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PAN-EUROPEAN BIOLOGICAL AND LANDSCAPE DIVERSITY STRATEGY

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towards integrating biological and landscape diversity for sustainable agriculture in Europe

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Innovative approaches to sustainable use of biodiversity and landscape in the farmed countryside

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Introduction

The purpose of this report is to broaden the approach to agri-environment issues in Europe, from a perspective that integrates human social considerations with economics and ecology. The report first looks back beyond the creation of the European Union and its Common Agricultural Policy (CAP). It traces how human societies have developed, through specialisation and centralisation that has favoured technological advance and intensified land-use.

In addition to broadening the temporal scope, the report also extends the geographic scale. It examines, with brief examples, how the issues of intensification and loss of biodiversity now recognised in Europe have been addressed within and beyond Europe. It sketches how the development of the international viewpoint on conservation, as represented by the World Conservation Union (IUCN), has widened to embrace the socio-economic guidance that is needed for sustainable development.

In the context of this temporal and geographic review, the report introduces mathematical notation to describe outputs from land use and some important inputs. For example, the letter *I* is used to denote the measurable output from intensively used land. The measure *I* can be qualified by the type of crop involved, or even site-specific ecological factors, and the units could be Euros per hectare, but could also be a measure of employment per hectare.

Based on a viewpoint extended in time and space, the report indicates how recent technologies could be used in processes that promote conservation. The report describes the approach adopted by the current EC 5th Framework Programme research project: "Definition of a common European analytical framework for the development of local agri-environmental programmes for biodiversity and landscape conservation" (AEMBAC, QLK5-CT-2000-01666). Finally, the report presents a proposal for "Sustainable Action for Fauna and Flora in the Regions of Europe (SAFFIRE)". SAFFIRE aims to quantify Europe-wide the scope for new approaches to sustain diversity of the biosphere and human culture and to start the social, economic and ecological modelling that could enable appropriate governance for conservation beyond the constraints of the CAP and of Europe itself. We aim throughout for approaches that "go with the grain" of socio-economic behaviour.

Production of this report has depended on a drafting committee fashioned through the Socio-Economics Programme of IUCN, and primarily from members of the European Sustainable Use Specialist Group (ESUSG). The drafting committee included Nicholas Aebischer, Sandor Csanyi, Stephen Edwards, Britt Groosman, Friedrich Reimoser, Robin Sharp, Riccardo Simoncini, Timothy Swanson and Kai Wollscheid. We are very grateful for their help.

1. History of society, agriculture and conservation

1.1. Social development

Humans have had profound effects on their environment for thousands of years, from the development of tools that aided hunting and gathering, through the domestication of animals and use of fire, to the development of arable agriculture and modern technologies. These developments have also been associated with changes in human societies, enabled by a progressive reduction in the time required to maintain daily energy requirements. The reduction in time required for maintenance enabled specialisation that enabled further advances in technology, in a cycle of increasing development (Bronowski, 1973).

Specialisation requires a pyramid of support, based on providers of food and with increasingly narrow layers for social maintenance, government and training that support a minority of experts. While communication was slow, primarily by writing and speech, support structures were conveniently based in the relative security of urban settlements. As communication improved, towns tended to become networked, with capital cities as centres of government. The capitals and other cities also were the centres of technological expertise. The creation and evolution of the European Union continues a process of aggregation, specialisation and resulting technological advance that has been occurring, albeit alongside intermittent failures of socio-political and socio-ecological systems, for thousands of years.

The centralisation of government and knowledge into urban areas, and the associated development of technologies to improve efficiency of land-use, has greatly affected rural communities. The importance of rural areas diminished for employment, and people moved to towns. In an urbanised democracy, the minority of residents in rural areas have fewer votes, and thus have diminished power to determine use of the land and rural resources.

1.2. Use of land

Rural areas provide a number of resources that are taken for granted as public or common goods, including oxygen as a by-product of photosynthesis and collection of precipitated fresh water. Other important products are raw materials for producing food and shelter, which are mostly farmed and traded as private goods. Wild resources of flowers, fruits, fungi and many of the smaller harvestable animals are often by tradition treated as common goods. This was appropriate when they were important as supplemental food for country-people. However, these wildlife resources are now, in the given context, more important for recreation than for survival in many parts of Europe.

A further resource is access to land. Access has traditionally been open to all, because it was essential for travel to employment, to obtain services and for collecting common-good resources. As land-use intensified and some resources could be damaged by frequent access, pedestrian and equestrian rights of way were developed, but the development of roads and road vehicles made off-road access less essential. However, decrease in the time required to maintain daily energy requirements was also giving rise to increased leisure time, and sedentary life-styles to a need for exercise. Access to the countryside has therefore become increasingly important for leisure of the urban majority. In England and Wales, paths and tracks that had developed over hundreds of years for utilitarian purposes were made into statutory pathways in the mid 1900s, to encourage town-dwellers to take healthy recreation in the countryside; new legislation (Countryside and Rights of Way Act 2000) extends access for recreation to uncultivated areas even where there are no designated paths, a right long available in countries where rural land has been less intensively managed.

The purpose of agriculture is the economically sound production of food and non-food raw materials (crops and/or livestock) that are essentially private goods. Agriculture modifies ecosystems to produce organic matter. Across the whole of Europe, agriculture is an extremely diverse and heterogeneous economic sector in terms of the products generated, the nature and structure of production units, and the variability of potential impacts on the environment (EEA, 1995). The agricultural use of natural resources in Europe is therefore, on a large scale, also very diverse. The

reason for this is that very different ecological, historical, social, institutional, and economic features have strongly influenced landscapes, biodiversity, cultivation practices, production and productivity, rural communities, farmers' skills and knowledge, land tenure, the size of farms and infrastructures (Pain & Pienkowski, 1997; AWG, 1998).

Agricultural productivity (measured in terms of both yields and labour productivity) in Europe has increased enormously in the last 40 years, due to intensification. This has involved increased specialisation and concentration of crops and livestock, greater mechanisation of many farming activities, drainage and irrigation, and the development and increased use of fertilisers and pesticides (EEA, 1995). Thus, agriculture conforms to the typical development pattern: intensification and specialisation of outputs (Bove, 2001). Industrial type farms were promoted, consuming large amounts of energy, raising livestock intensively and growing crops that demand high levels of fertilisers and pesticides (EEA, 1995). Farmers' "know-how" was devalued because the necessary technical knowledge came from outside (Bove, 2001).

Increased intensification has produced a tendency to simplify the countryside, enlarging plots to raise production and increasing the use of agricultural inputs (Potter, 1997). Agricultural employment and numbers of farms have decreased whereas the average size of holdings has grown and farms have become more specialised, favouring monoculture (Agriculture Directorate-General, 2000). Specialisation has reduced local variation in production, which involved types of crop and animal that were adapted to the local climate, soil and topography (Bove, 2001). There has also been a loss of traditional crop rotations in the last few decades, as well as a divergence of crop and livestock farming that has disrupted nutrient cycles within farms (EEA, 1995).

For agriculture too, it is remote factors that have driven the specialisation and intensification, facilitated by changes in farming, transport and market forces. Where a variety of products were once grown by many small farms primarily for a local population, demand is now driven by a few large merchandising organisations that have been able to leverage their prices by taking production subsidies into account. A need to compete with products not from the next county but from distant countries has reduced the number of local products to those that can be grown with maximum efficiency in the short-term. It has also driven enlargement of fields and of farms, to gain economies of scale. Land-use for agriculture has become decreasingly influenced by local factors and decreasingly diverse at a small scale.

Across Europe, market forces led to the single market in the EU countries and the collapse of centrally planned economies in CEEC (Marsh & Tangermann, 1992). The accession of many of these economies to the EU will result in EU policies driving markets in a much larger area, probably including adjacent areas outside the enlarged EU. It is therefore essential, as the EU's influence expands, that decisions about the CAP take full account of its biological, social and economic effects, based on the best scientific information available.

1.3. The Common Agricultural Policy

The failure of European Agriculture to meet food demands during the 1939-45 war, and shortly afterwards, made food security the main objective of agricultural policy since the late 1950s (Simoncini, 2000). To achieve this objective (i.e. to increase farm outputs and productivity) several measures were adopted to ensure reasonable living standards for farmers, stabilise farm produce markets and guarantee a stable food supply at fair prices for consumers (Agriculture Directorate-General, 2001).

Undoubtedly, the initial objective of the CAP was achieved, resulting in increased average yields and high productivity (Robson, 1997) from efficient use of capital and labour. However, this success has entailed increased impacts on the environment, ranging from pollution of groundwater to loss of habitats for plants and animals. It appeared by the beginning of the 1970s that three basic objectives needed reconciliation in the conduct of the CAP: production of food and agricultural products (surplus problems), protection of the environment (pollution problems) and maintenance of the socio-economic standards in rural areas (diversified production).

The first environmental considerations were introduced into agricultural policy discussions in 1973 ("Environmental Action Programme"; CEC, 1973). But it was not until 1985 that the EU acknowledged (in the "Perspectives for the Common Agricultural Policy"; CEC, 1985) that agriculture had a direct significant impact on the environment. In 1985 a detailed measure was

adopted within the CAP (Article 19, EC Regulation 797/1985) that permitted EU Member States to make payments to farmers, in environmentally sensitive areas affected by agriculture, for conserving or improving the environment (EEA, 1995). Discussions followed and in order to reduce surpluses, cut prices for consumers and, to a certain extent, to decouple support for farmers from production, the CAP was significantly reformed in 1992. This reform included the agri-environment regulation (Council Regulation 2078/1992), which provided for programmes to encourage farmers to carry out environmentally beneficial activities on their land (DG VI, 1998). Those programmes contributed to the income of farmers by recognising their costs when providing environmental services.

The potential integration of the Central and Eastern European Countries into the EU and the World Trade Organisation negotiations have required fundamental revision of the CAP, beyond the part revision of 2078/92. The EU proposed a series of changes set out in Agenda 2000 (Agriculture Directorate-General, 1999; Nowicki *et al.*, 1999).

The Agenda 2000 CAP Reform package provides the basic legislative framework governing agricultural policy for the period 2000-06 (OECD, 2001) which deepens and extents the 1992 CAP reform. The Agenda 2000 CAP reform encompasses a new rural development policy. It streamlines rural development measures by bringing them together in one regulation. Decentralisation and simplification underline all aspects of Agenda 2000 (Agriculture Directorate-General, 1999).

One of the most important objectives for CAP reform stated by the European Commission in Agenda 2000 is consistent with the integration of environmental objectives in the CAP and with the empowerment of the role of farmers in the management and conservation of natural resources and landscape (AWG, 1998). Agenda 2000 refers to two pillars of the reformed CAP (European Commission, 2001b) the first one being market regulation and the second one rural development. This second pillar includes special environmental measures, known as agri-environmental measures (EC Regulation 1257/1999). These provide payments for commitments going beyond good agricultural practice. They constitute an important environmental tool, being compulsory in all rural development programmes and based on voluntary and contractual basis by farmers undertaking an environmental service for a period of at least 5 years (COM(2001)162).

If Agenda 2000 were to be fully implemented, nearly 70% of the budget would be spent on direct aid to farmers, whereas in 1991, that same percentage was directed to export refunds and intervention buying-in (European Commission, 2001 a). However, certain factors (i.e. institutional inertia, agricultural interest group influence, member state finance) hinder the achievement of this full implementation. According to Nowicki *et al.* (1999), the CAP budget will continue to be dominated by compensation payments to farmers for price cuts, with negligible additional resources for rural development. The compensatory system operated by the EU is still far from being decoupled from production; by providing a guaranteed flow of income to recipients of direct payments it necessarily changes their calculation about the profitability of different enterprises. This distorts production decisions and is thus non-trade neutral. (Nowicki *et al.*, 1999). It is therefore likely to come under pressure from the World Trade Organisation (WTO).

Although there is much interest in ensuring that soil, water and climate conditions continue to maintain the sustainability of agriculture itself, relatively little attention is paid by policymakers to the impact of agriculture on biodiversity. However, agricultural practices can significantly contribute to or disturb the protection and enhancement of biodiversity (García Cidad, 1999). That disturbance can in turn indirectly affect the sustainability of agriculture, through changes in demography and attitudes of rural communities, through impacts on soil and water and through complex ecological processes and interactions with wild biodiversity (AWG, 1998). Thus, conservation of biodiversity is not merely an adjunct to agriculture, but also important for sustainability of agriculture.

Other policies are being developed parallel to the CAP and can (directly or indirectly) influence its development towards sustainability in agriculture. The European Commission adopted the Community Biodiversity Strategy (COM(98)42) on 4 February 1998. This strategy aims to predict, prevent and eradicate the causes of significant diminution or loss of biodiversity. It provides the framework for action in various fields of activities, developing Community policies and instruments in order to comply at the Community level with the United Nations Convention on Biological Diversity (CBD) that was signed by the EU at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992, and ratified on 21 December 1993. Within this strategy the Commission has produced a Plan of Action for Biodiversity in Agriculture (COM(2001)162). In this document it is stated that the rhythm of biodiversity integration into the CAP will be largely set up by

the implementation of Agenda 2000. It is expected that many positive effects on biodiversity will be achieved through the implementation of agri-environmental measures. Member States have an obligation to make a report before 2002 to define the present obstacles to improvement of biodiversity in agriculture (COM(2001)162).

1.4. Conserving biodiversity

Reduction in biodiversity through localised loss of wild species is a process with a long history in Europe. Loss was notable more than a century ago for many carnivores (Tapper, 1999), and elimination of large mammals that cause damage to game and livestock can be documented back to the 15th century (Gleich *et al.*, 2000). Habitat fragmentation and new technologies facilitated this elimination. Smaller mammal predators and raptorial birds were also eliminated from large areas, to reduce attrition of domestic poultry and pigeons and to enhance harvestable populations of wild prey that were valuable resources (Newton, 1979; Tapper, 1992).

An increase in recreational interest in watching wildlife, coupled with further reduction in predator problems through contamination with pesticides, resulted during the last century in an increasing demand to protect species from direct human impacts. The creation of protection and research organisations at national and then international level also gave a widening perspective, which revealed the severe decline in many species and habitats that were associated with changing land-use. The need to campaign against interests adversely affected by species protection, and to preserve the habitat remnants least affected by intensification, favoured large, central protection organisations to which governments would listen. In fact, a "protect and reserve" policy can be attractive to governments, as a positive step towards conservation that conceptually frees non-protected areas for intensive use.

At international level, the Council of Europe hosted the Bern Convention to protect species, and subsequently conventions to protect habitats and create reserves, such as the EMERALD network (Council of Europe Recommendation 16, 1989). There were corresponding directives on species and habitats protection adopted by the European Union, which gave strong enforcement procedures leading to the European Court of Justice. The centralised knowledge and power were important for recognising conservation problems and obtaining protection. However, decisions about use of wildlife were again being removed far from local communities. As a result, a species that remained locally common enough to motivate conservation as a resource might be barred from such conservation because decline elsewhere was motivating protection at international level.

Nevertheless, the centralisation also benefited understanding of how best to conserve nature and natural resources. In 1948, government and non-government organisations combined to create an International Union for Protection of Nature. As early as 1956, the organisation changed its name and remit to the International Union for Conservation of Nature and Natural Resources. Now known broadly as the World Conservation Union, IUCN brings together 79 states, 113 government agencies, 754 non-government organisations, 36 affiliates and some 10,000 scientists and experts from 181 countries. IUCN maintains a broad concept of conservation (Holdgate, 1999), enshrined in its mission "to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable". By contrast, the main emphasis of many constituent non-governmental organisations continues to focus on protection of species and creation of reserves.

Since the mid 1980's, with the publication of the World Conservation Strategy, IUCN's emphasis has focused on developing knowledge of the social, economic and ecological conditions for sustainable development, and of devising governance that empowers stakeholders to operate sustainably. IUCN's Sustainable Use Initiative, now superseded by the Socio-Economics Programme, of which ESUSG and other Sustainable Use Specialist Groups around the world have been a product, evolved from an appreciation that use of wild resources, whether consumptive (e.g. hunting, harvesting) or not (e.g. watching, wandering), could be important incentives to promote conservation. In 2000 a policy on sustainable use of wild living resources was overwhelmingly adopted by IUCN's members at their 2nd World Conservation Congress. This policy states that " Use of wild living resources, if sustainable, is an important conservation tool because the social and economic benefits derived from such use provide incentives for people to conserve them". At the same time, the policy states that "When using wild living resources, people should seek to minimise losses of biological

diversity. Furthermore, achievement of sustainable use of wild living resources involves an ongoing process of improved management of those resources … [where] … such management should be adaptive, incorporating monitoring and the ability to modify management to take account of risk and uncertainty." More recently IUCN has been working with the CBD Secretariat to develop broad "principles of sustainable use" that are parallel to the principles that provide the underlying framework for the Ecosystem Approach, which was adopted at the last Conference of the Parties.

1.5. Socio-economics of wildlife conservation

Much damage to biodiversity can be seen as a "Tragedy of the Commons" (Hardin 1968). On one hand, biodiversity itself can be seen as a rather intangible public good, such as the air we breath, without realisable value but with a notional responsibility of landowners to preserve it. On the other hand, there can be real value in many components of biodiversity from consumptive and non-consumptive uses, but often without ownership of that value. Thus, flowers, fruit and fungi can be harvested in most places without benefit to the landowner. When they become rare enough to be protected the landowner can be penalised for harming them. Once the resources become rare, there is actually motivation to destroy them before protection hinders other uses of the land. Thus, the resource has no value to the landowner when abundant as a common good, and can then become a liability through rarity.

For protection organisations, rarity itself can be an asset. It can serve as a campaign focus to attract membership or provide an attraction at reserves where members have rights of common access. However, if governments provide open access to other land, it can become harder for reserve managers or farmers to realise value from conserving biodiversity. Indeed, if access adversely affects land uses, for example through hindering livestock farming, incentives to conserve rare species are further reduced because they attract greater demand for access.

Thus, farmers often have little incentive to conserve biodiversity that involves abundant species, and disincentives from increased protection measures and demand for access when species become rare. In contrast, protection organisations benefit from species' rarity, and can also buy more land for reserves if poor economic conditions for farmers reduce the capital value of land. It is no wonder that farming and conservation interests become polarised. Moreover, farmers and local communities as a whole also have little power to change the situation. Remote governance of common goods and remote fiscal effects on private goods means that uses of rural resources are decreasingly determined locally. In general, rural stakeholders have been progressively disenfranchised from decisions about their environment.

However, recognition of the problem is an important stage on the road towards solutions. Moreover, new ideas and technologies indicate much scope for change. One important prospect, discussed by other reports to this conference, is the redirection of CAP to favour conservation by funding farmers to promote biodiversity. That subject is discussed in other reports to this conference.

In this contribution, our aim is to look wider than CAP in the present and beyond CAP in the future. This is because modification of CAP still represents use of subsidy to pay for common goods. That subsidy comes from taxes collected by democratic governments, which face pressures (a) to minimise taxes and (b) to devote what taxes they collect to fund security, education, health and transport systems. Elements of a CAP that are devoted to conservation may therefore be vulnerable to competition from more powerful lobbies, preventing growth in the short term and creating a risk of reduction in the future.

In a third section of this report, we examine ways to maintain and restore biodiversity in agricultural areas without long-term subsidies, by using approaches that can complement a revised CAP and may in the long term be more sustainable. These approaches benefit from empowerment of communities to determine their local activities and environment, albeit within a framework of regional, national and international knowledge and governance. Part of that empowerment could involve internalising, through sustainable use, the value of some countryside resources that are now treated as common goods. First, however, come examples of conservation benefits from community actions.

2. The role of communities

This part of the report considers examples of how the use of components of biodiversity beyond the agricultural products can bring economic benefits. For a variety of reasons, in each case the alternative approaches have been organised at community level.

2.1. The Bavarian Hindelang

The Hindelang district in the south-western Bavarian Alps is a diverse area of extensive low intensity agricultural farming. As in other parts of the Alps, the traditional mainly pastoral economy has shaped the landscape, producing a meshwork of flower-rich meadows. Traditions of land-ownership and use, operating primarily at community level, had developed over centuries to maintain sustainable agriculture in ecologically delicate conditions (Wolkinger, 1977). Although such landscapes are appreciated by a growing numbers of tourists, by the late 1980s, the agricultural economy was in serious decline as a result of changes in society and in external economic factors (Haug, 1998; cited in Nowicki *et al.*, 1999). Although compensation measures were attempted to preserve the rural economy, compensation payments were so low during the 1980s that the number of farms declined by almost 60%. The result was the reversion of the higher alpine flora-rich pastures to scrub (Walther, 1988). Given the importance of the flora and fauna to landscape and biological diversity, and their role in attracting and relating tourist income year round, the Bavarian State Government became involved to help retain both the biological and agricultural communities.

The outcome was an integrated development scheme, based on the practice of organic low-intensity grazing throughout the area. In association with the use of the Hindelang quality produce label, and re-establishment of a former dairy plant, the Hindelang community has been able to retain and expand pre-existing practices. The Hindelang quality label has helped establish a significant niche market, and led to the re-expansion of agricultural production within the valley. In turn, the loss of farms has been reversed, and the previously threatened alpine pastures have been slowly reclaimed. The net result has been positive for employment, leisure, wholesome food, environmental maintenance and tourism, but not at the expense of the valley's biodiversity (Haug, 1998; Nowicki *et al.*, 1999).

The economics of this example depend strongly on two factors, namely the use of a niche market for agricultural products and added value through tourism. Skilful marketing of a community name can benefit sale of the agricultural product and attract tourists at the same time. There is a need to examine how much land can benefit from such an approach before competition within the niche reduces the value of both these benefits, and how changes in fashion might affect the sustainability of both product sales and tourism. A national authority, armed with appropriate data, might then allocate start-up funding to an optimal number of communities to prevent flooding of the market.

2.2. Southern Africa

The basis of modern conservation through sustainable use have been developed mainly in the rangelands of southern Africa (Prins *et al.*, 2000). Livestock farming in these areas, with cattle, sheep and goats, motivated removal of large predators and competing native herbivores. High stocking levels also reduced diversity of vegetation and ultimately resulted in long-term damage to ecosystems through soil erosion (Hopcroft, 2000). A less damaging alternative was to farm selected species of native ungulate that were better adapted to local conditions, and in particular did not need extensive treatment against diseases that passed to domestic stock from reservoirs in wild ungulates (Grootenhuis, 2000). However, although there were gains for biodiversity and sustainable agriculture from ranching wild ungulates, the economic benefits were found to be marginal and vulnerable to change in demand for the meat of game as opposed to domestic animals (Bos *et al.*, 2000; Heath, 2000).

The economics and conservation benefits were found to improve greatly if two supplementary uses were developed for the wildlife, namely tourism and hunting (Earnshaw & Emerton, 2000). The two supplementary uses tend to complement each other. Tourism requires easy access to a site, to its surrounding land and to resources such as water, which often requires high initial investment. In one

study, trophy-hunting required an average investment of US$ 0.7/ha compared with US$15 for photo-tourism (Krug, 1999, cited in Gleich *et al*. 2000). Hunters tend to be less demanding of facilities and a politically secure environment, and provide more income per head than tourism, especially when they are trophy-hunting (Bigalke, 2000; Hurt & Raven, 2000).

Socio-political factors were found strongly to influence the ease of conserving biodiversity through use of wild resources (Child, 2000). In areas where central government had made killing of wild animals illegal, farmers were not able to benefit from ranching wildlife and experienced only the disadvantages of disease transmission, predation and crop damage (Deodatus, 2000). In this case, tourism remained possible in reserves, but illegal killing and exclusion by fencing removed most of the large mammals elsewhere (Ottichilo *et al*., 2000; Szapary. 2000). Permitting ranching, but not recreational hunting, did not benefit predators or wildlife outside large farms. The support of local communities for conserving biodiversity was highest (i) where recreational hunting was permitted and (ii) where local people, rather than central government, obtained the greatest share of hunting fees (Child, 2000; Child & Chitsike, 2000). In other words, effective conservation required those dependent on the land, the stakeholders, to benefit from the use of the wild resources (Grootenhuis & Prins, 2000).

Throughout human societies, centralisation of government and knowledge has been favoured both by aggregation of support structures that provided security, shelter and sustenance, and by slow communication. Two papers in Prins *et al.* (2000) also came to notable conclusions that, for the management of sustainable use of wild resources, (i) information technology permits devolved, self-governing systems (Child, 2000) and (ii) "the use of computers and models has increased the potential for ensuring economic viability" (Hearne & McKenzie, 2000).

We can use *U* to denote the income, or employment per hectare or square kilometre from utilisation of wild resources, remembering that *I* represents the equivalent values from intensive land use. On that basis, the studies of southern African rangelands collated by Prins *et al.* (2000) showed clearly that there was more income and employment than from intensive agriculture with livestock. Thus,

$$U > I$$

In Europe, on the other hand, the land area in which the use of wild resources could exceed the value obtained from agriculture in the same way would be relatively tiny. Indeed, for many areas the value of production (*I*) has subsidies (*S*) added to it. Thus, generally in Europe,

$$U << I + S$$

Much of the lack of interest by European conservationists in sustainable use of wild resources probably stems from an inability of sustainable use, by itself, to compete with intensive agriculture in Europe. Conservation through sustainable use has become "something for the developing world". Nevertheless, European thinking is changing, as demonstrated by the following two projects of IUCN's European Sustainable Use Specialist Group.

3. Agri-environment schemes

Agri-environment schemes place constraints on agricultural production in order to enhance biodiversity, employment and other less tangible public goods. Here we can create our final economic variable, *C*, for the income or employment that can be obtained if land-use is constrained, for instance for agri-environment purposes. On this basis, the aim of agri-environment schemes is to move CAP subsidies (*S*) from the production side of the equation,

$$C < I + S$$

to give added value to being constrained:

$$C + S > I$$

The rationale for using public subsidies to promote constrained use is the gain in public goods. However, there is a considerable lack of information regarding the true value of many environmental functions and natural resources. Perhaps for this reason, and despite relevant initiatives, both the European Union and Accession Countries still lack a coherent framework to fully integrate environmental concerns into agricultural policies (AWG, 1998).

According to De Groot (1992), environmental functions can be defined as "the capacity of natural processes and components to provide goods and services that satisfy human needs, directly or indirectly". Farmers, as managers of natural resources, have an indivisible dual role, the first being that of an entrepreneur trying to maximise their benefits (strongly influenced by the market economy), the second being that of a manager of public goods (Simoncini, 1999). Indeed, efficient valuation of the benefits and costs of environmental functions and of managing natural resources could result in $C > I$ even without subsidies.

Erroneous or partial evaluations of natural resource use produces externalities (a cost/benefit coming from the use of natural resources that will be borne/enjoyed without any compensation/payment by third parties not directly involved in their use). Pollution, for example, represents an external cost because damages associated with it are borne by society as a whole and are not reflected in market transactions (Koomey & Krause, 1997). According to Albert & Hahnel (year not stated), traditional theory holds that equilibrium prices in competitive markets represent accurate evaluations of the relative usefulness of society's scarce human and nonhuman resources, the relative benefits of different goods produced and the relative burdensomeness of different work situations. In reality, market prices give rise to externalities because the balancing of costs and benefits in market transactions is done by two actors: the buyer and the seller. If other parties are affected, these effects are not captured by market prices. An internalisation exercise therefore is required Albert & Hahnel (year not stated).

When considering sustainability in agriculture, it is fundamental to recognise its multifunctional character. Natural and semi-natural ecosystems perform ecological, economic and social functions. Similarly, agricultural systems provide goods and services which are ecological (e.g. soil erosion control, landscape conservation), economic (e.g. food production, support of rural/green tourism), social (e.g. human occupation of countryside, basis of employment in rural areas) and cultural (e.g. cultural identity, traditional knowledge) (AWG, 1998).

It is essential for the long-term survival of farming as an economic activity that it is conducted without depleting the natural resource base (Doornbos, 1999). To maintain their multifunctional character, both the ecological and agricultural systems need a certain amount of biodiversity, without which the performance of environmental functions (ecological, economic and social) would be impaired (AWG, 1998).

3.1. The approach of the Agriculture Working Group

The Agriculture Working Group (AWG) is one of four thematic groups in the European Sustainable Use Specialist Group. It is a group of experts, mostly academics but also NGOs and governmental policy officials, involved in the study of sustainability of uses of natural resources and trying to promote policy and practical advice based on multi-disciplinary analysis.

This group uses a multidisciplinary and holistic approach for evaluating sustainability in Pan-European agriculture, specifically focusing on the development of new agri-environmental measures that integrate biodiversity and landscape conservation (AWG, 1998). There is a need for new conceptual tools to handle implementation and monitoring while developing agri-environmental programmes, in order to include the complexity of the multiple functions of both agriculture and biodiversity. A need has also been identified to integrate the full value of goods and services provided by agriculture, through the internalisation of positive and/or negative environmental externalities (which are external to the present economic realisation but not to the state of the biosphere).

Since March 2001, these needs are being addressed in a European project financed by the 5th Framework Programme of the EC: “Definition of a common European analytical framework for the development of local agri-environmental programmes for biodiversity and landscape conservation” (AEMBAC, QLK5-CT-2000-01666).

The scientific approach taken in AEMBAC to evaluate sustainability in agriculture takes into account the three main factors of sustainable use of natural resources: ecology, sociology and economy. Sustainability is being analysed as an ongoing process that is redefined continuously with the integration of feedback information. The project is developing a common analytical framework,

which does not intend either to be exhaustive or definitive, but attempts to provide a structure in which scientific concepts and practical information can be viewed in a wider context (AWG, 1998). The project adopts the general DF/PSIR (Driving Force/Pressure-State-Impact-Response) framework proposed by the OECD (OECD, 1997) and the Commission on Sustainable Development (CSD, 1996).

The principal aim of the framework proposed is not to find common solutions to sustainability in agriculture throughout the whole European territory, but to suggest a common instrument for the identification, development and evaluation of the agri-environmental measures that are most appropriate at a local level (AWG 1998). The primary scale of analysis is the ecosystem/landscape level, because it allows effective evaluation of both the ecological and agricultural multi-functionality.

Developing agri-environmental programmes offers the chance to define the interdependencies between agriculture and the conservation of biodiversity, and to identify externalities produced by agricultural activities, as far as existing knowledge allows. For the purpose of this project and in order to better communicate results to policy makers, natural resource managers and farmers, the utilitarian view was selected.

At the Pan-European level, this approach could enhance transparency. It would possibly promote application of the subsidiarity principle in managing agri-environment programmes, by returning to local farmers and administrators the power to establish policy targets to achieve sustainability (AWG, 1998). It would also permit the development of dynamic programmes for the transition phase to achieve sustainability, including the promotion of technological innovation. Finally, this approach will foster environmental awareness amongst EU citizens, to define more precisely what are the risks and uncertainties of unsustainable agricultural practices, and to make trade-offs between different objectives with more precise information (AWG, 1998).

An important issue beyond this research project is the finance that will be made available for the implementation of agri-environmental measures. This finance will depend, according to the AWG report (AWG, 1998) on the ability to elucidate values for environmental benefits, the level of environmental information and awareness among European citizens and their willingness to pay. These factors should influence political decisions, such as the percentage of the CAP budget dedicated to agri-environmental measures, WTO acceptance of environmental subsidies as trade non-distorting, and the application of the polluter pays principle to gather financial resources to pay farmers for the provision of environmental goods and services (AWG, 1998).

3.2. SAFFIRE

Sustainable Action for Fauna and Flora in the Regions of Europe is an initiative of ESUSG's Working Group for Wild Species Resources (WISPER). The projects of WISPER and ESUSG's Agriculture Working Group are complementary. On the one hand, AEMBAC looks to internalise within agriculture the environmental costs and benefits that to a large extent must remain public goods (e.g. quality of air, water and soil), in effect as subsidies. On the other hand, SAFFIRE looks to funding for conservation from activities that have been treated widely as public or common goods but can in fact generate income for landowners and communities through use (*U*). In this case the aim is to produce situations in which use of wild resources that is enabled by constrained agriculture is more profitable than intensive agriculture, in other words:

$$\boldsymbol{U + C > I}$$

If combined with agri-environment subsidies, such a relationship could become yet more profitable:

$$\boldsymbol{U + C + S >> I}$$

Nevertheless, in the long term SAFFIRE looks to treat *S* at most as start-up funding, with the aim that *U* should be sustainable in its own right. This is because central governments of democracies have found that voters prefer low government spending. On one hand, such governments may be prepared to pay subsidies for clean air or water, and to keep farming itself sustainable, because these are general benefits for public welfare. On the other hand, governments have many other priorities for

their spending, such as security, health, transport and education services. These are likely to limit the central funding that remains available to maintain, for example, diversity of wild species in the countryside. It is important that funding for conservation is sustainable in socio-economic terms (Freese, 1998). Therefore, a major aim of SAFFIRE is to discover how much land might have its biodiversity enhanced at present by funding from individuals and local communities.

A second major aim of SAFFIRE is to elucidate socio-economic factors that can maintain and enhance funding from these local sources. It notes that in some countries with surveys of sustainable-use activities, there have been recent declines. For example, surveys by US Department of Commerce working with the Fish and Wildlife Service have detected a 17% decline during the last decade in people watching wildlife, although numbers hunting and fishing in the USA have remained stable (USDI & USDC, 1996). In Europe too, the British Trust for Ornithology has a worrying low recruitment of young members for its non-consumptive volunteer activities (Spence, 1999). Is watching wildlife becoming too tame for young people, compared with television and computer games, whereas the hands-on aspects of hunting and fishing are more appealing?

Investigation of the factors that initiate and promote an interest in conservation is especially important because of tensions between consumptive and non-consumptive users of wild resources (Devall & Barry, 1981; Arnold, 1993). As these resources become scarce because of widely intensive land management, the only answer may seem to be tighter protection of species and reserves, with no consumptive use. In densely populated countries such as the Netherlands, it can even become illegal to pick wild flowers. Yet how many youngsters first become interested in nature through picking flowers with their parents? May some of our present conservation measures unwittingly harm conservation through future loss of interest?

If SAFFIRE can show the way to substantially increasing biodiversity in the wider countryside, it will also promote social cohesion. At the agricultural production level, tensions should reduce because landowners will be motivated to de-intensify by economic benefits of being multi-functional, rather than constrained by authoritarian measures. This is also an advantage of agri-environment subsidies. However, tensions should also reduce at the wildlife resource level, because optimal funding is likely only by combination of all possible uses, through cooperation between the different users. In the UK in particular, tension between those who wish to use wildlife in different ways has been exacerbated by food production problems, creating serious public order issues. Governments may well prefer different groups to find cooperative ways to benefit farm incomes and conserve their environment.

The proposed first stage of SAFFIRE is a questionnaire survey of EU countries and Accession States to discover the economic value of sustainable use activities, and what factors may enhance or discourage such activities at national and individual level. Surveyed activities will include collection of plants for food or display, shooting, angling, falconry, horse and dog owning, wildlife observation, photography, research and education. This survey will estimate both the demand for wildlife resources and the expenditure associated with use of those resources. The potential value of sustainable-use activities is likely to be very large. For example, hunting, fishing, watching and feeding wildlife generated a total expenditure of US$101 billion annually from 62 million people in the most recent US survey, 29% from non-consumptive use (USDI & USDC, 1996). Some 60% was spent on equipment, which generates employment but no direct contribution to conservation through sustainable use. However, much of the remainder was spent on lodging, permits and land-access, creating substantial motivation for conservation through sustainable-use. Moreover, the US has a tax on equipment (e.g. binoculars, guns, fishing-rods) that is hypothecated for conservation, as is a Conservation and Re-investment Act (CARA) tax on industrial users of natural resources.

In contrast to the USA, there has been no Europe-wide survey of economic value from sustainable-use of wild resources. Other questions of interest for SAFFIRE were not tackled in the US studies, such as the definition of social value, for example in terms of indices of diversity of employment, or factors that may encourage use. Conveniently, the regions of Europe have a higher diversity of culture, urbanisation and economic activity than in the United States, which makes European data ideal for multivariate analysis of socio-economic factors that may affect sustainable use activities. Standard omnibus surveys of 1000-2000 individuals in each of the 15 EU countries plus 10 accession states by an international market research firm will contain screener questions to estimate participation. Detailed follow up of participants will then assess how much expenditure might be available for conservation and the factors associated with starting, such as rural upbringing, parental or peer example. Data on common activities (e.g. hiking, wildlife watching, fruit and fungi

collecting, shooting, fishing) from state-wide surveys will be complemented by survey of organisations devoted to these and less common activities (e.g. horse-riding, falconry), arranged through the broad national membership of ESUSG. Cross-checking of estimates will test for bias. For example, comparison of state-wide and organisation-based surveys for common activities will indicate any need for bias correction in organisation-based data on uncommon activities. If survey dates are spaced throughout the year, separate questions on expenditure during the year and on the last day can be used to check for recall bias.

The second stage of SAFFIRE will use best-practise case studies conducted by the SAFFIRE partners to estimate values of *U* that can offset various levels of constrained land use *C* and surpass *I*. Estimates will be made both in terms of benefit for farm incomes, and in terms of employment. The estimates will also go beyond agriculture, by including not only different types of crop and sustainable uses in northern, southern and eastern European farmlands (Britain, Hungary, Spain), but also similar relationships in forestry (Austria), upland (Scandinavia), wetland and coastal areas. This whole field of conservation socio-economics is very much in its infancy. As far as we know, no attempts have been made to evaluate relationships between *U*, *C* and *I* although data are available in a number of studies that can be used. For example, the reduction in cereal crop yields (=[*I*-*C*]/*I*) has been estimated when headland-edges are left unsprayed, which increases abundance of game birds and other wild fauna and flora (Boatman & Sotherton, 1988; Sotherton, 1991).

A third stage will be to combine data from the best-practise studies with Geographic Information System (GIS) data for the whole of Europe, in models that can estimate the areas of intensively farmed land that could benefit from this approach to conservation. The approach will of necessity be coarse, because data from the few suitable case studies must be applied widely and because resolution from the CORINE Land Cover database is only available Europe-wide at 250 m scale. However, the value of CLC can be checked with data from countries such as the United Kingdom, which have land-cover mapped at 25 m resolution from Landsat data (Fuller *et al.*, 1994). Detailed datasets may also be available from the Netherlands, Sweden and Finland.

Present areas of intensively farmed land represent demand for conservation through funding from sustainable use activities. Surveyed numbers of participants, combined with their potential spending, will indicate the supply of funding. The present supply is likely to be well below the demand, but data from SAFFIRE will also indicate how the supply of funding might be enhanced in future.

3.3. Extending SAFFIRE

In SAFFIRE, deficiencies of data and techniques will reduce the validity of some results, notably from extending case studies to wider areas through the land-use data. However, we see this project primarily as a beginning, serving to show what may be possible. We expect the approach to show where the priorities lie for gaining new data and improving assessment techniques. Very much research will be needed to understand how best to de-intensify in different regions, what control regimes can ensure sustainability of different practices and which types of sustainable use may be tapped most practically in different cultures. We believe that SAFFIRE can be an important stimulus and catalyst for that further research on conservation across wide landscapes, complementing the creation of reserves that has been generated by the EMERALD Network of Areas of Special Conservation Interest devised by the Council of Europe (Recommendation 16,1989).

There are two areas in particular that will require study in order to make SAFFIRE a practical approach for conservation of biodiversity. A huge and highly innovative effort will be needed to optimise conservation from sustainable use. At local level, supplies of funding will differ according to local wealth and attitudes, land suitability for different uses, alternative attractions for tourists (e.g. heritage), distance from towns and other factors. Optimal use of funding will need to trade the demand for different uses against economic costs and gains in biodiversity, eventually derived from relationships between biodiversity, ***U*** and *C*. For example, enlargement of headland strips at field margins may attract hikers and dog-walkers near towns, with funds for use coming from car-parking fees, accommodation taxes and dog-licences; management of such strips would probably be for short grassland. By contrast, in areas where hunting game is the main non-agricultural providers of funding, management would be for tall, tussocky grassland suitable for quite different fauna and flora (Aebischer *et al.*, 1994). At a larger scale, some external funding (perhaps from hypothecated taxes on

equipment) may be necessary to ensure that each community conserves enough of a locally uneconomic habitat to encourage connectivity across regions. The knowledge needed to plan conservation by sustainable-use will require far greater ecological and socio-economic research than has been necessary for a protect-and-reserve strategy.

The second area of study will be to determine the optimal extent of returning responsibility for their environment to local communities. Much of the research to optimise conservation through sustainable use will need to be done in large, multi-disciplinary institutes, creating complex models that link food webs with land-use economics. In other words, the knowledge will be centralised. However, the new technology that enables construction of complex models in computers can also be used to disseminate that knowledge so that planning decisions can again be made primarily at local level. The models can be made a basis for expert planning systems to be used at local level, through the Internet. Moreover, local experiences can be fed back in the same way to help improve the models, and local planning monitored centrally to ensure the necessary connectivity for fragment-dwelling species. The adaptive management that is crucial for conservation (Holling, 1978) will be possible at all levels. Thus, of the twin centralisations, of knowledge and power, at least the former at least is no longer necessary. Knowledge can be dispersed through the Internet, and built up in a dispersed fashion by feedback, leading to adaptive management.

Brechin *et al*. (2001) have reviewed recent conservation problems in the developing world. Their findings, from a great body of literature, are a need for community conservation, based on strong local organisation, self enforcement and social justice, while avoiding a pro-nature/pro-people dichotomy, organizational power struggles, central authoritarianism and other non-local forces. We suggest that the same principles should be applied in Europe. We also suggest that all the requirements of Brechin *et al*. (2001) are either met or motivated if conservation of wild resources is soundly based in economic benefit to local communities. Moreover, it is in the interests of governments to move towards conservation based on sustainable use, partly because an approach based on participation of all interests should reduce social tensions, and partly because subsidies to encourage generation of local economic benefit from conservation should be acceptable both to the World Trade Organisation and to taxpayers. IUCN has identified empowerment, governance and knowledge as the prerequisites for conservation through sustainable-use. In the United Kingdom, at least, the necessary infrastructure is already in place: local councils have the power to raise taxes and to make payments to farmers for environmental services; some local councils have conservation committees and web-sites.

4. Summary

The history of human development is a process of centralisation of both power and knowledge. This has tended to take decisions about land management away from local communities, or at least to guide and motivate local decisions remotely. Conventional agricultural products are private goods for which remote guidance and incentives encourage intensive land-use, putting pressure on wild resources. Motivation to conserve abundant wild resources is diminished by their traditional treatment as public or common goods (tragedy of the commons) and exacerbated because local communities have to compete with an urban majority for their use. When wild resources become rare, motivation to conserve them is removed or reversed by remote decisions to restrict use of the resources or of the land where they occur. The result has been a severe loss of biodiversity on agricultural land.

A widely proposed solution is the use of the Common Agricultural Policy to subsidise conservation of wild resources. There is much scope for agri-environment schemes, and IUCN's European Sustainable Use Specialist Group is developing (in its AEMBAC project) a set of conceptual tools to optimise use of such schemes. However, subsidies do not constrain competition for wild resources and may not be sustainable socio-economically. A complementary and possibly more sustainable solution is to internalise value of the goods by localised ownership and responsibility. Utility can enhance the value of wild resources and motivate their conservation locally if people pay for their recreational use. However, the use of wild resources alone is economically competitive only on land that is marginally economic for farming or forestry. As such land is rare in northern Europe, conservation through sustainable use has seemed unimportant.

However, income from sustainable use can complement constrained agricultural use to give greater income and employment than intensive use. ESUSG is developing a second project (SAFFIRE) to investigate how much land could have biodiversity enhanced by consumptive and non-consumptive sustainable use of wild resources. Optimising the enhancement of biodiversity through sustainable use will require integration of ecological, economic and social factors in complex models. Although such models must be developed centrally, the Internet can be used to disseminate knowledge in expert systems, so that management decisions can be made locally, and to retrieve local knowledge to improve the models. Thus, modern technology can enable local communities to regain motivation and responsibility for managing their environment.

5. Recommendations

We recommend that governments, relevant institutions and organisations

1. re-direct agricultural production subsidies not only to enhance biodiversity in the short-term, but also to develop systems that can sustain biodiversity in the long term with income from recreational and other non-agricultural uses of land and its biodiversity;

2. develop and apply conceptual tools to identify processes that degrade biodiversity, and thereby to design socio-economic approaches that enhance and sustain biodiversity;

3. fund work in Europe to identify and encourage all sustainable uses of land that benefit from enhanced biodiversity and can pay for it in the long-term;

4. encourage research to develop land management that, with minimal loss of agricultural yield, would maximise both biodiversity and consequent income from sustainable use of biodiversity;

5. support investigation of how much funding can be found at local level to enhance biodiversity, how that funding can best be applied, and how it can be sustained long-term;

6. replace centralised perverse restrictions and incentives by distribution of knowledge and responsibilities that encourages local communities to appreciate biodiversity, informs them how to enhance it economically and empowers them to motivate land managers accordingly.

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