interventions and management activities.

SA is increasingly advocated to support and encourage integrative processes between environmental, social and economic issues, local and global concerns, assessment methodologies, procedural approaches, institutional frameworks and political interventions (Eggenberger and Partidario 2000; Rotmans and van Asselt 2002; Bell and Morse 2003; Gibson and others 2005). It has been described as a concept that refers to a range of processes whose broad and common aim is to integrate sustainability concepts into decision-making (Gibson 2006; Pope 2006), by fostering early and consistent attention to transversal issues and linkages, adopting "frameworks that adjust or extend the three pillar categories to include cross-pillar concerns and connections" (Gibson 2006). Devuyst (1999) also highlights the importance of integrating these parameters as a priority of sustainable development and that this should be reflected in SA methodologies.

Worldwide, there are numerous types of sustainability assessment (Becker 1997; Harridge and others 2002; Noble 2002; Buselich 2002; Jenkins and others 2003; Pope and others 2004; Marsden and De Mulder 2005). Equally the definitions/terminologies used to describe the various different processes are wide-ranging. Dalal-Clayton and Sadler (2005) provide examples of at least 27 different approaches/applications of sustainability assessment, highlighting that SA "lies at the most demanding and testing end of a wide spectrum of integrative approaches."

The integration of social and ecological factors in collaborative management is also a topic addressed in the literature on biological conservation: "if ecosystems and human communities are interdependent, their sustainability must be managed simultaneously" (Keough and Blahna 2006). The following sections seek to show the relevance of Keough and Blahna's (2006) argument on balancing social and ecosystem values, by demonstrating that broader, interdisciplinary concepts such as ecosystem management, sustainability, ecological integrity and collaborative decision-making can be applied altogether.

The purpose of this article is to present and review the research results from the application of SA in the context of a European research project, to assess the potential sustainability consequences of different European rural and agriculture policy scenarios, looking at how agri-environmental change could affect biodiversity management. An empirical analysis was conducted, supported by six different case-study areas in Europe, to explore the feasibility of certain methods of SA when used at policy levels, in different national contexts and in an interdisciplinary context. The following sections outline the background provided by the European research project to the SA application, the methodology adopted for SA, the methods used, the analysis undertaken and the results achieved. Key results will be discussed in detail, leading to reflections on the multi-cultural and geographically diverse experience that assisted the application of SA. The article will conclude with lessons for the future of SA application.

## Background

For centuries, agriculture has played a multifunctional role in defining and sustaining mountain biodiversity in Europe through the management of habitats, species, and landscapes. In recent years, significant agricultural adjustment

[2] In the European Union, EIA has been legislated through Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment (85/337/EEC), subsequently amended by the 1997 Amendment Directive (97/11/EC) and the Public Participation Directive (2003/35/EC).

and contraction policies appear to determine changes on mountain biodiversity. Some of these changes may be deleterious, e.g. loss of locally adapted species and semi-natural habitats; others beneficial, e.g. new successional pathways providing opportunities for restoration of some of the large predators that occurred in the pre-agricultural landscape (Breitenmoser 1998, cited by Mitchley and others 2006).

The Common Agricultural Policy (CAP) as well as an increasingly wider range of rural development measures, have been designed to arrest or slow down depopulation and land abandonment. Less Favored Area (LFA) policies have been specifically designed to maintain a farming population and conserve the countryside by linking biodiversity objectives directly to the viability of farming. Objectives of the EU Biodiversity Strategy (European Commission 1998) and accompanying Action Plans (e.g. European Commission 2001a) include integrating biodiversity objectives into the CAP, regional rural development policies and spatial planning. But mountain biodiversity, and the human communities that live and work amongst it, face unprecedented threats from social, economic, and environmental forces of change. These same forces also bring exciting opportunities for the integration of knowledge and expertise toward sustainable solutions across the mountains of Europe. Effective policies for conservation of mountain biodiversity must take account of the social and economic objectives as well as the biodiversity and other environmental objectives in an integrated manner, in view of sustainable rural development in Europe (AAVV 2002; Mitchley and others 2006).

A three-year research project (2002–2005) funded by the 5th Framework Program of the European Union was carried out to investigate whether and how biodiversity conservation and agriculture use in mountain areas in Europe could be reconciled (*Bioscene—Scenarios for Reconciling Biodiversity Conservation with Declining Agriculture Use in Mountain Areas in Europe*) (AAVV 2002; Mitchley and others 2006). The Bioscene research project intended to achieve results that could support the provision of guidance on how to enhance the implementation of Natura 2000 (Directive 1992/42/EEC) and the European Biodiversity strategy. The project was structured around three distinct methodological streams: (1) the ecological approach based on baseline studies, species and habitats modeling, (2) the socio-economic approach based on the development of narratives, policy analysis, scenarios and visualizations, involving extensive multi-stakeholder consultations, and (3) the SA approach, that drew on the previous two to develop causal chains, consider the stakeholder views, and identify potential contributions or conflicts with sustainability objectives of alternative scenarios.


**Fig. 1** Location of the six study areas

BioScene was conceived as a multidisciplinary project with contributions of different disciplines, namely ecologists, economists, sociologists and human geographers, running simultaneously throughout the project. The project adopted a case study approach to the analysis of the biodiversity processes and outcomes of different scenarios of agri-environmental change in six countries (France, Greece, Norway, Slovakia, Switzerland, and the United Kingdom—described below) (Fig. 1). For each study area a national team, including members from each of these disciplines, were responsible for the work-packages on policy analysis and ecological modeling, while engaging also on sustainability assessment. The national teams did not include experts that would work singly on SA.

In BioScene the considered scenarios for change were not taken from real-case planning, but were developed as part of the research project to simulate alternative European policies (Mitchley and others 2006). Three scenarios, or "BioScenes," were initially established (and one variation was further added) for the six areas: (1) Business as Usual (BAU): extrapolation of current market and policy trends to 2030; (2) Liberalization (LIB): based on the effects of withdrawal of support to agriculture and biodiversity conservation in the transition to free market conditions; (3a) Managed Change for Biodiversity (MCB): based on the liberalization scenarios but with a major reform of agricultural and rural development policy geared to provide high support to maximize biodiversity conservation; and (3b) Wilding/Natural Processes (only applicable to France, and the United Kingdom): no support

to agriculture, but promotion of natural processes. Norway also developed a further scenario based on the views of local stakeholders (referred to as the "Environment and Solidarity" scenario). Mitchley and others (2006), Sheate and others (2008) explore further the scenarios used in Bioscene.

Initially each of the Bioscene methodological research streams engaged in coordinated but separate analysis, but throughout the project an interdisciplinary research environment was achieved, expressed through the interchange of findings, the development of joint analysis and discussions, and finally enabling cross-related results. A key driver to this developing interdisciplinary process was the application of a SA methodology, since it engaged every team under this common framework, the methods and outcomes of which are dealt with in the following sections.

## Sustainability Assessment: Purpose and Key Methodological Aspects in Bioscene

The integrative and cross-linkage notion advocated in the recent literature on SA and on collaborative decision-making, as previously discussed, was a key driver behind the conceptualization and implementation of the SA methodology in Bioscene. The purpose of this SA was to facilitate the interaction, mutual understanding and communication between the ecological and socio-economic teams, performing the two other methodological streams of the Bioscene project; to establish a multi-dimensional framework for SA; to understand the potential impacts of each of the scenarios considered in Bioscene on wider sustainability objectives; and to identify changes that will increase desirable and reduce undesirable consequences, taking into account stakeholders perspectives.

Four cross-related and integrative building blocks were considered in the SA: the strategic reference framework (Partidario 2007) of sustainability objectives, that express linkages across traditional dimensions of sustainability; active involvement of multi-stakeholders in assessing options and consequences for their livelihoods (in close collaboration with the socio-economic stream of Bioscene); the assessment of consequences of the different scenarios, using a cross-related disciplinary basis; and the interdisciplinary approach and discussions, engaging all the disciplines and methodological streams of the research team. These are presented in the following sections on Methods, Analysis, and Results, where achievements are discussed.

A more detailed account of the SA methodology applied in BioScene can be found in Sheate and others (2008), but for the purpose of understanding how SA was applied to the six different study areas a brief outline of that methodology is presented here.

The SA process involved three fundamental stages, common to many strategic-level assessments centered around objectives:

- Defining a framework of sustainability objectives: a framework of sustainability objectives was fundamental to ensure that all national teams related to the same broad overall sustainability issues, and that a cross-pillar approach was undertaken. Stakeholders' discussion contributed to fine-tuning the sustainability objectives at study area levels, developed by the national teams. The overall sustainability objectives are presented in the next section, as well as the method used for identification and selection.
- Evaluating the sustainability of proposed scenarios: this involved using the framework of sustainability objectives to assess the alternative scenarios to see how well they fulfill the objectives and where improvement would be possible. The SA explored the likely economic, social and environmental consequences of the different development scenarios for future agricultural change (the "object" of the SA in BioScene) using for that purpose the sustainability objectives detailed for each study area. Expert assessments, as well as stakeholder assessments, were conducted. Assessment methods are detailed in the sections ahead.
- Reporting on the sustainability of scenarios: in order to link SA results with other types of analysis conducted by other streams in Bioscene (for example, analysis of policies, analysis of interviews and narratives, analysis of the biodiversity situation, cost-effectiveness analysis) (Fig. 2), country sustainability reports were prepared to document the SA results of each of the scenarios, and recommend possible improvements.

The SA process stages were integrated within the overall project. Figure 2 summarizes the links and interactions between SA (right), the stakeholders engagement process (center) and the other two streams of BioScene's main activities and outputs (left).

The collaborative work with the other streams of Bioscene through the national teams was essential to enable a SA well focused on the study area as well as an interdisciplinary interpretation of the different cases. Based on the overall European objectives provided by the SA team, national teams defined national sustainability objectives, subsequently selected and detailed three sustainability objectives for each sustainability category, developed the specific versions of various types of scenarios of future agriculture change for their study areas, and used ecological modeling to explore the biodiversity consequences in a range of agri-environmental settings. National teams also undertook interviews with stakeholders, which led to a selection of a multi-stakeholder panel that was involved for

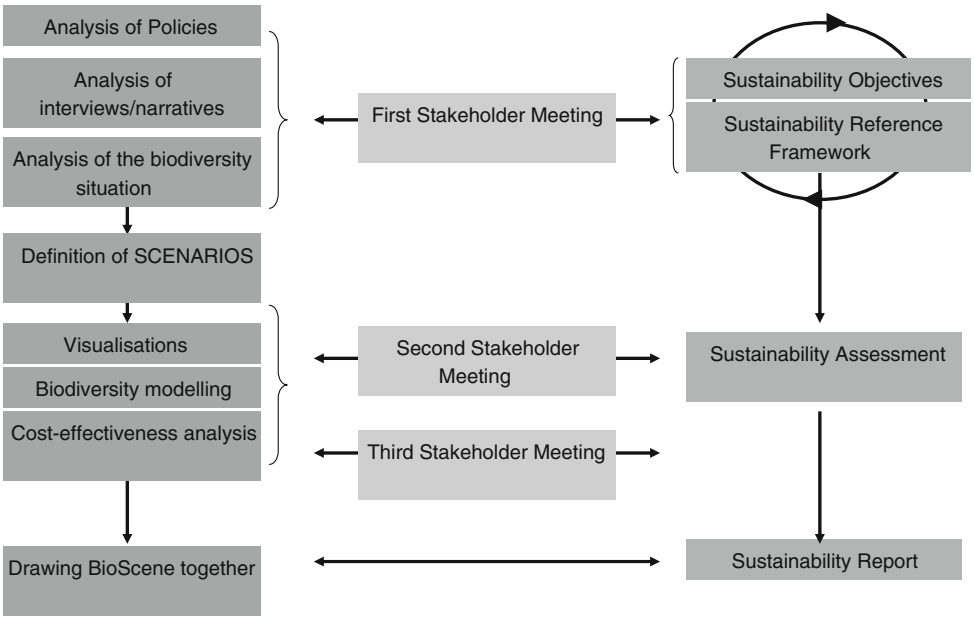


**Fig. 2** Assessment methodology of BioScene's scenarios

the entire duration of the project, and elaborated narratives that proved to be a fundamental source for the establishment of the country sustainability reports. National teams sought a comprehensive understanding of the drivers for change and their implications for all three dimensions of sustainability (i.e., environment, society, and economy). The authors coordinated the overall process of SA, with the aim of ensuring that all the different analyses undertaken by the teams in each study area contributed to understanding the implications for sustainability in the six study areas.

## Methods, Analysis, and Results

As mentioned in the previous section, four main building blocks have structured the SA: a strategic reference framework of sustainability objectives; the active involvement of multi-stakeholders; the assessment of consequences of the different scenarios; and the interdisciplinary approach and discussions. The following subsections address the methods as well as the analysis and the results achieved in each of the building blocks of SA.

### Sustainability Objectives: The Strategic Reference Framework

Establishing a framework of sustainability objectives was an initial and central task of the SA. Six sustainability themes and sub-themes were adopted (Table 1) leading to the establishment of the reference framework for assessment through the selection of sustainability objectives.

**Table 1** Sustainability themes and sub-themes

| Themes | Theme code | Sub-themes |
|---|---|---|
| Biodiversity | Bio | Biodiversity |
| Sustainable natural resources management | NR | Protection of natural resources |
| | | Energy |
| Rural development | RD | Agriculture |
| | | Forestry |
| | | Land-use planning |
| Social development | SD | Health |
| | | Equity |
| | | Culture |
| Economic development | ED | Local economy |
| | | Eemployment |
| Institutional capacity for sustainable development | IC | Local engagement |
| | | Institutional development |

European environmental and sustainability policies, along with rural and agriculture development policies, were considered to establish the Overall sustainability objectives for SA (Table 2). The sustainability objectives were then further detailed, and differentiated, for each country involved (Country sustainability objectives), and for each study area (Study Area sustainability objectives), which enabled investigation on key features in the case-study areas. In this way, each country team related their national and study area sustainability objectives to a common European-based sustainability objectives framework, as shown in Table 2.

**Table 2** European overall objectives of sustainability

| Categories | Sub-categories | Overall objectives |
|---|---|---|
| Biodiversity | Biodiversity | To conserve biodiversity |
| | | To protect endangered species and habitats |
| | | To maintain and enhance networks of sites |
| Sustainable natural resources management | Protection of natural resources | To promote the sustainable consumption of renewable and non-renewable resources |
| | | To reduce levels of pollution to natural resources and implement pollution prevention techniques |
| | Energy | To ensure efficient use of energy sources |
| | | To promote renewable forms of energy |
| Rural development | Agriculture | To promote more sustainable farming practices, maintaining the resource base and ecological processes |
| | | To protect and maintain traditional agricultural landscapes |
| | | To promote sustainable agricultural related policies |
| | Forestry | To promote an environmentally responsible management of forest resources |
| | | To ensure long-term conservation through sustainable use of the biological diversity of forests |
| | Land-use planning | To promote sustainable land-use planning and rural development |
| | | To enhance the quality and distinctiveness of the landscape by restoring degraded land |
| | | To improve accessibility to the uplands, forest and agricultural areas |
| Social development | Health | To prevent and minimise threats to public health |
| | | To promote health care and improve services |
| | Equity | To ensure equal rights, besides gender, race, disability, age and sexual orientation |
| | | To promote equality of opportunity in the delivery of and access to services and environmental goods |
| | Culture | To maintain and develop distinctive culture and identity of communities |
| | | To promote traditional knowledge and ensure that historic sites are recognized and preserved |
| | | To improve educational achievement and opportunities for lifelong learning |
| Economic development | Local economy | To support the viability of local economy and capacity for innovation |
| | | To promote environmentally responsible tourism |
| | Employment | To promote new livelihood opportunities based on local and regional resources |
| | | To promote training of local communities to ensure skilled human resources |
| Institutional capacity for sustainable development | Local engagement | To increase awareness of local communities on issues relating to environmental protection and use of natural resources |
| | | To enhance participation of local communities in local decision-making processes |
| | Institutional involvement | To improve governance and accountability among local administration and rural organizations |
| | | To provide institutional support for long-term management in relation to land tenure and natural resource ownership |

The Study Area objectives were thus based on two sets of more generic sustainability objectives (overall objectives—international and European priorities, and Country specific objectives—national priorities), derived from the analysis of official documentation, policies, and legislation from international, European, and national sources. These more broad-brush objectives acted as a strategic reference framework (Partidario 2007) for the definition of the study area objectives, which were developed and approved by the country teams, with support from the stakeholder panels. While the method for identification of Country and Study Area sustainability objectives were the same, the resulting objectives naturally differed across the six study areas. The intention behind such a nested set of objectives was to provide a coherent framework within which local development strategies could best add value to European and national policies: the framework should secure co-ordination between the top-down policies and the work of local level development agencies (vertical integration), avoiding duplication or conflict. The Study

Area SA objectives illustrated what sustainability meant for the study areas.

Early on in the project, the BioScene socio-economic stream undertook reviews of policy trends for agriculture, rural development, land-use and biodiversity conservation. These initial review documents provided the basis for individual interviews and group discussions with a range of stakeholders. Detailed investigations were conducted by national teams on the socio-economic character of their respective study areas and on the main ecological—and specifically biodiversity—issues and concerns, responding to the project's interdisciplinary approach and to the investigation of the implications of agricultural restructuring and decline for biodiversity conservation in Europe's mountain areas.

The study areas were chosen to represent a wide range of geophysical, socio-economic, and cultural characteristics in mountain areas in Europe, summarized in Table 3. Some of the significant socio-economic characteristics of the areas are highlighted in Table 3, including major trends such as land abandonment, migration of young people and subsequent aging of the resident population, farm amalgamations and resulting changes in agriculture practices, as well as the rise of off-farm income diversification. Based on Soliva and others (2005b) the third column gives figures of total agricultural land and percentage decline in number of farms. Furthermore, all areas have agriculture systems that are highly dependent on subsidies and not competitive (Soliva and others 2005b).

## Defining the "Object" of Assessment in the Sustainability Assessment

In preparation for the assessment, with the establishment of the reference framework—the sustainability objectives—it is fundamental to identify the "object" of assessment (Partidario 2001; Bina 2003). As stated above, the purpose of the SA included to establish a multi-dimensional framework for SA (above described), to understand the potential impacts of each of the scenarios considered in Bioscene on wider sustainability objectives and to identify changes that will increase desirable and reduce undesirable consequences, taking into account stakeholders perspectives (described below), and to illustrate how the assessment of the potential sustainability consequences of different European rural and agriculture policy scenarios could be carried out. It was also mentioned before that SA needs to consider strategic options, such as development scenarios, in the assessment in order to assist policy-making. The "Bioscenes" were therefore the object of assessment in SA.

For the purpose of SA, each scenario, introduced in the Background section, was framed as a set of detailed flowcharts illustrating the causal chains that link key drivers, to impacts and to land use consequences: Drivers > Primary impacts > Secondary impacts > Land Use consequences.

The object of assessment was therefore represented through the causal chains of the three alternative scenarios of future agriculture change: Business As Usual (BAU), Liberalisation (LIB), and Management for Biodiversity Conservation (MBC). For Norway, also the Environment and Solidarity scenario and for the UK and France the Wilding/Natural processes scenario are also considered. This causal link structure helped the multidisciplinary teams to see the connections between various factors influencing their study area, and emphasized the indivisibility of economic, social, and environmental factors.

Each scenario included between five and ten drivers of change, which vary according to the scenario. To enable their assessment, each causal chain linking drivers, related impacts and consequences was described as a flowchart (Fig. 3), which was then disaggregated for each driver for use in the assessment (see two examples on disaggregated causal chains in Fig. 4, based on Sheate and others 2008). This disaggregation was necessary due to the complexity of the causal chains and the need to streamline relevant processes of change. The purpose was to establish how each scenario contributed, or conflicted, with the study area objectives and indicators.

## Multi-Stakeholder Engagement: Considering Multiple Perspectives

A wide range of stakeholders, representing multiple interests and perspectives, were involved in the six-study areas: (1) farmers (e.g. an unemployed sheep farmer for Slovakia, a dairy and meat cattle farmer for Switzerland), (2) private sector and tourist industry (e.g. private land owners for Slovakia, drug store owner and local tourism business for Switzerland, a business woman and a forester for the United Kingdom), (3) local and regional public administrations (e.g. director of National Park Authority and the mayor of a village for Slovakia, a member of the Scottish Youth Parliament for the UK), (4) non-governmental organizations for environment and development (e.g. forest protection NGO for Slovakia, the Royal Society for the Protection of Birds for the UK), and (5) visitors to the areas as well as recent migrants (e.g. previous city dwellers moving to mountain areas for Switzerland, conservationists, writers, and naturalists for the UK). Table 4 provides a more complete stakeholder profile of the six study areas, indicating the key perspectives and the average number and type of stakeholders.

The stakeholders contributed at three key moments (multi-stakeholder meetings) of the Bioscene process (Fig. 2), contributing to the different stages of the SA: first

**Table 3** Basic description of the six study areas

| Study area | Overview of key socio-economic characteristics | Agriculture decline |
|---|---|---|
| Jotunheimen—Norway | East Jotunheimen: the area is within the two municipalities of Vågå and Lom in East Jotunheimen in central Norway | 6321 ha of agriculture land<br>Decline in terms of nr of farms: circa 20% (1989–1999) |
| | In the areas studied 25% and 18% of the working population within agriculture (including forestry), compared to a national average of approximately 4% | |
| | Difficult farming conditions and small-scale farms. The dominating production is animal husbandry—sheep and dairy production. Off-farm income important for households | |
| | Policy of regional specialisation is crucial for maintaining agriculture in mountain areas | |
| | Trends: decreased profitability in farming, fewer and larger farms, reduced grazing and reduced use of the outfields, and forest colonisation | |
| Causse Méjan—France | Southern France: the Causse Méjan is a high altitude Mediterranean limestone plateau 90 km north of the Mediterranean | 33000 ha of agriculture land<br>Decline in terms of nr of farms: 27% (1970–2000) |
| | Since 1970, loss of farms is continuous but slower than in other regions and slows down since 1988 | |
| | Farmers still control most of the territory. Arable land increases but rangeland and pastures decreases | |
| | 60% of farms are larger than 200 ha and use 91% of the total agricultural land (arable land + rangeland). Number of sheep increases constantly but active population decreases | |
| | Trends: diversification in non-agricultural activities is under strong development, especially in tourism activities | |
| Vikos and Aoos—Greece | Northern Greece—the area contains the Vikos Aoos National Park (gorge and valley) in the Zagori region | 1079 ha of agriculture land<br>Decline in terms of nr of farms: 60% (1961–1991) |
| | Small size of settlements situated at very high altitude. Extremely small and scattered plots where less intensive methods of production are applied. Abandonment of marginal land. Predominance of forestry and cattle-raising | |
| | Socio-economically marginalized, sparsely populated with ageing population | |
| | Trends: population stabilisation, out-migration ceased recently. Some immigrants from Albania. Area with tourist potential | |
| Bukovské vrchy Mts—Slovakia | NE corner of Slovakia: the area is part of the Carpathian mountain range, and lies in the National Park Poloniny and Man and Biosphere (MAB) East Carpathians Biosphere Reserve | 4300 ha of agriculture land<br>Decline in terms of nr of farms: 48% (1949–2003) |
| | Marginal region—gross domestic product per capita is only 65% of the Slovak average | |
| | Forest dominates this region (more than 70%) and agricultural land is mostly grassland for pastoral grazing | |
| | Agriculture decline recorded since 1960s. Individual farmers manage very small fields and pastures. The population's vitality index = 0, 44 | |
| | Trends: shift from agricultural productivity to more environment friendly management based on extensive forms of agriculture. The main animal production is beef cattle, with low crop production | |
| Surses—Switzerland | South-Eastern Switzerland, canton Grisons: the area includes the valleys of Albula and Sursés, and three protected areas: Alp Flix, Val da Sett and Piz | 1906 ha of agriculture land<br>Decline in terms of nr of farms: 35% (1980–1996) |
| | Population is slightly decreasing. Approx. 40% of employees work in tourism, 17% in agriculture/forestry; about 50% of inhabitants depend directly on tourism | |
| | Agricultural production: mainly dairy farming and cattle raising | |
| | Trends: from milk production toward extensive cattle raising; toward environment-friendly production: 60% of farmers produce organically. Off-farm employment is widespread, mostly in winter tourism | |

**Table 3** continued

| Study area | Overview of key socio-economic characteristics | Agriculture decline |
|---|---|---|
| Cairngorms—United Kingdom | Scotland: Area: the area is located within the boundaries of the "Cairngorms Partnership Board Area" and it occupies the most of the north east and north west quadrants of the Cairngorms area<br>Sparsely distributed population; increasingly an ageing population<br>Agriculture includes traditionally managed arable land, upland farming, forestry and livestock farming<br>Decline in number of upland farms and subsequent amalgamations has led to loss of farmland habitats<br>Trends: continued dependence on agricultural income despite off-farm diversification; significant out-migration of young people predicted over next decade. Growth in the tourism sector. Reduction in farms due to declining rate of succession, sue in turn to increasingly vulnerable farm businesses | Circa 10000 ha of agriculture land<br>Decline in intensity not in area |

*Source*: Bezák and others (2005), Cooper and others (2005), Marty and others (2005), Ronningen and others (2005), Soliva and others (2005a, b), Togridou and others (2005)

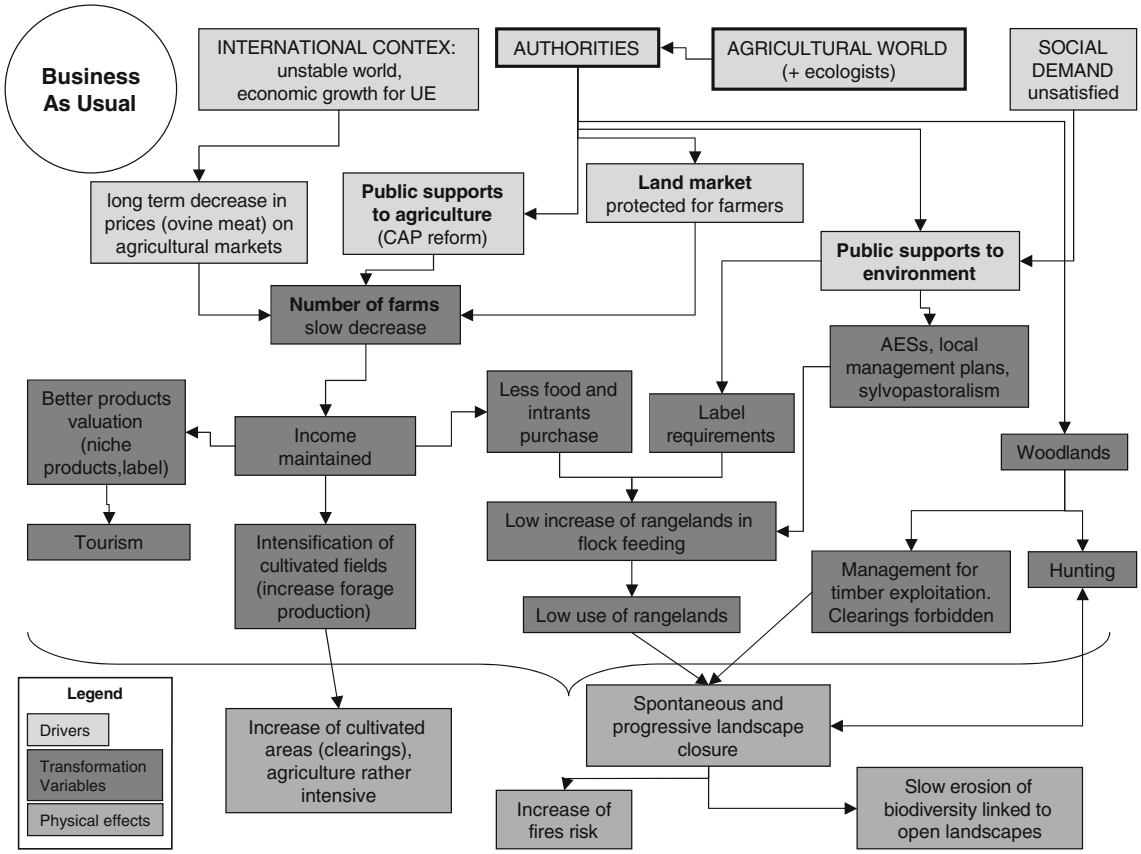


**Fig. 3** Example of BAU causal chain for the Causse Méjan area (France)

to help fine-tune study area objectives and establish the reference framework, second to contribute to visualization of future landscapes and third to contribute a civil society perspective to the sustainability assessment of development scenarios. Early interviews conducted by the socio-economic teams provided the basis for the selection of stakeholder panel members. The composition of each stakeholder panel was intended to be representative of the range of perspectives, and not of particular groups or interests. In practice, stakeholders ranged from very sophisticated debaters, often capable of taking a broader collective perspective, to rather narrowly focused (but

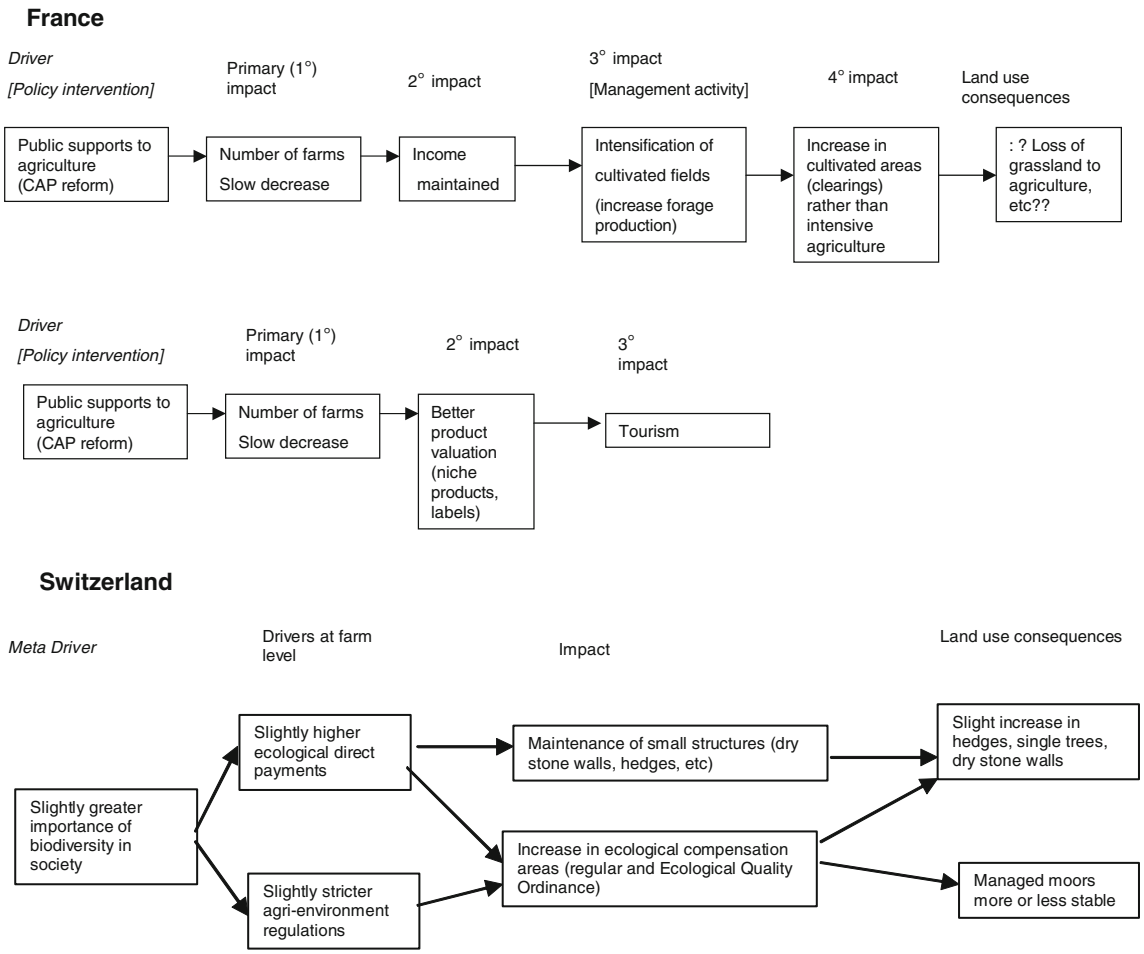


**Fig. 4** Examples of individual disaggregated causal chains

equally articulate) exponents of essentially personal interests.

The first meeting provided an insight into stakeholders' perceptions, assumptions and expectations for the future of their land and for their livelihoods, allowing them to identify narratives of landscape change. This material, together with interviews and an analysis of policies for agricultural change (local, national and European), was instrumental to the first stages of the SA process: the definition of study area sustainability objectives and of the major sustainability issues, trends and challenges identified for each area.

The study area objectives illustrated what sustainability meant for the study areas, and attempted to balance the expert (Bioscene teams) and lay (stakeholders) views of what should be achieved in order for development in the study area to be more sustainable. Stakeholders discussed a draft list of study area objectives proposed by the national teams, and were asked, through a questionnaire, to comment and to contribute additional objectives where necessary, and also to identify the top three objectives for the area. This led to some interesting results (Table 5).

Table 5 reveals some similarities across study areas. Objectives relating to biodiversity/natural resources—while considered important—did not feature strongly as priorities, instead objectives relating to livelihoods were considered most important. Sustaining social cohesion in rural communities was seen as an important objective including the maintenance of current family farming practices. Cultural links between those living in a community and the landscape, including the preservation and promotion of cultural heritage were also identified as priority areas. To support this, preferred objectives included the need to maintain or develop transport infrastructure to improve access, to make study areas "more attractive" for residents and newcomers, and to improve social services (for education and health). The creation of jobs for young people and newcomers was also a prominent concern, and the development of the tourism industry was considered important, although this would have to be "sound and

**Table 4** Stakeholders makeup for the six study areas

| Country | Key perspectives | Average nr. stkh | Type of stakeholders |
|---|---|---|---|
| Norway | Holding out farmers | 14 | Conventional dairy farmer (2) |
| | New rural development | | Small scale farmer |
| | Nature conservation | | Sheep & dairy farmer & member of Mountain Board |
| | | | Leader of small farmers union |
| | | | Niche food development project |
| | | | National Park |
| | | | Organic goat farmer |
| | | | Teacher—wildlife tourism, cultural heritage |
| | | | Leader of sawmill/forestry company |
| | | | Municipal agricultural officers—(2) (including the leader of the office) |
| | | | Regional agricultural administration |
| | | | Hunters and anglers association |
| France | Agro-environment and development | 13 | Sheep farmer—dairy |
| | Agro-environment and nature conservation | | Sheep farmer—meat (2) |
| | | | Farmer—honey & lamb |
| | Pro-forest | | Sheep farmer—meat and tourism |
| | | | Poultry farmer—tourism |
| | | | Mayor/cheese factory owner |
| | | | Vice mayor |
| | | | National Park officer |
| | | | NGO |
| | | | Local tourism business |
| | | | Agricultural high school teacher |
| | | | Forest manager—department of forest and agriculture |
| Greece | Business | 9 | Mayor of Central Zagori |
| | Agriculture | | In-migrant, tourist entrepreneur |
| | Agro-environment and development | | Local products, tourist entrepreneur |
| | Development-tourism, hunting | | Hunter, member of the movement against the National Park |
| | Landscape, architecture, cultural heritage | | Architect |
| | | | Farmer |
| | Social—quality of life | | Local, involved in cultural landscape |
| | Nature conservation | | Member of WWF (NGO) |
| | Forest | | Ornithologist |
| | | | In-migrant, mountain guide |
| | | | Employee of the information of National Park of Valia-kalda |
| | | | President of the cultural society |
| | | | PhD student, biologist |
| | | | Head of the management committee of the National Park |
| Slovakia | Farming | 12 | Head of regional forest owners |
| | Tourism | | Head of Dept of Cultural and Regional Development at the Borough Council |
| | Nature protection | | |
| | Forestry | | Forestry NGO (2) |
| | | | National Park Authority (3) |
| | | | Mayor of village |
| | | | Unemployed sheep farmer |
| | | | Director of forest and agricultural farm |
| | | | Primary school teacher |
| | | | Water reservoir manager |

**Table 4** continued

| Country | Key perspectives | Average nr. stkh | Type of stakeholders |
|---|---|---|---|
| Switzerland | Farming | 8 | Sheep farmer—dairy |
| | Retirement-quality of life | | Cattle farmer—dairy and meat (2) |
| | Tourism business & hunting | | Retired newcomer from lowlands |
| | Forestry | | Cantonal employee/amateur hunter |
| | | | Retired veterinary/leisure sheep farmer |
| | | | Local tourism business |
| | | | Forest manager |
| | | | Gamekeeper |
| | | | Drug store owner/amateur botanist |
| United Kingdom—Scotland | Farming | 10 | Farmers (3) |
| | Quality of life | | Forester |
| | Business | | Conservationists (3) |
| | Nature conservation | | Nature reserve warden and member of the Scottish Youth Parliament |
| | Forestry | | Writer and naturalist |
| | | | Business-woman |

sustainable" and "mild (tourist) development," taking into consideration the cultural and environmental values of an area. Continued agricultural activity was favored, with emphasis on organic farming and the use/promotion of labels and quality/certified products, particularly of local produce.

Some objectives relating to biodiversity/natural resource aspects of sustainable development were identified as a priority, mainly in relation to the protection/maintenance of semi-natural grasslands (with emphasis on stopping their decline) (Slovakia & France) and the protection and proper management of the natural environment (Slovakia & Greece). Also, the sustainable use and management of forestry was identified as a priority area. One case study area (Switzerland) highlighted the importance of forestry in terms of its protective function against natural hazards such as global warming. Emphasis was placed on the importance of finances necessary for any 'environmental investments' to take place (Slovakia).

The Norwegian case was one of the most successful in the clearness of the objectives obtained. Reviewing the Norwegian case in more detail allows us to elaborate further on the process and substantive implications of stakeholder involvement in this task. The preferences expressed by Norwegian stakeholders were in line with the trends above, with the highest questionnaire ratings relating to "cultural landscapes," the "securing of settlements," followed by "tourism," "cultural heritage," and, finally, "species"—thus appearing to favor social and economic development. The fact is that the stakeholders viewed the landscape as an expression of the overall situation in the study area, linked to livelihoods, social, cultural, and aesthetic/visual aspects, and did not consider biodiversity as the major issue. As the Norwegian experts team concluded, biodiversity could probably rather be seen as a function of the overall landscape (Ronningen and others 2005). However, when asked to discuss the result of their scoring (at the third meeting) stakeholders insisted that what appeared to be a preference for socio-economic objectives rather than straight biodiversity ones, was misleading. They explained that for them the two categories were actually closely interlinked and that by meeting an economic development objective, they expected also to meet biodiversity aims.

The second multi-stakeholder meeting was designed to obtain the views of stakeholders on a visualization exercise. This was based on the biodiversity consequences of the "BioScenes" predicted through ecological modeling of shifts in priority species and landscape changes, which were translated (and synthesized) into photographic representations to help generate feedback from the stakeholder groups concerning the acceptability of the "BioScenes" presented to them. This was very important as an input for the second stage of the SA process, to enable an a priori indication on stakeholders' perception on preferences and priorities regarding the future development of their areas.

As in the first meeting, in this second meeting stakeholders were again invited to discuss the preliminary list of sustainability objectives for their areas, compiled by national teams responsible for each study area under analysis. Each national team organized this task in a slightly different (locally appropriate) way, but the aim was to

**Table 5** Stakeholder choice of priorities for the study area objectives (all six areas)

| Country | Top priority objectives and related theme (Bio, NR, RD, SD, ED, IC) cf. Table 6 |
|---|---|
| Norway | To maintain family farming, incl. mountain summer farming and a varied animal husbandry as important economic activities based on local grazing resources (RED = Rural Economic Development) |
| | To ensure a sustainable use of outfield resources linked to fishing, hunting, grazing, forestry, recreation and tourism (NR) |
| | To create jobs for highly educated people so the local community is able to offer local youth and incomers work after ending education (RED) |
| France | To maintain resources of semi-natural grasslands for breeding activity (NR) |
| | To improve roads network and others means of communication (telecom network) (RD) |
| | To promote labels and local production (RD) |
| | To develop use of both timber and non-timber resources (RD) |
| | To develop employment for young people (ED) |
| | To promote farmers installation (public support, access to farmland) (ED) |
| Greece | The preservation and promotion of the cultural heritage (SD) |
| | The protection and proper management of the natural environment (i.e. education, environmental studies, implementation of nature conservation laws etc) (Bio) |
| | The promotion of mild tourist development with respect of the cultural and environmental values of the area (ED) |
| | The support to traditional activities (creation of small eco-units or schools of traditional skill) (ED) |
| | The improvement of social services and the upgrading of the social capital of the area (SD) |
| | The continuation of agricultural activity with special emphasis toward organic farming and quality/certified products (RD) |
| Slovakia | To ensure state finances for environmental investments (ED) |
| | To provide such activities that stop the decline of biodiversity of grasslands (overgrowing, succession) (Bio) |
| | To ensure integrated protection of natural resources (water, forest, soil and grassland resources) (NR) |
| Switzerland | To ensure a sound and sustainable development of tourism (ED) |
| | To make the area more attractive for residents and newcomers (especially for young people and families), and promote a balanced regional development (RD) |
| | To manage and take care of forests so as to ensure their protective function in times of increasing natural hazards (due to global warming) (NR) |
| United Kingdom | To sustain vibrant, diverse and socially cohesive rural communities (SD) |
| | To maintain the infrastructure, extension services, skills base and social capital necessary for land management and to ensure that the region has the capacity to produce primary products (ED) |
| | To respect cultural links between people, place and landscape (SD) |
| | To maintain and enhance the biodiversity interest and ecological status of sites designated for nature conservation (Bio) |

*Source*: Bezák and others (2005), Cooper and others (2005), Marty and others (2005), Ronningen and others (2005), Soliva and others (2005a, b), Togridou and others (2005)

identify any objective that raised serious disagreement. It also intended to provide national teams with additional objectives or themes that they might have missed but which were important to some of the stakeholders. Finally stakeholders were asked to identify the three objectives, which they felt were the most important (out of lists of maximum 20 objectives) (Table 5). In one case (the Cairngorms, UK), stakeholders were actually asked to write down their own lists of objectives (cf. Sheate and others 2008).

The third meeting was conducted to get the stakeholders direct input on the assessment of the Bioscenes. Following the initial experts' assessment, carried out by the experts team—national and SA teams—(described below), the perspective of the "civil society" was brought into the assessment through workshops conducted with stakeholders to discuss the preliminary results of the matrix analysis at this third—and final—meeting (cf. Sheate and others 2008). Discussions revealed stakeholder understanding of the scenarios and the causal relationships they represent, and enabled them to explore where the limits of acceptable change might lie. Stakeholders helped reveal how people understand and perceive the concept of biodiversity, knowledge about biodiversity conservation, agricultural practices and the link between the two in the case of mountain areas.

The repeated involvement of many stakeholders over a period of three years helped to engage individuals and to engender a sense of extended group discussion, in most of the six groups. Successive debates and the increasing notion on each stakeholder's relative position on the issues at stake would contribute to a general sense of what could be expected from each other, and from the group as a

**Table 6** Summary scenario comparison matrix (Switzerland)

| Categories of objectives | BAU | LIB | MCB |
|---|---|---|---|
| Biodiversity objectives | + | − − | ++ |
| | +/− | − − | ++ |
| | +/− | − | ++ |
| Sustainable natural resources management objectives | 0 | 0 | 0/+ |
| | − | − − | 0/+ |
| | 0 | − − | 0/+ |
| Rural development objectives | + ? | − | + ? |
| | +/− | − − | +/− |
| | 0 | − | − − |
| | 0 | 0 | 0 |
| | +/− | − − | 0 ? |
| | + | − − | ++ |
| Social development objectives | − | − − | − − |
| | 0 | − | 0 |
| | 0 | − | 0 |
| Economic development objectives | 0 | − ? | + ? |
| | 0 | − ? | 0 |
| | + | − − | + ? |
| Institutional capacity for sustainable development objectives | + | − | + |
| | 0 | + | 0 |

Legend for the 5-point scale:

++ Strongly positive, i.e., driver makes a major positive contribution; + positive, i.e., driver makes a positive contribution; 0 neutral, i.e., driver has no significant contribution; − negative, i.e., driver conflicts with objective (highlighted in bold); − − strongly negative, i.e., driver is in major conflict with objective (highlighted in bold); +/− uncertain i.e., uncertainty on positive contribution or conflict, depending on nature of action; ? uncertain i.e., uncertainty about the likelihood of an impact

*Source*: Soliva and others (2005a)

whole, which became relatively evident in the nature, and easiness, of dialogues undertaken. The intensity of dialogues, the collaborative attitude and the eagerness to participate in all of these discussions also supports this notion of engagement. These group dynamics, combined with exposure to increasing information and results of expert analyses (especially the visualization and sustainability matrix analysis), led to some shifts in the position of stakeholders on specific issues and in terms of their support or dislike of certain scenarios.

For example, in the Vikos and Aoos area (Greece) the role and management of the National Park had been a source of significant tension amongst the local and regional population. At the first meeting, several of the stakeholders involved in BioScene were demanding a stronger local involvement in the management of the park and the abolition of a regulation prohibiting human activity within its boundaries. However, by the last meeting, a certain degree of consensus arose, and "the stance of stakeholders representing the views of hunters and of the local community (largely against the current management of the park) became gradually milder" (Ioanna Bella personal communication May 2005). In the Cairngorms (UK), the dialogue between conservationists and economic actors involved in agriculture and/or tourism was intense, and although often it seemed that some progress was made toward greater mutual understanding, at the end of the third meeting the essentially polarized positions seemed to resurface, leaving doubts about the possibility of enduring changes. In Norway, the stakeholders rejected the Wilding scenario (and its inclusion of encouragement for large predators, such as wolves—itself a highly charged and controversial issue in Norway) at the second meeting and instead suggested parameters for their own preferred scenario. The Norwegian team used these parameters to develop an alternative scenario (referred to as the "Environment and Solidarity" scenario, which reflected the Norwegian stakeholder's wider concern for global issues as well as local) that was included in the SA process. However, interestingly when the results of this scenario were presented and discussed at the third stakeholder meeting it did not emerge as the stakeholders' strongly preferred scenario, but rather as one of their two preferred scenarios (the other being MCB).

## The Matrix-Based Assessment of the Scenarios

A common assessment technique used in SA is the matrix (DHV 1999; ERM 1998; ODPM 2003; Thérivel 2004). In BioScene, this common approach was adapted to the nature of the scenarios and drivers, and a general assessment matrix for each driver and associated causal chains was proposed to each of the national teams, who then used the matrix for their particular case (Sheate and others 2008).

The SA methodology established that BioScene scenarios were evaluated in terms of their contribution to, or conflict with, the six sustainability themes and objectives specific to each case area (Study Area objectives). Given the way that sustainability objectives were structured, as introduced before, linking European to national and study area objectives, the sustainability objectives used by the national teams in their study areas, and subsequent discussions amongst stakeholders, were both locally relevant and could also be related to national and European goals.

Subsequently, the national teams and the authors, albeit independently, completed the SA matrix-based analysis of the scenarios. Taking the causal chains (exemplified in Figs. 2, 3) as the processes of change, the purpose of this scenario's analysis was to consider whether drivers of change would determine significant positive or negative contributions to the sustainability objectives, and how these contributions might differ according to the different

scenarios. At this stage the matrices reflected the views of "experts." The perspective of "civil society" was incorporated into the SA process through the presentation and discussion of the preliminary results of the matrix analysis with stakeholders (as described). The SA results were then further revised by the experts' teams taking into account the perspectives of the stakeholders.

At meetings in each study area, national teams presented summary matrices showing the results of the SA for all three scenarios. Table 6 shows an example of a summary matrix where results of each objective were aggregated according to six sustainability themes.

Table 7 shows the overall results for the SAs for each scenario in all countries. It summarizes the expert-led SA matrices for all scenarios across all six study areas allowing us to comment on the relative contribution of all BioScenes to sustainability objectives.

The managed change for biodiversity (MCB) scenario was the most positive in terms of contributing to the objectives for biodiversity, natural resources and institutional capacity. The MCB scenario was followed closely by business as usual (BAU) as the scenarios most likely to meet rural, social and economic development objectives. The wilding scenario (only for France and the UK) was essentially in conflict with objectives for biodiversity, natural resources and economic development. And as discussed above, liberalization appeared to lead to the greatest conflicts with sustainability, particularly in relation to biodiversity, social and economic development—but was more positive in relation to institutional capacity. One reason why "wilding" appeared negative for biodiversity was because the biodiversity objectives are invariably linked to current biodiversity priorities. A wilding approach would necessitate a willingness to think beyond

**Table 7** Summary results of the SA matrix assessments for all scenarios in six study areas

| Sustainability objectives | | Biodiversity | Sustainable natural resource management | Rural development | Social development | Economic development | Institutional capacity for SD |
|---|---|---|---|---|---|---|---|
| Scenario 1—BAU | NO | − − | − | ? | 0 | ? | − |
| | FR | − | ? | + | +? | + | + |
| | GR | −+ | − | + | +? | +? | + |
| | SL | + | + | ++ | + | ++ | + |
| | CH | + | 0 | +− | − | + | 0 |
| | UK | +− | + | + | + | + | 0 |
| Scenario 2—Liberalisation | NO | − − | − | − | − | − | − |
| | FR | − − | − | + | − | − | 0 |
| | GR | − | − | − − | 0 | − | + |
| | SL | + | + | − | − − | − | + |
| | CH | − − | − − | − − | − − | − | + |
| | UK | +− | +− | +− | +− | +− | 0+ |
| Scenario 3—Wilding | NO | | | | | | |
| | FR | − − | − | + | − | − − | 0 |
| | GR | | | | | | |
| | SL | | | | | | |
| | CH | | | | | | |
| | UK | +− | +− | −+ | + | + | +− |
| Scenario 4—MCB | NO | −+ | + | + | + | + | + |
| | FR | ++ | ++ | ++ | ++ | + | + |
| | GR | ++ | ++ | ++ | ++ | + | + |
| | SL | ++ | ++ | + | − | + | ++ |
| | CH | ++ | 0+ | + | − | +? | 0 |
| | UK | ++ | + | ++ | + | + | +− |

Columns key: NO = Norway, FR = France, GR = Greece, SL = Slovakia, CH = Switzerland, UK = United Kingdom

Symbols key—legend for the 5 point scale:

(empty) not applicable

++ Strongly positive, i.e., driver makes a major positive contribution; + positive, i.e., driver makes a positive contribution; 0 neutral, i.e., driver has no significant contribution; − negative, i.e., driver conflicts with objective (highlighted in bold); − − strongly negative, i.e., driver is in major conflict with objective (highlighted in bold); +/− uncertain i.e., uncertainty on positive contribution or conflict, depending on nature of action; ? uncertain, i.e., uncertainty about the likelihood of an impact

current agriculture-based biodiversity priorities to quite different biodiversity targets and opportunities.

If we consider the less aggregated SA matrices (i.e., the expert-led task of the SA process, with comments from stakeholders) for just the liberalization scenario across all six areas (Table 8) we notice some interesting comparative results. For each study area, the table shows the scores given to individual objectives per sustainability theme (six themes in total). Thus, for biodiversity, the table shows that—except for the Cairngorms (UK) that show significant variability in likely effects—all other areas expect some critically negative results (i.e., − −, expressing conflict with objectives). Only the Bukovské vrchy mountains (Slovakia) expect some very positive contribution (i.e.: ++) toward ensuring "protection of virgin forest and close-to-nature management of other forest." Likely significant conflicts with objectives for sustainable management of natural resources are expected in four areas (Causse Méjan, Jotunheimen, Bukovské vrchy mountains, and Surses) out of six, but some contribution to other objectives in this category is also expected; thus, the results are more diverse in this category. The rural and economic development objectives, which were found—not surprisingly—to be of great

**Table 8** SA matrix assessments for Agricultural Liberalization scenarios in six study areas

| Sustainability themes | Jotunheimen—Norway | Causse Méjan—France | Vikos and Aoos—Greece | Bukovské vrchy mts—Slovakia | Surses—Switzerland | Cairngorms—United Kingdom |
|---|---|---|---|---|---|---|
| Biodiversity | − − | − − | − | ++ | − − | +/− |
| | 0 | − − | − | − − | − − | −/+ |
| | | | − − | + | − | −/+ |
| | | | | | | −/+ |
| | | | | | | +/− |
| Sustainable natural resources management | ? | − − | 0/− | ++ | 0 | +/− |
| | + | + | 0 | − − | − − | + |
| | − | + | − | + | − − | 0 |
| | − − | | | | | |
| | 0 | | | | | |
| Rural development[a] | − − | + | − − | − | − | +/− |
| | − | 0 | − | − | − − | + |
| | ?/+ | + | − − | − − | − | +/− |
| | 0 | | − | + | 0/? | |
| | 0 | | 0 | | − − | |
| | + | | − | | − − | |
| | − | | | | | |
| | + | | | | | |
| Economic development[a] | | − − | | + | −/? | |
| | | ? | | − | −/? | |
| | | ? | | − | − − | |
| | | − | | | | |
| | | ?/− | | | | |
| Social development | 0 | − | 0 | − − | − − | −/+ |
| | − | − | + | − − | − | 0 |
| | − − | − | 0 | − − | −/? | + |
| | | | 0 | | | +/− |
| | | | − | | | |
| Institutional capacity for sustainable development | − | 0 | ++ | 0 | − | 0/+ |
| | − | 0 | 0 | + | + | |
| | − | | − | | | |
| | | | − | | | |

[a] Partners in the areas in Greece, Norway and the United Kingdom chose to combine the rural and economic development themes

*Sources*: Soliva and others (2005a), Bezák and others (2005), Cooper and others (2005)

interest to stakeholders who viewed these as the expression of their livelihoods, were found to be generally negatively affected by the driving forces of liberalization. Causse Méjan and the Cairngorms are the only two areas where potentially positive contributions are expected. It is also noticeable that, for these two interrelated themes, the level of uncertainty (i.e., "?") is particularly high, suggesting that the complexity of causal chains and the difficulty in predicting the direction of many trends leaves many open questions about threats and opportunities. A generally negative pattern is noticeable also for social development objectives, except in Vikos and Aoos (Greece) and the Cairngorms, where a combination of positive and negative effects is envisaged. Finally, the institutional capacity objectives present a mixed picture, except in Jotunheimen, where liberalization is expected to conflict with all objectives in this category.

## Discussion of Results

### Reflecting on Methodological Issues: Methods and Approaches

The SA process in BioScene provides some innovative, and challenging, dimensions to the wider debate on strategic-level assessments. The multidisciplinary nature of the project meant that the SA could combine a range of approaches, sources of information, but also understandings—especially given the participatory dimension integrated throughout the research project. This was made possible by the three distinct methodological streams adopted in Bioscene: (1) the ecological approach based on species and habitats modeling, (2) the socio-economic approach based on the development of narratives, scenarios and visualizations, and (3) the SA approach, that drew on the previous two to develop causal chains, include stakeholder views, and identify potential contributions or conflicts with sustainability objectives.

The wealth of data, and the time available in a research project of this dimension is rarely available in real-life cases. Nonetheless, it is our conclusion that a wide range of approaches and methods to strategic-level assessment is feasible and desirable, even within time and resource constraints. A significant amount of information can be developed on the basis of existing data, and uncertainty—as has been demonstrated in these six studies—remains a fundamental part of any such high-level analysis, often independently of the amount of resources. Furthermore, the experience suggests that there is benefit in adopting a consistent methodology across case studies so long as there is a degree of flexibility that allows adaptation in the light of contextual differences.

Bearing in mind the need to ensure replication of results achieved into real-life application of SA, leading to concrete decision-making for proposed policies, it is important to note that for those themes where the matrix-based assessment has revealed particularly complex, diverse and uncertain results (for example, the rural development and natural resources themes), that these be followed up through more deliberative approaches to assessment, including focus group discussions or seminars, as recommended in the existing literature (Bina 2003; Stirling 2006; Camilleri 2005; Owens and others 2004). Of the six case study areas, the French came closest to adopting this approach, during the third stakeholder meeting: the expert team presented details of likely impacts of particular drivers/chains and engaged stakeholders as a group to come to a collective assessment score and to explore the areas of uncertainty. Thus, in a real-life application of SA, the positive results achieved should in principle lead to further deliberations toward the identification of sustainable futures.

### Reflecting on the Overall Participatory Process in BioScene

Two factors have led to the diverse response to participation: (1) the wide range of cultural contexts represented and (2) the different style adopted by each national team in managing and facilitating the meetings. In terms of cultures, the six areas included Swiss citizens accustomed to direct participatory democracy and wide use of referendums, but also the rather more reticent Slovakian citizens, who were just beginning to adopt more participatory processes. As for the different styles, we note that the French and Norwegian meetings were facilitated with the aim of engaging participants as actively as possible, seeking their reactions to the results of the impact matrices. Other teams, such as in the UK, took a more detached approach, placing greater emphasis on the aim of not influencing the focus and extent of discussion (or lack thereof) between the stakeholders, inviting views and comments from participants but refraining by-and-large from active facilitation of discussions. These differences have meant that the extent of learning amongst all parties involved (experts and civil society) varied from case to case (Potter and Cooper 2005), and that more active facilitation of discussions by the BioScene team members appears to have led to greater learning opportunities through argumentation. Overall, the project's experience echoes the findings by Walz and others (2007): "the participatory involvement deepened and validated the existing system understanding of the researchers profoundly and ensured relevance, logic, consistency and validity of the elaborated scenarios."

The fact that participatory approaches are inherently context-specific is another relevant research finding, supported by other scholars who have introduced participation in assessment processes: as Stirling (2006) notes, "[a]ny general framework for thinking about the articulation of participatory deliberation and multi-criteria analysis… will itself depend fundamentally on context." Finally, where the effectiveness of the participatory exercise depends on active engagement and on thinking "outside the box," the BioScene experience also stresses the benefits of involving experienced facilitators, as was the case in Norway.

## Reflecting on the Assessment Results

The results achieved led us to reflect on a wider point: that of creating rigid categories. In BioScene we adopted six sustainability themes (Table 1) reflecting some of the commonly recognized dimensions of sustainable development as well as the project's own focus on biodiversity. These six themes did, though, allow more flexibility than the even more rigid traditional three "pillars" of sustainability: environment, social and economic. However, as Camilleri (2005) notes, when identifying major environmental themes, the public tends to identify different ones compared to the more traditional, and rigid, "classification of physical or social, and natural or cultural." Instead, it allows for "an interplay of social and physical factors, which is much more reflexive of real-world situations." The experience in the six areas confirms this statement, since often stakeholders' discourse was mixed, unable to bind to the pre-established categories. Nevertheless stakeholders often found that the SA process provided an opportunity to discuss the priorities they themselves had for the study area, and which were often broader than BioScene's focus on agriculture and biodiversity. This therefore allowed the project to explore issues beyond the more disciplinary focus of the respective ecological and socio-economic streams.

With respect to the final results of the SA in each study area, it is important to recall that the main purpose of the SA research in BioScene was to explore hypothetical scenarios of land use change. It would be misleading to imply, therefore, that the project sought to come to any definitive conclusions on the optimum sustainability policies for each study area. That was not the intention of the research, which was rather to explore and understand what might constitute sustainability under the different possible futures considered. But there are obviously other possible futures that may or may not relate to agricultural and biodiversity drivers that were the primary focus for BioScene. However, the understanding developed even from this limited range of scenarios can help inform the development of future policies for the more sustainable management of mountain areas, which clearly points to policies that support biodiversity and local livelihoods through agriculture and tourism.

## Reflecting on the Interdisciplinary Challenge of the Project

BioScene was conceived as an interdisciplinary project that aimed to build on the contributions of different disciplines, namely ecologists, economists, sociologists, and human geographers, running simultaneously throughout the project. Each country team included members from these disciplines who were responsible for the work-packages on policy analysis and ecological modeling, while engaging also on sustainability assessment. The analytical tasks, such as the different assessments (see Fig. 2), required close collaboration and joint outputs from all members (AAVV 2002). Of the three packages, the SA was the one that had the greatest potential to promote the interdisciplinary ethos in the project. However, due to financial and practical constraints the SA work package did not have dedicated researchers in each country team, but depended on central support (researchers in London and Lisbon) and drew on the researchers in each country team to complete the work. This factor affected the ability to use the SA process to strengthen interdisciplinarity and meant that material in the original language could only be used by the country teams. It also meant that keeping the SA process a priority within the overall research project was probably more of a challenge. However, the challenge also had positive outcomes: country team members who had no prior knowledge of SA concepts and methods were able to apply these successfully. Both these difficulties and positive outcomes can provide lessons for the wider application of SA processes, since it is not uncommon to be faced with a lack of resources and expertise.

The following example of the challenges faced in BioScene illustrates that while the project teams were multidisciplinary in the beginning, the interdisciplinary thinking evolved throughout the project, becoming an achievement and an outcome of the whole research process. Throughout the project, some teams were less convinced than others in terms of the opportunity to involve stakeholders beyond eliciting their views on agriculture and landscape change, and seeking their input into the SA process. The attitudes toward involving lay people in research (even applied research such as this) varied between social and natural scientists. In one study area, the national teams (especially those from the natural sciences) were unconvinced of the merits of involving stakeholders in the discussion and definition of a list of sustainability objectives. They were convinced that their lay views would be inevitably biased representations of individual interests

and would reflect an ignorance of the ecological science underpinning scientifically informed objectives. Other teams were simply concerned (through lack of experience, though BioScene provided some training on participatory processes) about whether they could engage stakeholders at all. The traditional knowledge expressed by stakeholders as well as their collaborative attitude and contribution to the dialogues proved the concerns expressed by the teams to be much less critical. This example emphasizes the different multidisciplinary attitude of the Bioscene teams involved, which constitutes in itself an interdisciplinary challenge.

Interesting parallels can be drawn here with the findings of Bruce and others (2004) and of Tress and Tress (2005) who stress the need to be clear about who will take decisions on the basis of the whole research exercise, including the participatory dimension, and argue that natural scientists have a tendency to dismiss lay contributions in relation to problems that can be framed as "scientific" (such as the protection and management of biodiversity). The case analysis conducted by Keough and Blahna (2006) reveal that it is important to share decision-making with stakeholders. The work of Camilleri (2005) also highlights the tensions and limits of the use of expert and lay knowledge to frame environmental problems and define thresholds for use in Environmental Capacity Assessment (Jacobs 1997): in several instances, there were "clear divergences between expert and lay constructions of environmental issues" (Camilleri 2005) and senior officials and politicians tended to consider public views as those of people who are "uninformed and unaware of environmental matters" (Camilleri 2005).

During BioScene, there have been similar difficulties, revealing fundamental differences between ecological and socio-economic researchers, as well as the challenges of such a wide range of cultural backgrounds. However, the overall impression during the final project conference on *Biodiversity Conservation and Sustainable Development in Mountain Areas of Europe: The challenge of interdisciplinary research* (20–24 September 2005) in Greece was that progress had indeed been made and that significant learning across disciplines had been achieved. Those members who had been most skeptical about interdisciplinarity and the SA process were the individuals who were often most convinced of the benefits of a new approach to investigation.

In her paper, Olsson (2005)—an ecologist by training and one of the members of the national team in Norway—raised the following strengths and weaknesses based on the SA experience: she appreciated the need for "logic thinking along causal chains" and the fact that the SA helped her team to "identify possibilities and limitations of [the area's] situation within a social framework," and that it *may* have led to a certain "empowerment of citizens." SA was seen as "[a] tool to realize and balance completely different factors—with a sustainability focus" and demanded an interdisciplinary mindset. On the negative side, Olsson felt the exercise was "extremely time consuming" and raised concerns about obstacles to interdisciplinary work, given that, for example, it does not led to "any merits—especially not in environments of natural scientists," i.e., disciplinary recognition or prestige. Which, in itself, can be seen as an obstacle to greater interdisciplinarity.

The experience of BioScene therefore has important consequences for the repeated emphasis and endorsement of interdisciplinary research. While this seems desirable and necessary, especially in the context of inquiries into sustainability issues, there are still many obstacles, not least in terms of academic career that need urgent attention. These include problems of shared terminologies, principles and methods that may be so divergent as to influence processes of analysis and assessment. Other obstacles may be related to some non-deliberated resistance to innovation that precludes the development of a more open and flexible scientific thinking, engaging into more post-modernism approaches, and the acceptance of less traditional, empirically evidenced results, where assumptions open the way for further explorations.

## Conclusions

The case that has been presented provides a good example of the application of SA to a policy level decision in view of assuring sustainable development. Six case-studies were used as an empirical methodological support to explore the role of SA in proactively influencing, and mainstreaming sustainability issues in policy-making. By taking agri-environmental policy scenarios as the object of assessment, the case developed a reference framework based on sustainability objectives at three different scales (European, national, and area-specific), analyzed the current situation, explored policy scenarios and their causal-links to landscape and biodiversity changes, and developed an analytical interpretation and an understanding on the meaning of such changes in view of the sustainability objectives at the three scales considered. The final results achieved with SA were then used in support of BioScene's wider recommendations on the European future policies on biodiversity and agriculture development.

Figure 5 illustrates the overall process, from the initial inputs concerning the existing biodiversity and land use situation, through an analysis of the relationship between landscape and biodiversity, drawing on two complementary methods, public participation to elicit people's values,

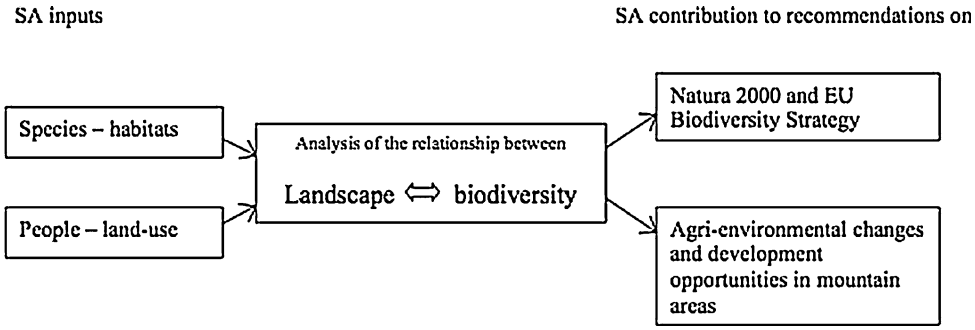


**Fig. 5** SA exercise contributed to Bioscene project's main recommendations

and scientific analysis, including SA, toward the final outcome of contributing recommendation for guiding policy implementation and performance.

Three major lessons can be learned from this SA application in Bioscene. The first relates to the strategic nature of the SA engaged in this policy level assessment, based on an analysis of trends and processes of change, the essential purpose of which is to influence the concept and design of policy intentions, as opposed to a more traditional cause-effect assessment that focuses essentially on assessing the effects of policy implementation actions, with a very limited capacity for influencing policy formulation in itself. In the present case, rather than attempting to identify final outcomes as results of the application of policy or planning proposals, the approach explored and assessed processes, in the form of possible development trends and their consequences, exposed as processes of change. This fact introduces a significant dynamic aspect in the assessment, where scenarios play a significant role as an analytical tool. It also, crucially, helps to deal with the often high levels of uncertainty associated with policy-making.

Another lesson that deserves emphasis relates to the role and importance of stakeholders' engagement in the whole Bioscene process. As explained in the paper, the stakeholders managed to communicate a strong perception of the values associated with a sustainable development concept in the area, with social, ecological and economic aspects closely interlinked (e.g. "by meeting an economic development objective they expected also to meet biodiversity aims"). The stakeholders viewed the landscape as an expression of their livelihoods (including social, cultural and aesthetic/visual aspects) and did not consider biodiversity as a major issue. Their discussions revealed a clear departure from scholarly categorization of sustainability themes, as their own perception of landscapes was expressed in terms of individual relationships with its various components. However they rejected the idea that they prioritized socio-economic aspects at the expense of biodiversity. For many stakeholders, the two aspects were closely inter-twined.

A third and final lesson relates to the interdisciplinary nature of the whole process engaged in BioScene, whereby, as mentioned above, SA had the greatest potential to promote the interdisciplinary ethos in the project. This is evident in the facilitation of communication across teams of different disciplines, namely for exchange of information and perspectives, as SA provided a common platform with analytical tools (causal-links and matrices), terminologies, and also common objectives (the sustainability themes, objectives, and indicators) that enabled the enhancement of interdisciplinary work.

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