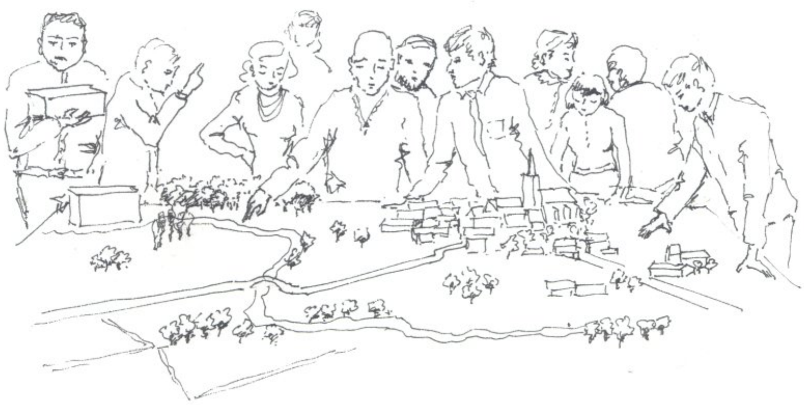

The Ecosystem Approach applied to Spatial Planning

A report of the BIOFORUM project

Peter Nowicki, Juliette Young and Allan Watt (Editors)

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The BIOFORUM project
EUROPEAN BIODIVERSITY FORUM - IMPLEMENTING THE ECOSYSTEM APPROACH

PROJECT EVK2-CT-1999-2006

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Tables and figures:

1. Executive Summary

1. The management of conflicts between biodiversity conservation and human activities has to be applied in a temporal and spatial framework. If applied wisely, spatial planning, or an ecosystem-based spatial development strategy can lead to sustainable development and reconciliation of different human activities by addressing drivers leading to major land use changes. Strategic Environmental Assessments can be instrumental in identifying drivers of change and their effects on biodiversity at early stages of planning in order to avoid potential conflicts.

2. Planning is an iterative, continuous activity requiring the incorporation of the Ecosystem Approach, the availability of sound data and analysis and the involvement of a range of arenas and disciplines, including social sciences.

3. The involvement and participation of relevant stakeholders is instrumental to share knowledge and gain understanding of the whole system, in order to reach better management of the natural environment and the development of spatial plans.

4. The choice of species and habitats to be considered in the spatial planning is important and should take into account their requirements, roles within the ecosystem and status in order to be placed into a hierarchical framework to accommodate different needs and scales. Possible land uses can be considered through the use of a “suitability and constraint” matrix, which brings together and contrasts both process and value.

5. Ecosystem management and the application of the Ecosystem Approach underlie the BIOFORUM approach to the spatial planning process. This approach covers all elements of the ecosystems, including interactions between them and has sustainability as its basic value.

6. Spatial planning has to take into account the evolving legislative framework at the EU level, including conventions, policies, regulations and directives. As landscapes, ecosystems and biodiversity associated with these are always changing due to a wide range of drivers, so does the EU legislative framework relating to biodiversity. Spatial Planning has to

accommodate these changes through the constant development of new approaches and methods.

7. Ecological modelling can play an important role both in analysing and understanding as well as predicting ecosystem changes, stability and vulnerability in time and space. However, modelling is dependent on geographically referenced data, which is often costly and time-consuming to gather and raises issue of data confidentiality and the way in which the data will be interpreted and applied by stakeholders. The further development and refinement of analytical tools can make a significant contribution to spatial planning and conflict management.

2. Preface – BIOFORUM focus on Spatial Planning

The focus of BIOFORUM is the reconciliation of human activities and biodiversity conservation. Once knowledge is gained about the conflicts generated in terms of biodiversity conservation objectives by the pursuit of certain activities, the resolution of these conflicts becomes possible. The methods for conflict resolution proposed by BIOFORUM have to be applied in a temporal and spatial framework; for this reason the ordered application of conflict resolution strategies requires reference to spatial planning. The use of spatial planning instruments – as an implementation of the ecosystem approach suggested by the CBD SBSTTA (Young et al. 2003) – is an encouragement for applying the ecosystem approach in (a) strategies for spatial planning and (b) other new methods to visualize the spatial distribution of biodiversity at the level of genetic variation, as well as taxonomic and phylogenetic diversity.

A common understanding of the role of spatial planning, and the possible use of the instruments associated with it, was debated amongst BIOFORUM colleagues. Although a wide variety of perspectives were expressed, a concise package of planning principles emerged from the discussion.

Two statements regarding biodiversity set the parameters for the discussion:
- Biological diversity is the variety and variability among living organisms and the ecological complexes in which they occur. Diversity can be defined as the number of different items and their relative frequency. For biological diversity, these items are organized at many levels, ranging from complete ecosystems to the chemical structures that are the molecular basis of heredity. Thus, the term encompasses different ecosystems, species, genes, and their relative abundance[1].
- Biological diversity is to be viewed as an attribute of natural processes operating at the landscape, ecosystem, species, and genetic levels. These processes are altered by both human and natural factors. While the focus is

[1] U.S. Congress Office of Technology Assessment (1987): “Technologies to Maintain Biological Diversity”

on biological factors, abiotic elements are also recognized as important components of natural systems[2].

Considering a spatial approach to ordering human activities elicits very strong responses, some considering the potential to improve human welfare and others being concerned that human freedom is curtailed, and moreover in a partially arbitrary manner. In this light, a neutral assessment, such as the following, puts these concerns into perspective.

One way to describe the spatial approach is to think of it in terms of the processes that shape the future pattern of development, investment and service delivery. The spatial approach therefore needs to take into consideration the variety of public and private activities which affect the way we use land and other resources, and plan service delivery[3].

The processes that shape land use exist of themselves, so the first question is whether humans consciously guide these processes, encouraging or attenuating them, or if they respond to the effects these processes produce in an *ad hoc* manner. The second question is the application of human knowledge of a specific sort as the basis for guiding these processes. In the remit of BIOFORUM, the assumption exists that knowledge about biodiversity can serve as this basis.

The fundamental characteristic of the restrictive perspective on spatial planning is a concern that the rules ordering the process of elaborating land-use decisions are 'technocratic', i.e. controlled by people with technical expertise, but who are not representative of the values that a broad constituency would place on the potential land uses. The corresponding attribute in the second category is a stewardship perspective: humans have to take the responsibility of managing land use in a sustainable manner, and in a democratic context the decision-base has to be as large as possible. The opportunity exists to promote land use decision-making that is conscious of

[2] Memorandum of Understanding: California's Coordinated Regional Strategy to Conserve Biological Diversity, "The Agreement on Biological Diversity", 19 September 1991

[3] 'UK Practitioners' Guide: Lessons learned from the Interreg IIC experience', a report prepared by an informal network of local authority officers from the English and Scottish Regions (March 2001).

the challenge to preserve or even enhance biodiversity. In a decision-making system of representative governance, the place given to information of high quality becomes essential, including the clear inclusion of social values in the interpretation of data.

The experience with spatial planning within BIOFORUM reveals an array of attitudes spanning the two perspectives. Much of current spatial planning is executed in a top-down manner; on the other hand, the majority of citizens do not understand environmental complexities and dangers (e.g. the risk incurred by building in a flood plain). Spatial planning in relation to biodiversity is about managing conflicts; but the planning process can also help to identify potential conflicts and thus avoid decisions being made in favour of land use that would have a negative outcome for biodiversity. Although planning laws can pro-actively avoid deleterious impacts upon biodiversity, the best way to insure biodiversity preservation is to increase protected areas. Zoning as a planning technique can be both desirable, as a way to manage land use in densely populated areas, and dangerous, especially when rural areas are compartmentalised into separate zones for intensive agriculture, multi-functional land use and biodiversity conservation. The dangers range from implicitly granting a licence to pollute to missing the opportunity to apply an ecosystem approach that would take into account localised constraint and suitability for a variety of potential land use.

In some countries, in particular within Central and Eastern Europe, there is a tradition of ecological planning, often applied to specific land cover categories, such as grasslands and forests. This experience testifies to the importance of taking into account the natural change in land cover, and the different land management strategies that are appropriate for natural, semi-natural and the artificial ecosystems where the majority of people live. Biodiversity is understood to have particular patterns of spatial organisation. The role of spatial planning is to involve stakeholders having an interest in the use and future state of biodiversity. Social values should be attached to the natural components as well as the social components (i.e., ecological networks and transportation corridors have both similar and dissimilar functions in the migration patterns of wildlife and people, and the importance accorded to these functions – and the possible conflicts between them – is a social decision more than a simply technical one).

Certain biodiversity-relevant objectives for spatial planning are clear. Spatial planning offers the possibility for human society to understand the natural world better, as well as to manage the use of space in a way that benefits from the opportunities that biodiversity offers and to avoid (costly) destruction of the natural qualities of the land. Wet soils, for example, are suited for extensively grazed grasslands or nature reserves and are unsuitable for housing foundations. As humans have a social need for open space, not only for recreation but also for psychological 'space' to compensate for the stress of crowded living conditions, a natural area has the same sort of relevance as a football field or a green commons at the heart of an urban residential area. Spatial planning is a decision-making support system for balancing social needs and natural resources. As such, it also lends itself to educating the public about the elements involved and the weight accorded to each. This allows social debate about the completeness of the survey of the natural environment, the public interest for land-use proposals, and the vision of the future state of the environment.

What arises from the discussion is the opportunity to 'design with nature' and to avoid conflicts between human activities and biodiversity conservation by organising land use in a spatial and pragmatic manner. Such a design process takes into account not only the natural cycles, periodic fluctuations or changes in state, but also recurrent patterns in human history, as well as sociological premises related to sanitary and psychological hygiene. Ecological planning can be considered as the foundation for sustainable development, as its basic principle is that human society is embedded within biodiversity.

Spatial planning, considered within a wide-angle perspective, is more than an instrument or simple management tool: spatial planning is a potential source of conflict. On the one hand, human society can benefit from ecosystem services; on the other hand, the current tendency is not to analyse human activities from the perspective of biodiversity, so the 'costs' that figure in a cost/benefit analysis underestimate the 'price' of biodiversity detriment to society. There is a repeatedly tragic asymmetry: a decision on a biodiversity plan can easily be reversed, but the infrastructure plan replacing it cannot.

How nature works can be put into the process of spatial planning. Biodiversity is a multi-faceted phenomenon in spatial terms, and would normally be reflected in multifunctional development (mixed land-use). Fragmentation and continuity are important concepts to apply to spatial planning with regard to ecosystem functions, as are constraint and suitability with regard to human land uses. The ideal to have in sight is multifunctional zoning, regulated by performance standards, so that what is built is subsidiary to how it functions when deciding upon a particular use of land in relation to biodiversity.

The complexity of the environment is still challenging for humans, including scientists. One challenge for BIOFORUM has been to approach spatial planning in a way that will increase public awareness and improve the manner in which scientists present their knowledge, so that the gaps in knowledge do not discredit spatial planning but instead serve to improve the willingness to dialogue over the place of spatial planning in resolving conflicts between human activities and biodiversity conservation.

This report on spatial planning is the fruit of a collective reflection that has been challenging and stimulating to all who have taken part in BIOFORUM. Considering the predominance of natural scientists in the working group, the emphasis is on the spatial expression of ecosystems management. But the contribution of the social scientists and the professional planners has transformed this emphasis to a pragmatic examination of the potential for spatial planning *per se* to incorporate ecological principles. For this reason, our report is addressed to spatial planning professionals and the other persons responsible for territorial policy regarding the use of land and expresses the possibility – citing the marvellous phrase introduced by Ian McHarg some 40 years ago – to *design with nature*.

3. Spatial focus on conflict resolution

3.1. Introduction

The focus of BIOFORUM is the resolution of conflicts between human activities and biodiversity conservation. Once knowledge is gained about the conflicts generated in terms of biodiversity conservation objectives by the pursuit of certain activities, the resolution of these conflicts becomes possible. The methods for conflict reconciliation proposed by BIOFORUM have to be applied in a temporal and spatial framework; for this reason the ordered application of conflict resolution strategies requires reference to spatial planning.

This report recommends principles and guidelines for applying an ecosystem approach to spatial planning across Europe, based upon the Malawi Ecosystem Approach[4], taking into account the existing and emerging European Union legal and strategic frameworks. These principles and guidelines evolved from the initial reflection on the Malawi Principles at the beginning of BIOFORUM (Young et al. 2003: Chapter 3) and case studies presented at several BIOFORUM workshops (see Chapter 9). An analysis of existing and emerging analytical methods and tools to apply the Ecosystem Approach has led to the identification of future research needs.

To ensure that the recommendations are robust, the work was undertaken by an interdisciplinary working group of practitioners from across Europe, involved in planning, applied ecology, land management, scientific research, stakeholder consultation and mediation.

3.2. Spatial Planning

Ecosystems today are rarely at the centre of spatial planning. They should be, for sustainable development is unimaginable without an ecosystem-based spatial development strategy.

[4] 12 principles presented to the Fourth Conference of the Parties to the Convention on Biological Diversity in May 1998 (UNEP/CBD/COP/4/Inf.9)

Planning is the systematic preparation of future activities to achieve a goal in the best possible way given current constraints (Meyer 1969). Spatial planning views landscapes as an aesthetic, ecological, cultural and economic unit, in which landscapes mirror human perceptions, aspirations, and knowledge as well as the totality of the environmental conditions. Spatial planning aims at accounting for this multi-functionality of landscapes. To achieve this goal it assesses and evaluates the spatial relationships between existing and/or planned future spatial patterns of land use addressing their impact on the sustainability of ecological and economic services as well as on cultural and aesthetic values. Spatial planning develops concepts to protect, restore, or modify landscape functions (Riedel & Lange 2001). The use of spatial planning instruments can encourage the implementation of the ecosystem approach as suggested by the Convention on Biodiversity and provide new methods to visualize the spatial distribution of biodiversity at the habitat, genetic, as well as taxonomic and phylogenetic diversity level. Thus spatial planning, if used wisely, can be a proactive form of ecosystem management with regard to human land use, contributing to the reconciliation of different human activities and aspirations.

3.3. Biodiversity in the Spatial Planning Process

Landscapes, ecosystems, and the associated biodiversity values continuously evolve, as do human aspirations, land use requirements, and activities. Thus spatial planning is not a one-off activity but has to adapt continuously to new conditions and goals. New European Union directives that are relevant to biodiversity and which set new political and ecological priorities and goals, such as the Water Framework Directive, and amendments to existing national laws and regulations, will be made and will have to be implemented in spatial planning. Though it is recommended that spatial planning uses existing approaches and methodologies for such new challenges, it is likely that for all major new directives additional approaches and new methods will need to be developed.

Experience gained from successes and failures in spatial planning continuously increases and scientific progress broadens the knowledge base available for effective and efficient spatial planning. Some of this progress has been incorporated into approaches used in spatial planning. However, spatial planning has to integrate methods from a wide range of scientific disciplines and the timely integration of advances in relevant disciplines remains a major challenge. Additionally, spatial planning has to deal more explicitly with uncertainty and unpredictability inherent in any natural and human system.

Planning is an iterative never-ending process. Decisions about land use, including biodiversity conservation, are conditioned by the knowledge of the natural environment and by the means – and the necessity – to sustain livelihoods. In turn, our knowledge will increase by carefully assessing and evaluating the consequences of land use decisions. This knowledge can be fed into future land use decisions.

Planning is at the heart of the political arena, wherein desires and basic needs meet and sometimes confront each other (See Figure 1), especially over limited financial resources. The desire for a better quality of life has to accommodate certain requirements for a place to live and work, the provision of environmental goods and services (i.e. clean water and air), and the promotion of biodiversity. Although the relationship between desires and needs might be in harmony, it may also be that the provision of housing and a place to work will put pressure on the other ways human beings derive benefit from natural resources.

Therefore the specific use of land is permanently under question, perhaps guaranteed for a time by the discretionary prerogative provided by ownership or a particular status provided by law or custom. When either of these no longer holds, then the status of a particular land use may become uncertain. On one hand, a plan is a representation of a desired state for land use, and will serve as a reference when orientations for land use are once again debated. On the other hand, this desired state might become so modified that some of the original orientations will be abandoned, and the replacements take a contrary direction. So a plan by itself has only a temporary value, but the process by which a plan is prepared can have a perennial character. What is important is that this process is inclusive of stakeholder diversity, and that it respects the ecological principles that are the basis of the BIOFORUM approach.

3.4. The Ecosystem Approach applied to Spatial Planning

The foundation of spatial planning has to be the environment along with economics and the other social science disciplines that translate the options society has for using land and other natural resources into a framework for sustainable development. It is in this perspective of the ecological environment that an electronic conference was used to explore an Ecosystem Approach, using the Malawi principles which emerged from the CBD (See Table 1A).

The electronic conference concluded that the Malawi principles were isolated from the process of their application. BIOFORUM then further developed 10 points (Table 1B) for application of the Ecosystem Approach to spatial planning and the management of conflicts in Europe. These 10 points took full account of the 12 Malawi principles and added some requirements of stakeholders, necessary for their successful engagement in the conflict management process.

Both the Malawi principles and the BIOFORUM guidelines put full stakeholder participation at their heart. BIOFORUM advocates the involvement of all stakeholders as part of the conflict management process to achieve application of ecological principles into all forms of land-use. Malawi principle 12 stipulates that stakeholders must include all relevant sectors of society and scientific disciplines. BIOFORUM also clarifies the additional neutral role played by scientists in the provision of information, vision and advice (Malawi principle 11).

For conflict management and spatial planning BIOFORUM also recognises that successful outcomes depend on how stakeholders engage with the process. Stakeholders must be willing to negotiate, open about their position, clear that some changes are inevitable and truly committed to try and achieve consensus.

Informed by numerous case studies presented throughout the course of the project, and the ecological principles underlying ecosystem management in Europe, BIOFORUM developed 8 guidelines for the consideration of ecosystems within spatial planning.

Table 1A. Malawi ecosystem approach requirements

1. Management objectives are a matter of societal choice. 2. Management should be decentralised to the lowest appropriate level. 3. Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems. 4. Recognizing potential gains from management there is need to understand the ecosystem in an economic context. Any ecosystem management should: a. Reduce those market distortions that adversely effect biodiversity; b. Align incentives to promote sustainable use; c. Internalise costs and benefits in the given ecosystem to the extent feasible. 5. A key feature of the ecosystem approach includes conservation of ecosystem structure and functioning. 6. Ecosystems must be managed within the limits to their functioning. 7. The ecosystem approach should be undertaken at the appropriate scale. 8. Recognizing the varying temporal scales and lag effects that characterise ecosystem processes, objectives for ecosystem management should be set for the long term. 9. Management must recognize that change is inevitable. 10. The ecosystem approach should seek the appropriate balance between conservation and use of biological diversity. 11. The ecosystem approach should consider all forms of information, including scientific and indigenous knowledge, innovations and practices. 12. The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

(Source: UNEP/CBD/COP/4/Inf.9)

Table 1B. BIOFORUM Ecosystem Approach requirements

1. Stakeholders can be identified so as to take into account the interests which are in conflict within any particular terrestrial / aquatic area. 2. Stakeholders are willing to negotiate on the objectives for the management and use of biodiversity. 3. Stakeholders are able to assess their common pool of knowledge, and are able to decide which other specific sources of knowledge may be required in order to attempt resolving conflicts involving biodiversity. 4. Stakeholders are able to recognise when external factors (beyond their control) impinge upon the possibility to determine / implement management decisions which will resolve the conflicts that have been identified. 5. Stakeholders state their ideas about the boundaries and the time horizons that they consider relevant for each subject of conflict under analysis. 6. An attempt be made to evaluate biodiversity both in qualitative and quantitative terms, including a monetary valuation. 7. Normative ecological principles be considered in the negotiating process [what is "normative" is assumed to evolve over time!]. 8. The negotiating process has to arrive at consensus, if the implementation of biodiversity management is to be successful. 9. Stakeholders recognize the possibility that agreed management actions can lead to unanticipated effects, and therefore a biodiversity management strategy must include an agreed monitoring programme. 10. Stakeholders anticipate that changes in ecosystems will occur, whatever the management regime and independently of whether human activities are present or not.

(Source: Nowicki in Young et al. 2003)

Guidelines for an Ecosystem Approach Applied to Spatial Planning

- Identify driving forces and pressures for change
- Identify and involve stakeholders
- Examine implications of change at the appropriate level and scale
- Take a strategic approach for a sustainable solution
- Retain large contiguous (connected) areas that contain critical ecosystems
- Consider short, medium and long term changes

- Use the natural potential of the land and avoid land uses that deplete natural resources over a broad area
- Integrate habitat and species restoration and enhancement into change proposals in order to increase biodiversity (not just to compensate for losses).

The use of these ecological guidelines for land use has been adopted as the theoretical basis for the elaboration of the ecosystem approach as applied to spatial planning. These guidelines are considered in the next chapter.

4. Application of ecological guidelines for land use

4.1. Identify driving forces and pressures for change

A wide range of driving forces and pressures causes biodiversity changes. Spatial planning is most relevant for addressing those drivers that lead to major changes in land use type and intensity as well as landscape structure. Spatial planning provides a framework for the integration of different sectoral planning, including planning for biodiversity conservation.

Since conflicts can be avoided most easily if biodiversity issues are taken into account at the earliest possible stage of planning (see BIOFORUM report on Conflict Management by Jones et al. 2005), it is recommended that each policy sector assess drivers and their effects on biodiversity through the use of Strategic Environmental Assessments (see section 5.9). This will contribute to raising awareness and to the integration of the ecosystem approach into all sectors of spatial planning. Experience has shown that most other policy goals receive priority in the political decision process of spatial planning. The inclusion of biodiversity effects in form of a SEA in sectoral plans can help alleviate this structural disadvantage of biodiversity in the decision process.

The framework for spatial planning set at the national level is strongly influenced and determined by European Union legislation and policies, such as the EU Habitats and Birds Directives, the Water Framework Directive, agri-environment measures under the Common Agricultural Policy, the Cohesion policy etc. The link between these main drivers and an ecosystem approach on spatial planning is discussed in Chapter 5.

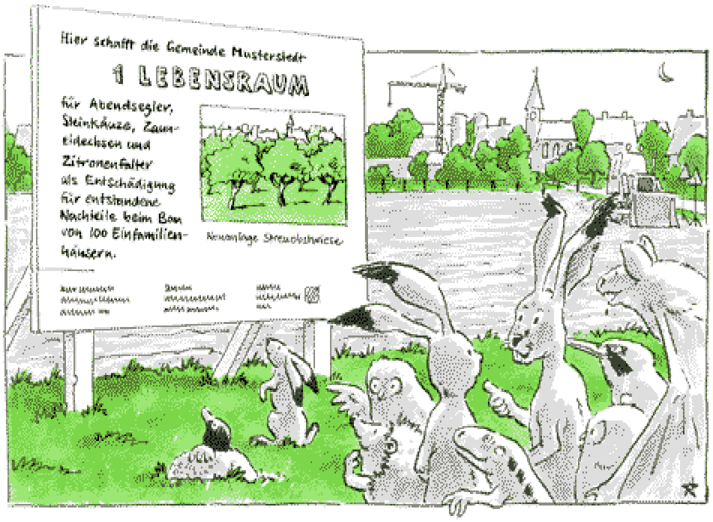

Figure 1. "And where shall we stay?"
(Translation: 'The model village creates one new habitat for bats, owls, sand lizards, and butterflies as a compensation for environmental impacts caused by the construction of 100 family homes.')

High quality planning requires the availability of sound data and analyses of all relevant drivers and pressures and their effects on biodiversity. Science has made tremendous progress in the development of adequate designs for data sampling and data analysis (e.g. Cooperrider et al. 1986, Yoccoz et al. 2001, Williams 2002), in the development of scenarios and predictive models (e.g. Burgman et al. 1993, Grimm et al. 2004), and in optimising networks of biodiversity priority areas (e.g. Margules and Pressey 2000). However, experience has shown that spatial planning usually remains well below the available state-of-the-art and uses standards that are inadequate for sound inferences. This is caused mainly by inadequate payment of a job that requires high skills and by frequently selecting among competing planning companies the one with the cheapest offer even if it is clear that it cannot deliver sound results. Therefore, there is an urgent need for higher minimum standards across Europe. Failure to meet these standards should be challenged in court.

4.2. Identify and involve stakeholders

Those who have an interest in the issue in question need to be involved because:

- They provide critical knowledge input
- This builds social capital
- It achieves fairer and more equitable sharing of benefits
- It complies with various international and European commitments (e.g. CBD, Ramsar and Aarhus objectives)

Early inclusion of stakeholders when spatial planning options remain open is critical to achieving a sustainable outcome and to avoid disempowerment and mistrust. Continued involvement in exploring the consequences of choices contributes to a more successful outcome for all. Good practice in communication is particularly important for environmental managers in making satisfactory progress in situations of potential conflicts, such as spatial planning. A shift in attitudes and actions of environmental professionals is also necessary.

Stakeholder involvement is explored more comprehensively in Chapter 7 of this report.

4.3. Examine implications of change at the appropriate level and scale

Some issues require decisions and measures at international or national level whereas others require planning and management at regional or local level. For instance, at the regional level there are strategic choices to be considered that cannot be changed in local planning, e.g. how to maintain connectivity of habitats by maintaining ecological corridors and avoiding barriers. Local planning and decisions have to be linked to a wider spatial context and to gather data to get a “bigger picture”. Changes that occur as a response of land use decisions can be minor at a local level but significant at a national or international level (Mühlenberg & Slowik 1997), and vice versa. A species can be regionally very common but nationally rare. Therefore regional and national planning should also keep in mind the “smaller picture”. This need to link different spatial levels applies similarly to all levels, with information on local characteristics of biodiversity, economy and local knowledge being incorporated into planning.

There is a need to:

- Consider costs and benefits at the various scales, among local, regional, national or even larger socio-economic systems
- Ensure the access and use of natural resources by local populations

Decisions have to be made as to when costs and benefits should be internalised and when externalisation is justified.

4.4. Take a strategic approach for a sustainable solution

Different species and habitats have different requirements and will therefore be affected by landscape changes in different ways. In most cases it will not be possible to make an assessment of the impact on the full range of species or habitats occurring within an area nor will it be possible to plan to accommodate all species or habitats that have the potential to occur within an area. It is therefore important to make a careful choice of species/habitats to consider in the spatial planning process, not only with regard to the scale of the requirements of different biota but also with regard to trying to cover a range of roles, functions and interactions within the landscapes and ecosystems under consideration (Figure 3). For example, this may mean ensuring that requirements of residents and migrants are considered, that species with very narrow requirements are considered together with those utilising a wider range of habitats, and that due consideration is given to all the different functions and components within an ecosystem.

Beyond the consideration of accounting for different roles of species in a particular landscape, it is important to consider the status and trends of habitats and species when making choices. Usually Red Lists for species and habitats are a suitable first guiding principle but the national responsibility for the conservation of habitats and species (Steinicke et al. 2002) and their representation in networks of biodiversity priority sites (Margules & Pressey 2000) need to be taken into account as well. To facilitate the choices among habitats and species, target systems needs to be developed that account for these different requirements (Reck et al. 1996, Walter et al. 1998). The ultimate references within the Europe Union are of course the species and habitats lists found in the annexes of the Habitats and Birds Directives.

These systems should be placed within a hierarchical framework, from the European to the national, regional and local level to accommodate the different needs that exist on different scales. These systems should be sought by those taking planning decisions or expert advice taken.

It is essential to identify 'priorities in biodiversity conservation' and areas with high biodiversity when seeking opportunities for the protection and enhancement of biodiversity. Important areas could be those that:

- Support endemic, rare or declining habitats, species and/or genotypes
- Act as a buffer or play an important part in maintaining environmental quality or critical ecosystem processes.
- Have important seasonal uses (e.g. migration grounds).
- Support habitats, species populations, ecosystems that are vulnerable, threatened throughout their range and slow to recover.
- Support particularly large or continuous areas of previously undisturbed habitat.
- Support habitats that take a long time to develop characteristic biodiversity.
- Are currently poor in biodiversity but have potential to develop high biodiversity with appropriate intervention and management.
- Support species and habitats that are not yet well represented in effective conservation areas.

Once identified, these areas do not necessarily have to be strictly protected but they should be treated flexibly, combining use and conservation by using a wide range of planning and management measures to avoid negative effects of human activities (Kaule 1991).

4.5. Retain large contiguous (connected) areas that contain critical habitats

No one location or site in a landscape can be divorced from its surroundings: what is happening in the surroundings will impact on the biodiversity potential of that location (and vice versa). In general, maximising the biodiversity value (whether this is assessed in terms of species richness, rarity of the species present or functional complexity within any one unit area) will be directly linked to the heterogeneity of different habitats and the structure of those habitats that occur within that unit area, with a greater mixture allowing more opportunities for different species to occur. It is, however, important to emphasis that it is inadvisable to focus simply on species richness *per se*, since some natural and highly endangered habitats are species poor but nevertheless deserve prime consideration in spatial planning. Furthermore, the size of the unit area that needs to be considered will vary markedly depending on the type of biota under consideration. For example, viable populations of a very wide range of invertebrates may potentially be accommodated satisfactorily within an area covering only 10s of hectares (Settele et al. 1996), whereas maximising the number and abundance of larger species such as birds and mammals would require consideration of 100s of km^2 (Goodman 1987). Differences in the scale required will mean that it will not be feasible to provide for the requirements of all species. Hence the focus of the spatial planning process should not simply be directed at whether it is possible to provide the range of conditions required by any target group of organisms but just as importantly needs to consider whether it is feasible to accommodate sufficient amounts of the required resource(s) to maintain viable populations of those organisms in that landscape.

The type of issues which need to be taken into consideration in any situation include:

- The current (and potential future) size of existing habitats and features
- The situation within their immediate surroundings
- The condition of these habitats and features and how this is likely to change with time
- The location of these habitats and features in the landscape, especially with regard to: their proximity to other features in the landscape with which they could interact; potential barriers to movement and/or spread of species across the landscape; the potential for making connections between habitats and features of importance
- The topography of the landscape and how this impacts on the potential to maintain or enhance existing habitats or make provision for new habitats.

In addition, many habitats and landscape types may be dependent on some form of disturbance in order to periodically (either regularly or irregularly) create conditions favouring a return to a more varied mixture of structures and habitats and/or retain parts of a particular habitat in a specific growth form. Such disturbance events may be linked to management (e.g. cutting, grazing, burning) or more ‘natural’ factors (e.g. land slides, flooding). In either event, it is important to take the need for such events into account and to allow for these in the spatial planning process. For example, if maintaining the biodiversity value of a heath land is dependent on periodic burning then situating houses or woodland in the immediate vicinity will put limitations on the scope for such occurrences in the future. Similarly, if a meadow or woodland is dependent on periodic flooding then alterations to the upstream hydrology will have an adverse effect on this.

4.6. Consider short, medium and long term changes

In regard to time scales, there are three types of important issues that need to be accounted for in the spatial planning process to accommodate the needs of particular species and habitats.

Some species have different needs at different points in their lifecycle, that may or may not vary with the seasons. In any event, it will be important to recognise what these requirements are and ensure that these are put in place when required, in order to guarantee the survival of those species within that landscape for the entire year. Other species may not be resident in the area throughout the year and may only occur within particular seasons, but again it is important that their needs during those times are known and accommodated.

Some habitats and landscapes are much more dynamic than others and therefore may change over much quicker timescales (seasonal, annual) than others. The species associated with these different types of habitats will be adapted to the different dynamics, hence the importance of targeting both types of biota within the planning process.

In some cases there may be significant time lags between a habitat being ‘placed’ within a landscape and it being colonised or utilised by the species associated with it. By the same token, particular examples of different habitats may only be utilised very occasionally (e.g. once every five years when conditions are such that the population of a particular species has a good year) but nevertheless their continued existence in the landscape is essential in order that they can be made use of as and when necessary (e.g. to support the metapopulation dynamics of butterflies).

In addition, it is natural for habitats to change their condition and structure over time and for individuals of particular plant species to grow old and die at individual points within that habitat. Hence it is essential to ensure that the habitat provided is large and varied enough to allow this natural senescence to occur in some parts while establishment and new growth can occur in other locations. The size required will vary with the habitat and species and the connectivity of the landscape.

Overall there is a need to consider the short, medium and long term when viewing the potential impacts of change. What may be detrimental to some species in the short-term may be advantageous to them in the long term (and vice versa). If the short-term negative impacts are 'buffered' by what surrounds the location of change, then this may be less of an issue (as species could 'move out' during the bad times and come back in when conditions are again suitable). Hence there is a need to consider the potential for any negative impacts to be offset by the surroundings.

Effects of human activities on biodiversity can be direct, e.g. by habitat loss or destruction, indirect, e.g. through altered species composition due to changes in abiotic conditions, delayed, e.g. by altered predator-prey relationships due to loss of a keystone species, cumulative time- and space-crowded effects, e.g. ongoing habitat loss or fragmentation over time, that result in progressive isolation and reduced gene flow (Treweek 1999). Ecological processes function at many time scales and ecosystems are in constant change. Due to this dynamic nature of biodiversity, impacts of human activities may not be seen for many years, sometimes even decades. This propensity for change over space and time is a problem in predicting effects of human interventions (Dale et al. 2000). Long-term effects are especially difficult to predict. Thus, on the species level, normal seasonal and yearly fluctuations in populations and time lags between the perturbation and evident response in the population (especially for long-lived and slow producing species) make any prediction difficult. In addition, recovery times for ecosystems and species are often difficult to establish.

Planning for the long term requires consideration of impacts and effects that cannot be predicted precisely. Therefore, the application of the precautionary principle is necessary. The changes need to be estimated as accurately as possible with available data, but if there are still doubts about the degree of decline of biodiversity or unexpected adverse effects as a consequence of a planned activity, such activity should be halted as a precaution until there are enough data available.

In defining boundaries for planning it is important to plan adequate survey time to collect baseline data and identify important seasonal phenologies. Different temporal scales of influence of planned biophysical and socio-economical changes also need to be determined so that planning covers long-term effects of land use decisions.

4.7. Use the natural potential of the land and avoid land uses that deplete natural resources over a broad area

Spatial planning seeks to place a particular land use within a framework of natural suitability of an area for the land use, and also to arrange a multiplicity of land uses in a complementary pattern wherein each land use functionally supports the others. In terms of the prescriptive handling of natural areas *per se* – where the choice between conserving the actual state or restoring a former state is the issue – spatial planning can help describe the suitability and the constraints of either option. Those involved in planning consider the possible land uses in a 'suitability and constraint' matrix that will have several ecological, social and economic components. The ecological component is a question of fact: the land use options are either suitable within the existing natural conditions or they are not, and the cost of the ecological compensation for each land use option (if necessary) can be calculated. The social component attributes another sort of value to each option: the possible land uses either maintain the overall ecological integrity of the landscape or they have another importance in socio-cultural terms. The economic component identifies the trade-offs between different financial values for the use of natural resources, and also considers the possibility of each possible land use to contribute some benefit within the web of economic exchanges at a given territorial level. Spatial planning considers possible land uses against the vision of a desired future state of the natural environment, relates the social values involved, and establishes the financial costs and benefits at present and future values.

The advantage of planning is that both process, i.e. the way in which change in state will or can occur, and value, i.e. the meaning that humans attribute to such change, are brought together, and contrasted. The landscape will be modified over time, either with or without human choice being brought into play, so the advantage of spatial planning is to reinforce the beneficial aspects of volition as these are organised in the political sphere.

4.8. Integrate habitat and species restoration and enhancement into change proposals in order to increase biodiversity (not just to compensate for losses)

There is growing recognition of the substantial loss and fragmentation of habitats and ecosystems throughout Europe, and the consequent impact on a wide range of species. This is particularly evident in lowland areas with intensification of agriculture, and population expansion with associated infrastructure, such as transport, services and other industries. Many of the remaining pockets of habitats have become isolated from each other and species are becoming more and more unviable.

Upland and mountainous areas of Europe have fared somewhat better because of less intense pressures from development and greater difficulty of land improvements due to the terrain and harsh environments. Large areas of semi-natural land including grasslands, heath lands and forests still remain but the biodiversity of these areas has also declined through overgrazing, agricultural intensification and drainage, intensive burning practices, tourism and related developments, atmospheric deposition and forestry. The attraction of these areas for wind farms is also an issue in certain areas. Other mountainous areas have seen a loss of biodiversity through depopulation and reduction in agricultural employment and ‘traditional extensive farming practices’, with for example, the decline in species-rich meadows and an increase in rank vegetation and scrub.

Significant losses of biodiversity have increased the demand for restoration, enhancement and recreation of habitats, and this is being encouraged by a range of drivers, such as the Habitats and Birds Directives, Water Framework Directive, Biodiversity Action Plans, agri-environment measures under a partially reformed CAP, and individual countries and government targets. For example, in England, a Public Service Agreement target now requires 95% of all Sites of Special Scientific Interest to be in ‘favourable management’ by 2010. However, it is clear that it is extremely difficult, indeed inappropriate to consider specific restoration and enhancement opportunities and proposals in isolation, hence the importance of adopting an ecosystem approach and spatial planning framework when addressing these issues.

In many lowland situations in Europe, restoration will involve both the re-creation of habitats on currently intensively managed land; adapting management on intensively managed land to make it more sustainable and provide specific biodiversity niches; and the (re-)introduction of favourable management onto remaining fragmented or abandoned semi-natural habitats (Mühlenberg & Slowik 1997). In upland and mountain habitats, water catchments planning procedures are being used to restore and improve the biodiversity condition of land to reduce diffuse pollution from upland catchments and to reduce extremes of water flows. Undertaking restoration of such habitats to recreate a more natural hydrology and to reduce erosion will also be encouraged by a number of drivers, including the Water Framework Directive (Rode et al. 2001, Scholten et al. in press). Proposals for restoration also need to take an ecosystem approach in order to reach sustainable size and connectivity thresholds. Some of these issues are being addressed within the agriculture sector through the proposed Entry Level Scheme and Higher Level Scheme agri-environment measures in England.

Proposed development schemes need to find ways of halting the degradation of biodiversity and look at opportunities to improve biodiversity. The genuine enhancement of biodiversity in planning includes creating new habitats or managing existing ones to increase biodiversity so that there is a new benefit, not just compensating losses caused by the planned activities.

Although the level of demand for restoration is likely to increase with the incorporation into policy guidance, critical success will still be dependent on a number of key elements:

- The strength of environmental impact, environmental conditions and cross-compliance measures to prevent further damage to the environment and biodiversity;
- The attractiveness of financial incentives to encourage restoration;
- The setting of realistic restoration timescales and interim targets where full restoration is likely to be a lengthy process;

- The development of restoration knowledge (through applied research) and technologies to improve likelihood of success;
- The application and dissemination of advice on restoration techniques;
- The monitoring of restoration projects to ensure the greatest chance of success.

Experience has shown that the permutation of natural communities and the change of ecological processes over time often goes so far that the restoration of ecosystems or landscapes to the conditions found previously is no feasible planning option and frequently even impossible (Dale et al. 2000, Schultz & Wiegleb 2000, Kaule 2001, Scholten et al. in press). However, there is on-going investment in The Netherlands, for example, for the restoration of natural meanders of streams that have been rectified (Noord Brabants landscap, personal communication), using air photos from archives to locate where meanders existed two generations ago. To what extent is the dialectic merely one of mastering 'ecological engineering' constraints, to conserve or to restore? Does this impact on the roles of spatial planning?

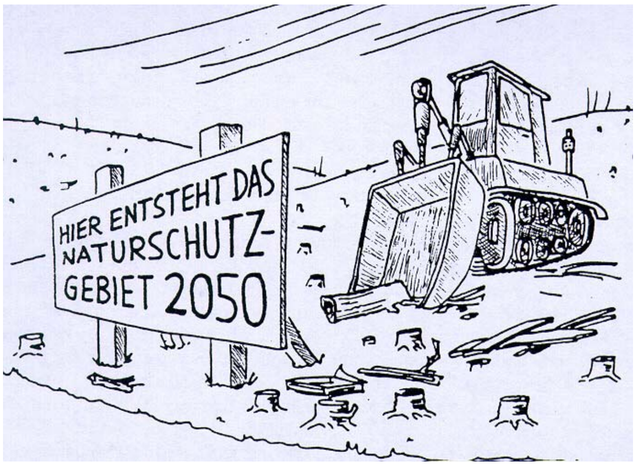

Figure 2. "The nature conservation area of the year 2050 under construction"

4.9. Ecosystem Management and Principles

Ecosystem management underlies the BIOFORUM approach to spatial planning. This type of management is defined in two different ways: the first emphasizes the need to maintain, protect or restore ecosystem or ecological functions and processes; the second describes ecosystem management as a strategy or system, developed for the achievement of desired conditions. These approaches are illustrated by the following definitions.

- "Ecosystem management is management driven by explicit goals, executed by policies, protocols, and practices, and made adaptable by monitoring and research based on our best understanding of the ecological interactions and processes necessary to sustain ecosystem composition, structure, and function" (Christensen et al. 1996).
- "Integration of ecological, economic, and social principles to manage biological and physical systems in a manner that safeguards the ecological sustainability, natural diversity, and productivity of the landscape" (Wood 1994).

Ecosystem management is holistic, covering all elements of ecosystems, both biological and physical, and interactions between them (Haeuber et al. 1996). The robust ecological theory, understanding of bio-physical interactions and monitoring data on state and trends represent background for further consideration in ecosystem management. There is general agreement that the protection of ecosystem functions is an essential prerequisite for achieving ecosystem services and goods in the long term (Heissenbuttel 1996). Successful ecosystem management requires advances in ecological understanding (Meyer et al. 1996). If science is the model for ecosystem management, then scientists and resource managers must understand what is known, what is not known and what problems must be solved or question answered, when considering a new management decision (Heissenbuttel 1996). The understanding of the dynamic nature of ecosystems (both in space and time) represents a key component in decision making in ecosystem management.

Christensen et al. (1996) summarised the basic elements of ecosystem management in the report of the Ecological Society of America on the scientific basis for ecosystem management. The main features, properties and elements of ecosystem management are described below:

- *Sustainability is considered as the basic value.* Ecosystem management assumes intergenerational sustainability as a precondition for management rather than an afterthought. Thus, the manager accepts the responsibility up front of managing in such way as to ensure provision of the opportunities and resources we enjoy today for future generations.

- *Goals.* Ecosystem management is as applicable to intensive utilitarian objectives as it is to the conservation of pristine wilderness; however, goals should not focus exclusively on "deliverables" such as board feet of timber, total catch or visitor days. Goals must be explicitly stated in terms of specific "desired future trajectories" and "desired future behaviours" for the ecosystem components and processes necessary for sustainability. Furthermore, these goals should be stated in terms that can be measured and monitored.

- *Sound ecological models and understanding.* Ecosystem management is based on sound ecological principles and emphasizes the role of processes and interconnections. It should be rooted in the best current models of ecosystem function. Questions of long-term productivity, sensitivity to stress, adaptability to changes and conditions in the future should be taken into account. Ecosystem management depends on research performed at all levels of organization.

- *Complexity and connectedness.* The importance of ecosystem complexity and the vast array of interconnections that underlie ecosystem function is certainly one of the most important lessons of decades of ecological research and natural resource management experience. Biological diversity and structural complexity of ecosystems are critical to such ecosystem processes as primary production and nutrient cycling. Complexity and diversity also impart resistance to and resilience from disturbance, and provide the genetic resources necessary to adapt to long-term changes. However, with complexity comes uncertainty. We must recognize that there will be always limits to the precision of our predictions set by the complex nature of ecosystem interactions while striving to understand the nature of those limits. Ecosystem management cannot eliminate surprises or uncertainty.

- *Recognition of the dynamic character of ecosystems.* Sustainability does not imply maintenance of status quo. Indeed, change and evolution are inherent characteristics of ecosystems, and attempts to “freeze” ecosystems in a particular state or configuration are generally futile in the short term and certainly doomed to failure in the long term.

- *Context and scale.* Ecosystem processes operate over a wide range of spatial and temporal scales, and their behaviour at any given location is very much affected by the status and behaviour of the systems or landscape that surrounds them. There is no single appropriate scale or time frame for management. The importance of context in determining the behaviour of ecosystems at a particular location has been the impetus for advocacy of a “landscape approach” in terrestrial ecosystems (Noss et Harris 1986) and development of the “large marine ecosystem concept” (Sherman et al. 1990).

- *Humans as ecosystem components.* Ecosystem management acknowledges the role of humans, not only as the cause of the most significant challenges to sustainability, but as integral ecosystem components that must be engaged to achieve sustainable management goals. The current trends in population growth and demand for natural resources will undoubtedly require more intensive and wiser management, particularly to support human needs in a sustainable way. Thus, identifying and engaging stakeholders in the development of management plans is a key ecosystem management strategy.

- *Adaptability and accountability.* Our knowledge base is incomplete and subject to change, similarly current models and paradigms of ecosystem function are provisional and will be changed. Management goals and strategies must be viewed as hypotheses to be tested by research and monitoring programmes that compare specific expectations against objective measures of results. Adaptability and accountability are central elements of ecosystem management. Managers must be able to adapt to the unique features or needs of a particular area and to inevitable temporal changes as well. To be adaptable and accountable, management objectives and expectations must be explicitly stated in operational terms, informed by the best models of ecosystem functioning, and tested by carefully designed monitoring programmes that provide accessible and timely feedback to managers.

Adaptive management of ecosystems structures a system in which monitoring improves the knowledge base and helps refine management plans (Ringold et al. 1996). It is useful to regard the monitoring plan itself as adaptive. In such case, it must include an interlink between information presentation, its reinterpretation from both user and planner positions and consequently consideration on monitoring design improvement.

The emphasis of approach to management on the ecosystem level includes careful consideration of the spatial dimensions, based on concepts of landscape ecology and conservation biology. Efforts to make ecosystem management a workable concept have recognized that units should have natural boundaries, meaningful to important processes, such as watersheds or collections of watersheds (Montgomery et al. 1995). Landscape scale management activities (e.g. agriculture, grazing, damming, logging) modify the composition and structure of the landscape, influencing species in different ways. A number of authors have suggested that the best approach to maintain native biodiversity is to imitate natural disturbance regimes (Galindo-Leal et al. 1995). The requirement to maintain natural processes intact, the concept of mimicking natural disturbances, the maintenance of wide-ranging populations, and the recognition that planning for sustainable use must be hierarchical all require the consideration of large areas. In fact, the commitment to biodiversity conservation requires planning over several scales including full consideration of the regional context (Galindo-Leal et al. 1995). However, in Europe, there is also a need to recognise that natural processes heavily influenced by man have formed many of the habitats and ecosystems now considered of biodiversity value. Although many of the human-driven processes may have operated in harmony with the available environmental conditions, they are nevertheless unnatural and would not necessarily be replicated at the same levels of intensity and scale by more natural processes. Hence there is a need to take the dynamics of these long-term intimate relationships into account when considering the management requirements of an ecosystem.

The theoretical principles for ecosystem management can be extended to the proactive domain of spatial planning, as exemplified by the work of Dale et al. (2000). Five principles of ecological science have particular implications for land use and can guarantee that fundamental ecosystem processes are sustained. These ecological principles deal with time, species, place, disturbance, and spatial patterns. The recognition that ecological processes occur within a temporal setting and change over time is fundamental to analysing the effects of land use. In addition, individual species and networks of interacting species have strong and far-reaching effects on ecological processes. Furthermore, each site or region has a unique set of organisms and abiotic conditions influencing and constraining ecological processes. Disturbances are important and ubiquitous ecological events whose effects may strongly influence population, community, and ecosystem dynamics. Finally, the size, shape, and spatial relationships of habitat patches on the landscape level affect the structure and function of ecosystems. The responses of the land to changes in use and management depend on expressions of these fundamental principles in nature.

Table 2. Ecological Principles

1. Time principle: Ecological processes function at many time scales, some long, some short; and ecosystems change through time. 2. Place principle: Local climatic, hydrologic, edaphic, and geomorphologic factors as well as biotic interactions strongly affect ecological processes and the abundance and distribution of species at any one place. 3. The principle of spatial patterns: The size, shape, and spatial relationships of land-cover types influence the dynamics of populations, communities, and ecosystems. 4. Species principle: Particular species and networks of interacting species have key, broad-scale ecosystem-level effects. 5. Disturbance principle: The type, intensity, and duration of disturbance shape the characteristics of populations, communities and ecosystems

5. European context for Spatial Planning

5.1. Introduction

Spatial planning is under the influence of a legislative framework and it is important to understand the origin of this framework at the European level. The international conventions and treaties create the background for building this framework and therefore the most important ones are included in this chapter. Strategies and tools have been developed in order to implement these various conventions and treaties on the global or the European level. To implement the Bern Convention, the European Community adopted the Habitat and Bird Directives. On the pan-European level, the Bern convention resulted in the Emerald network. Similarly, the Convention of Biological Diversity (CBD) was the basis for the Pan-European Biological and Landscape Diversity Strategy and the Important Plant Areas programme.

The legislative framework reflects changing practices in biodiversity issues during the last decades. For example, the Bonn Convention concentrates more on strict nature protection and conservation of species and their habitats, while the CBD emphasizes the conservation of biological diversity and the sustainable use of its components through ecologically sound spatial planning that integrates local and stakeholder needs with ecological planning principles and data.

The environmental policy of the European Union has been closely linked to the Environmental Action Programmes since 1973. The current, 6th Programme runs from 2001 to 2010. The nature and biodiversity theme is one of its four priority areas. Another policy significantly influencing spatial planning is the Common Agricultural Policy (CAP), reformed several times over recent years to address the environmental problems related to intensive agriculture.

Besides the Birds and Habitat Directives, the Water Framework Directive, Environmental Impact Assessment Directive, Directive of Strategic Environmental Assessment and Nitrate Directive also affect spatial planning.

The networks of sites put objectives and aims of conventions, policies and directives into practice. The degree of protection and integration into spatial planning varies between different networks. On the one hand, by law, the projects and plans that may have significant adverse effects on Natura 2000 sites have to be assessed. On the other hand, Important Bird Areas and Important Plant Areas may or may not have any legal protection.

5.2. Conventions and treaties

International treaties and conventions aim at protecting biodiversity on a global or European scale. They have been drawn up over a long time period, from the Ramsar Convention in 1971 to the Convention on Biodiversity Conservation (CBD) in 1992. Although the conventions usually do not result in direct protection of certain places or areas, they have an impact both on nature conservation and spatial planning. Sites that have been identified as important in the implementation of the respective conventions are usually designated as sites specifically reserved for nature/biodiversity conservation in the process of spatial planning. Moreover, the text of some conventions includes measures directly related to spatial planning.

Convention on Biological Diversity

The Convention on Biological Diversity provides a broad framework of objectives that underpin a whole ecosystem approach to spatial planning. The key objectives of the Convention in relation to spatial planning are the conservation of biological diversity through the sustainable use of its components. There are three articles which are particularly relevant.

Firstly, through Article 6 *(General Measures for Conservation and Sustainable Use)* the Convention requires the development of national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adaptation of existing strategies, plans or programmes for this purpose. It also promotes the integration of the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

Secondly, the integration of the conservation and sustainable use of biological resources into national decision-making is described under Article 10 (*Sustainable Use of Components of Biological Diversity*).

The link between impact assessment of projects and the conservation of biodiversity is well established by Article 14 of the CBD. This article (*Impact Assessment and Minimizing Adverse Impacts*) requires the use of environmental impact assessment of proposed projects that are likely to have significant adverse effects on biological diversity, with a view to avoiding or minimizing such effects and, where appropriate, for allowing public participation in such procedures.

Bern Convention

The Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention) was adopted in Bern, Switzerland in 1979, and came into force in 1982. The principal aims of the Convention are to ensure conservation and protection of all wild plant and animal species and their natural habitats (listed in Appendices I and II of the Convention), to increase cooperation between contracting parties, and to afford special protection to the most vulnerable or threatened species (including migratory species) (listed in Appendix 3). To this end the Convention imposes legal obligations on contracting parties, protecting over 500 wild plant species and more than 1000 wild animal species. As of September 2003 there were 45 Contracting Parties to the Convention.

To implement the Bern Convention in the EU, the European Community adopted the Birds Directive in 1979 and the Habitats Directive in 1992 (section 5.7), with the Natura 2000 network (section 5.11) as a tool for their implementation. The Emerald network (section 5.11) is designed to realize the aim of Bern Convention on the pan-European scale.

Pan-European Biological and Landscape Diversity Strategy

The Pan-European Biological and Landscape Diversity Strategy is an European response to support implementation of the Convention on Biological Diversity. The Strategy introduces a coordinating and unifying framework for strengthening and building on existing initiatives. The Strategy requires the application of 10 principles through all sectors using natural resources, to achieve wise management of biological and landscape diversity. These are principles of: careful decision making, avoidance, precaution, translocation, ecological compensation, ecological integrity, restoration and (re)creation, best available technology and best environmental practice, polluter pays, and public participation/public access to information.

The Strategy aims are that:

- Threats to Europe’s biological and landscape diversity are reduced substantially.
- Resilience of Europe's biological and landscape diversity is increased.
- Ecological coherence of Europe as a whole is strengthened.
- Full public involvement in conservation of biological and landscape diversity is assured.

In its 20 year time scale (1996-2016), the Strategy seeks to introduce biological and landscape diversity considerations into all social and economic sectors by striving to integrate them into agriculture, forestry, hunting, fisheries, water management, energy and industry, transportation, tourism and recreation, defence, structural and regional policies and urban and rural planning. Actions are to be implemented by dividing the Strategy into five year Action Plans, the first from 1996 to 2000.

Ramsar Convention

The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) was signed in Ramsar (Iran) in 1971. The Convention defines wetlands as “areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres”. Each Contracting Party designates suitable wetlands within its territory for inclusion in a List of Wetlands of International Importance. The Contracting Parties formulate and implement their planning so as to promote the conservation of the wetlands included in the list, and as far as possible the wise use of wetlands in their territory. They should also consider their international responsibilities for the conservation, management and wise use of migratory stocks of waterfowl.

Bonn Convention

The Convention on Protection of Migratory Species (Bonn Convention) is concerned particularly with those species of wild animals that migrate across or outside national jurisdictional boundaries. The Contracting Parties are asked – *inter alia* – to perform co-ordinated conservation and management plans and to maintain a network of suitable habitats appropriately disposed in relation to the migration routes.

There are also some other international conventions operating on a regional scale, e.g. Rhine and Danube Conventions, which are related to watersheds.

5.3. European Spatial Development Perspective

Policies of the European Union are of growing importance for spatial structures and the state of the environment within the Member States of the EU. The reasons can be found firstly in the Structural Funds and secondly in the ruling competencies the EU has acquired in many fields of spatial and environmental relevance, some of which are examined in the following sections. Furthermore some specific instruments for spatial and regional development have been elaborated in recent years which are, however, not legally binding, at least if they focus on conceptual or planning aspects. As – in accordance with article 6 of the treaty of Amsterdam – "environmental protection requirements must be integrated into the definition and implementation of the Community policies and activities", the question arises to which extent the goals of the Community's environmental policies have already been integrated into European spatial development policies, and what is the coordination mechanism for this.

The European Spatial Development Perspective (ESDP), subtitled *Towards Balanced and Sustainable Development of the Territory of the European Union*, was agreed at the Informal Council of ministers responsible for Spatial Planning in Potsdam, May 1999. This programme for territorial development gives attention to the loss of biodiversity and the disappearance of cultural (semi-natural) and natural landscape features. Coastal zones and mountain areas are recognised as being the most fragile and under the most pressure from urban forms of development: housing, commercial/industrial activity zones, mass recreation (i.e., marinas, ski resorts). Rationalization of agriculture and forestry has a tendency to result in monocultures and over-use of water resources through irrigation. The ESDP recognizes that countervailing measures exist: Natura 2000, rural development programmes, structural funds all can have a spatially specific, beneficial impact. The point is to organise the collaboration between landowners/land managers and the political authorities that orient land use.

The European Spatial Development Perspective is a set of guidelines for coordination of environmental policies and spatial development polices, including nature conservation and the natural heritage. ESDP is intended to be a common frame of reference for the European Commission, Member States, and regional and local authorities; the aim is to reinforce synergies and trans-national cooperation in spatial development in a harmonious way across Europe. A draft ESDP was agreed at an informal meeting in 1997 of Member State ministers responsible for spatial planning, and a final discussion on the document occurred in 1999. In the aftermath, the European Spatial Planning Observation Network (ESPON) was established, and the Coordination Unit established in Luxembourg prepares European level surveys of trends in spatial development. The results of these surveys serve as reference material for the Cohesion Reports, for the European Commission in general and also for the deliberations of the European Council when these concern EU territorial strategies.

In a polycentric model of spatial development that is currently emphasized at the EU level, the urban areas – each according to its strategic significance – are deployed within geographic and economic space as anchor-points for regional development. Within the resulting web, both cities and towns are partners to rural areas, and through an integrated approach all are mutually responsible for regional economic development. This is the synergy proposed by ESDP. Within that context it is specifically noted that "*the conservation and development of natural resources calls for appropriate integrated strategies and planning concepts as well as suitable forms of management*" (ESDP, paragraph 138). This indicates that biodiversity has to be seen as an asset provided by rural areas that is a precious resource for the sustainable development of urban and rural areas alike.

5.4. The Sixth Environmental Action Programme of the European Union 2001-2010

The Sixth Environmental Action Programme (6EAP), *Environment 2010: Our Future, Our Choice* identifies four priority areas:

- Climate Change
- Nature and Biodiversity

- Environment and Health
- Natural Resources and Waste

To achieve improvements in these areas, the current Programme sets out five approaches. These emphasise the need for more effective implementation and more innovative solutions. The Commission recognises that a wider constituency must be addressed, including the business sector that can only gain from a successful environmental policy. The Programme seeks new and innovative instruments for meeting complex environmental challenges. Existing EU legislation is not abandoned, but a more effective use of this legislation is sought together with a more participatory approach to policy making.

The five key approaches are to:
- Ensure the implementation of existing environmental legislation;
- Integrate environmental concerns into all relevant policy areas;
- Work closely with business and consumers to identify solutions;
- Ensure better and more accessible information on the environment for citizens;
- Develop a more environmentally conscious attitude towards land use.

The 6EAP provides the environmental component of the EU Sustainable Development Strategy: A Test Case for Good Governance. It continues to pursue some of the targets from the Fifth Environment Action Programme, which came to an end in 2000, but goes further, adopting a more strategic approach. It calls for "the active involvement and accountability of all sections of society in the search for innovative, workable and sustainable solutions to the environmental problems we face".

There are six 'Thematic Strategies' to establish future objectives and measures to be taken, and which cover the following themes:
- Soil protection;
- Marine environment;
- Sustainable use of pesticides;
- Air pollution;
- Urban environment;
- Sustainable resource use;
- Waste recycling.

With specific reference to nature and biodiversity the prime objective within the 6EAP is to protect and restore the structure and functioning of natural systems and halt the loss of biodiversity both in the European Union and on a global scale, by:

- The implementation of environmental legislation, in particular in the area of water and air;
- Extension of the scope of the Seveso II Directive[5] on major industrial accident hazards;
- Coordination of Community Member States' action on accidents and natural disasters;
- Examination of the need to protect plants and animals from ionising radiation;
- Protection, conservation and restoration of landscapes;
- Protection and promotion of the sustainable development of forests;
- Establishment of a Community strategy for the protection of soil;
- The protection and restoration of marine habitats and the coast, and the extension of the Natura 2000 network to include them;
- Reinforcement of controls on labelling, monitoring and traceability of GMOs;
- The integration of conservation and biodiversity into commercial and development cooperation policies;
- The creation of programmes for gathering information on nature conservation and biodiversity;
- Support for research in the field of nature conservation.

5.5. Common Agricultural Policy

The CAP (Common Agricultural Policy) set up in 1962, was initially based on the Treaty of Rome (1957) and aimed to increase production, provide more food at a lower cost for EU countries, and realize a fair standard of living for farmers. The effects of increasing agricultural production included: a reduction of natural areas with a loss of flora and fauna diversity as well as changes in habitat structure and plant and animal communities, soil and waters pollution with pesticides and nutrients.

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[5] Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances.

The CAP has seen a number of reforms since its creation, notably in 1992, when direct aids, rural development measures and production limits were introduced to reduce surpluses and encourage environmentally sound farming. Agenda 2000 reforms in 1999 aim at strengthening Community policies and provide the European Union with a new financial framework for the period 2000-06 with a view to enlargement. Following a mid-term review of the application of the Agenda 2000 in the CAP, EU farm ministers agreed to reform the CAP yet again on the 26th June 2003. This new reform makes the CAP subsidies independent of the volume of production, with "single farm payments" based on the direct subsidies farmers received in a reference period (2000 to 2002) and linked to environmental, food safety and animal welfare standards. This decoupling of production and subsidies is expected to make "EU farmers more competitive and market-oriented" (European Commission 2004a).

The CAP is now made up of two pillars: Pillar 1 deals with market and income support, while Pillar 2 deals with rural development. Within the rural development fund, Member States can adopt a number of measures, including the designation of Less Favoured Areas (LFAs), and agri-environment schemes. These agri-environment schemes are probably the most important incentives for conserving biodiversity in agro-ecosystems, and were introduced in the 1992 reforms of the CAP to transfer financial incentives towards environmental measures rather than production support (Ovenden et al. 1998).

The current changes to the CAP support mechanism are expected to result in a decrease in environmental pressure from farming practices within the EU. There is therefore the potential to see some reversal in some of the farmland biodiversity declines observed over recent decades. However, any such reversal of biodiversity fortunes is not anticipated to be uniform across all agricultural sectors. Indeed, it is likely that dairy farms in particular will continue to have an adverse impact as economic pressures drive those farmers who continue in this sector to increase herd sizes and the associated area of land that they farm. In addition, although current input rates are relatively low on farmland in Central and Eastern European Countries (CEECs), some intensification is expected under the new economic and political framework following accession of these countries to the EU. Some areas of high nature value (HNV) farmland may therefore be exposed to intensification in the near future (EEA 2004a).

The further focus on the increased use of agri-environment schemes in the rural development measures is also good in principle. However, the reforms to-date have done little to address the question as to whether or not the programmes themselves have been effective in achieving their biodiversity objectives. In particular, many of the wide variety of schemes currently available suffer from the fundamental difficulty in attempting to manage biological features that have evolved as integral functional components of farming systems, as if they were simple material features. As a result, many schemes have a tendency to be over-prescriptive, are targeted too closely at specific material aspects or conspicuous species and some may have been over ambitious in their objectives. The ecological complexity of farmland and the fact that no two farms are the same has been difficult to address, as has making clear the distinction between high nature value farmland and the more impoverished systems of management and production associated with intensively managed areas (Bignal & McCracken 2000)

European agriculture is currently entering a period of great uncertainty, since it is unclear exactly what impacts the changes to the CAP support mechanisms will have on farming practices, land-use, agricultural landscapes and farmland biodiversity across Europe. There appears to be some scope for biodiversity gains to occur on what was previously intensively-managed farmland, but also concern that the abandonment of HNV farmland will continue and result in significant biodiversity losses. For most intensively managed areas of farmland, an improvement in biodiversity value can be achieved either by lowering inputs across the agricultural landscape as a whole or by reintroducing a greater range and mixture of habitats into the landscape. Conversely, for most HNV farmland the issues revolve around maintaining the diversity in habitats and farming practices which already exists. It is essential that policy recognises that the approaches that need to be taken differ between these two types of farmland. In addition, the fact that neither the Ecosystem Approach nor indeed any spatial planning considerations have been at the heart of CAP decision-making to-date needs to be addressed.

Agricultural biodiversity losses will only be halted if appropriate measures are directed where they can be most effective. Site protection under the

Birds and Habitats Directives is an appropriate but insufficient conservation tool. At best only about one third of existing HNV farmland area is likely to benefit from these measures. Conservation of farmland biodiversity outside protected areas depends mainly on the application of rural development measures within the CAP (especially agri-environment schemes) and similarly there is a need for these measures to be targeted both at HNV farmland and at those areas of intensively-managed farmland which have the greatest potential to achieve biodiversity recovery. There also, however, needs to be a recognition that CAP measures are not the only factors influencing land management decisions on farms across Europe (Box 1). There needs to be more integration of policies aimed at addressing all the agricultural, economic and socio-economic issues driving biodiversity changes on farmland. In particular, there needs to be closer linkages between the development of Structural Funds and CAP measures to ensure that the local infrastructure required by the farmers is maintained, especially in HNV farmland areas.

Box 1. The need for integration of CAP objectives with those of structural funds

Abandonment of farmland is already a common feature in regions of Europe where agricultural productivity is relatively low. Irrespective of the current changes to CAP support and the increasing focus in agri-environment concerns, abandonment of farmland (much of it of high nature value) is likely to continue across Europe as socio-economic considerations put increasing pressure on the viability of farming. Low incomes, hard working conditions and a lack of social and rural infrastructure in many remote areas make farming a less attractive option for young people. The situation is not only particularly worrying in southern Europe but also in central and Eastern Europe, where political and economic change has negatively affected the viability of high nature value farmland (EEA 2004b).

Even where positive measures are taken to encourage farmers to maintain particular types of habitats, other factors which are not affected directly by the CAP policy can influence whether or not it is viable for the practice to continue. The fact that measures and priorities set within the reformed CAP are not integrated with other support mechanisms are likely to lead to difficulties in maintaining appropriate farming practices on high nature value farmland in the future. For example, a large decrease in animal numbers in CEECs over the past 15 years has been accompanied by a loss of rural infrastructure (e.g. local slaughterhouses, milk processing plants). Even if production on farms can be encouraged from an environmental-management perspective and market demand promoted, it will be difficult, if not impossible, to exploit these effectively, and thus maintain existing farmland biodiversity, unless the local infrastructure can be reinstated, enhanced and adapted to future needs. Integral to this process will be the need to broadening farming activities by, supporting producer groups, and by developing HNV farmland friendly rural development measures to exploit the market potential of locally distinctive crops and products. Strenuous efforts need also to be taken to ensure that discussions over Structural Funds priorities and Rural Development Regulation needs are sufficiently well integrated with one another to foster the development of a 'critical mass' in the appreciation and understanding of farmland biodiversity issues (EFNCP 2004).

5.6. European Union Biodiversity Strategy

The European Union Biodiversity Strategy was adopted in 1998 and is intended to be complementary to the strategies of MS, further the implementation of existing Community policy on biodiversity and integrate biodiversity concerns into the relevant sectoral Community policies and instruments.

The European Community Biodiversity Action Plans (BAPs) implement the Strategy. One of the aims of the European Biodiversity Action Plans is to promote the application of existing and planned environmental legislation. They are a focus for better integration of existing environmental instruments. However, it is not clear, whether EC BAPs have significantly enhanced the integration of biodiversity in spatial planning. Integration of biodiversity into sectors – especially through spatial planning – is very much about resolving conflicts between human activities and the conservation of biodiversity (Young et al. 2003). The EU has been adapting its policies to meet the challenge of the 2010 deadline for halting the loss of biodiversity. Ever since the European Council launched the Cardiff Process in June 1998, the Spring Council has examined how environmental concerns are considered in the decisions and activities of other sectors, in terms of EU policy, thereby putting article 6 of the EC Treaty into practice. This led to the review of the EU Biodiversity Strategy as a major orientation during the Irish Presidency (January-June 2004), cumulating in a Stakeholder Conference hosted by the Irish Government at Malahide in May: *Biodiversity and the EU – Sustaining Life, Sustaining Livelihoods*. The "Message from Malahide" presented 18 priority objectives for halting the loss of biodiversity, and formulated a series of targets associated with a first set of headline indicators – based on CBD decision and focal areas[6] – to monitor progress in meeting the 2010 deadline. Objective 1 refers to spatial planning, and Objective 8 specifically addresses it. Thus the EU Biodiversity Strategy will certainly encourage the use of spatial planning as a tool to preserve biodiversity for the future.

[6] UNEP/CBD/COP/7/L.27

OBJECTIVE 1: To ensure conservation of Europe's most important wildlife habitats and species within a thriving wider environment.

2010 and earlier targets

…

1.2. Natura 2000 contributes to the establishment of effectively managed, comprehensive and ecologically representative networks of protected areas at land and at sea, integrated into a global network.

…

1.7. Article 6 (avoidance of damages to Natura 2000 sites) of the Habitats Directive fully transposed into national legislation and planning policies, and routinely implemented; where development proposals cannot avoid damage to sites, special effort given to the adequate design and implementation of compensation measures.

OBJECTIVE 8: To ensure that Cohesion policy and spatial planning support conservation and sustainable use of biodiversity.

2010 and earlier targets

…

8.3. All territorial plans subject to Strategic Environmental Assessment Directive take full account of impacts on biodiversity from July 2004.

8.4. Spatial plans have ensured the maintenance and enhancement of the ecological functioning of landscapes and of the coherence of the Natura 2000 network.

5.7. Habitat and Birds Directives

Two EU directives, the Habitat and Birds Directives, deal with conservation of biodiversity, focusing on the protection of sites as well as species.

The 1979 Birds Directive (79/409/EEC) identified 181 endangered species and sub-species for which the Member States are required to identify and designate Special Protection Areas (SPAs). Member States have to identify and designate the most suitable territories, in number and size for endangered and vulnerable bird species listed in Annex 1 of the Directive. They must also identify and designate the most suitable territories for other regularly occurring migratory species not listed in Annex 1, but needing protection on their breeding, moulting, staging and wintering grounds (with particular attention to wetlands, especially wetlands of international importance).

Member States must take measures to ensure that wild bird populations are maintained at a level consistent with ecological, scientific and cultural requirements, both within and outside protected areas, while taking account of economic and recreational requirements, and take the requisite measures to preserve, maintain or re-establish a sufficient diversity and area of habitats (Arts. 2 and 3).

Steps must also be taken to avoid the deterioration of SPAs and the disturbance of wild birds using them (Arts. 6 and 7 of Council Directive 92/43/EEC superseding Art. 4 of this Directive). In January 2004, there were a total of 2,300 SPAs identified in the EU15, covering 273,700 km^2.

The 1992 Habitats Directive (92/43/EEC) aims to protect wildlife species and habitats. Each member state has to identify Sites of Community Importance (SCIs), and designate these sites once they have been agreed with the Commission, as Special Areas of Conservation (SACs); and establish priorities for the management of these sites (Art. 4). The sites have to meet ecological requirements of natural habitats (Annex 1) and species (Annex 2) thus ensuring their favourable conservation status. In January 2004 there were a total of 15,500 sites covering 453,600 km^2 proposed by the EU15. These SACs, together with SPAs (see above), form the Europe wide network of protected sites known as Natura 2000 (section 5.11).

Measures are required for the conservation of SACs which may include management plans specifically designed for the sites or integrated into other development plans, and appropriate statutory, administrative or contractual arrangements which correspond to the ecological requirements of the habitats and species concerned (Art. 6).

Like the Birds Directive, Member States must take appropriate steps to prevent the deterioration of SACs and the disturbance of the species for which they were created in so far as such disturbance could be significant in relation to the objectives of the Directive (Art. 6).

Assessment is required of any plan or project that either by itself or in combination with other plans or projects is likely to have a significant effect on an SPA or SAC, and ensure that any such plan or project is not approved if it would adversely affect the integrity of the site, unless there are 'imperative reasons of overriding public interest'. If a plan or project is approved in spite of a negative assessment (for imperative reasons of overriding public interest), all necessary compensatory measures to ensure that the overall coherence of Natura 2000 is protected have to be taken (Art. 6 of Council Directive 92/43/EEC).

The Habitats Directive is linked with the EIA Directive (85/337/EEC), as one of the criteria which triggers an Environmental Impact Assessment is the value and sensitivity of sites affected by proposed developments. Thus SACs and SPAs are evaluated for possible damage under the EIA Directive and could be seen to benefit from this additional 'protection'.

In April, 2000 the Commission published a guidance document "Managing Natura 2000 Sites – The Provisions of Article 6 of the 'Habitats' Directive 92/43/EEC."[7] This document provides very detailed guidance on how to deal with the issues affecting the management of designated sites.

Monitoring, research and any other work required as a basis for the protection, management and use of SACs and SPAs is encouraged. The public must also be consulted before agreeing to a plan or project that is likely to have a significant effect on an SPA or SAC.

When the ten new Member States joined the EU on 1st May 2004, the legal requirements of the two Directives had to be transposed into national law, SPAs designated under the Birds Directive and a national list of Sites of Community Importance proposed under the Habitats Directive. A number of changes had been made to the Annexes of the Habitats and Bird Directives in order to enable the inclusion of new species and habitats of the new Member States.

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[7] http://europa.eu.int/comm/environment/nature/art6_en.pdf

In land-use planning and development policies, Member States must seek to encourage the management of features of the landscape that are of major importance for wild plants and animals (Art. 10) with a view to improving the ecological coherence of the Natura 2000 network. To implement the Natura 2000 and other European networks and to integrate them with other human interests, spatial planning can provide the necessary tools.

5.8. Water Framework Directive

The Water Framework Directive (2000/60/EC) establishes the basic principles of sustainable water policy in the European Union by acting as a comprehensive legal instrument introducing a new holistic approach in the water sector management and policy. The Directive aims at maintaining and improving the aquatic environment in the Community (WFD, Preamble, item 19), establishing a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which prevents further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems, and aims at enhanced protection and improvement of the aquatic environment inter alia through specific measures (WFD, Art. 1). However, there is an on-going discussion regarding the extent to which non-aquatic biodiversity is covered by the Directive (Petry et al. 2002). Scientifically, the need to cover the biodiversity of flood plains, other wetlands, and terrestrial ecosystems that are influenced by rivers via the groundwater pathways can be well justified (Petry et al. 2002) and most water administrations and other stakeholders tend to follow this interpretation. Thus, the Water Framework Directive does not guarantee but provides excellent opportunities for biodiversity conservation. Since the Water Framework Directive is a recent directive, practical experience on its contribution to biodiversity conservation is not yet available.

From the point of view of implementation of the basic ecological principles and guidelines in spatial planning, there are several basic characteristics of the WFD that can be considered revolutionary after many decades of domination of the water use/consumption and water quality models:

- Introducing the ecosystem (basin) approach in overall and integrated water management;
- Introducing water bodies as smallest (landscape) unit to be managed;

- Establishing definitions for ecological status (= an expression of the quality of the structure and functioning of aquatic ecosystems associated with surface waters, which is quite different from water quality) of the natural water bodies and for biological potential of the artificial and heavily modified water bodies;
- Introducing the biological quality elements and respective ecological quality ratio (EQR) to be used in ecological classification of all natural water bodies.

The Water Framework Directive takes an Ecosystem Approach, explicitly demanding that water resource management considers the whole river basin, without stopping at administrative boundaries. Furthermore, it demands an integration of strategies for the use and protection of water as a resource with management plans covering the complete river basin. Thus, the Water Framework Directive provides major challenges for spatial planning.

Spatial planning can provide the tools necessary to implement the Water Framework Directive and take advantage of the scope it provides for biodiversity conservation. For example, landscape planning has gained considerable experience in the definition and mapping of semi-aquatic and terrestrial habitats and in the assessment of their quality. Landscape planning can show the spatial relationships between the water body, biodiversity, and a good environmental status of flood plains and other ecosystems that are influenced by river systems. It can identify the functions of these systems, especially in relation to water resources, and evaluate them in ecological and in socio-economical terms. Spatial planning has effective tools to integrate the goals of the Water Framework Directive with those of other directives and with the planning for other human land use needs. It has access to data and financial means to implement measurements, e.g. agri-environmental schemes.

A number of measures have to be undertaken by Member States in accordance with the WFD. The role of spatial planning will be important for the implementation of each of these measures.

Member States have to ensure the establishment of a programme of measures for each River Basin District in order to achieve the Directive’s objectives, including environmental ones (Article 11). Such programmes of measures may make reference to measures following from legislation adopted at national level and covering the whole of the territory of a Member State. Each programme of measures shall include the “basic” measures and, where necessary, “supplementary” measures. As part of the Programme of Measures, wetland creation, restoration and management, may prove a cost-effective and socially acceptable mechanism for helping to achieve the environmental objectives of the Directive (Art. 11.4; Annex VI, B(vii)).

The WFD also requires Member States to establish a register of all areas lying within each River Basin District which have been designated as requiring special protection under specific Community legislation for the protection of their surface water and groundwater or for the conservation of habitats and species directly depending on water (WFD, Art. 6).

The purpose of the WFD is to ensure that the integrated river basin planning system created by the WFD helps to deliver the objectives of other water-related legislation, as it applies to environmentally vulnerable or important parts of the river basin’. A crucial part of the development of the Protected Areas Register will be the identification of those habitats and species within the Natura 2000 network that qualify under WFD criteria (Table 3).

Table 3. Ecological criteria for identifying Natura 2000 Habitats and Species that are directly dependent on the status of water

Natura 2000 SPECIES	Natura 2000 HABITATS
1.a Aquatic species living in surface waters as defined in Article 2 of the WFD (e.g. bottle-nose dolphin, freshwater pearl mussel)	2.a Habitats that consist of surface water or occur entirely within surface water, as defined in Art. 2 of the WFD (e.g. logographic waters; estuaries; eelgrass beds)
1.b Species with at least one aquatic life stage dependent on surface water (i.e. breeding; incubation, juvenile development; sexual maturation, feeding or roosting - including many Natura 2000 bird and invertebrate species)	2.b Habitats which depend on frequent inundation, or on the level of groundwater (e.g. alluvial alder wood, blanket bog, fens)
1.c Species that rely on the non-aquatic but water-dependent habitats relevant under 2.b and 2.c in the HABITATS column of this Table (e.g. Killarney fern)	2.c Non-aquatic habitats which depend on the influence of surface water - e.g. spray, humidity (bryophyte-rich gorges) should be considered

Wetlands are a significant part of the SACs and SPAs, and all of them are relevant to the provisions of the WFD (see table 3). Although the WFD does not provide a definition of "wetlands", a common text was agreed at the Water Directors Meeting (Copenhagen, 2002): "Wetland ecosystems are ecologically and functionally significant elements of the water environment, with potentially an important role to play in helping to achieve sustainable river basin management". The WFD does not set environmental objectives for wetlands. However, wetlands that are dependent on groundwater bodies, form part of a surface water body, or are Protected Areas, will benefit from WFD obligations to protect and restore the status (both ecological and chemical) of water. The environmental objectives of the WFD are exclusively to be applied to, and monitored through "water bodies", therefore it is important for Member States to have a clear understanding of the relationship between water bodies (ground and surface) and wetlands, in order to understand how these systems might be encompassed within the cycle of river basin planning. Wetlands have the potential to offer benefits in terms of flood prevention, nutrient and pollutant load abatement, biodiversity/wildlife protection, tourism and recreation. Obligations are requested also specifically under the Habitats and Wild Birds Directives, to take protective or restorative action in the management of wetlands which are included in the register of protected areas following Annex IV(v).

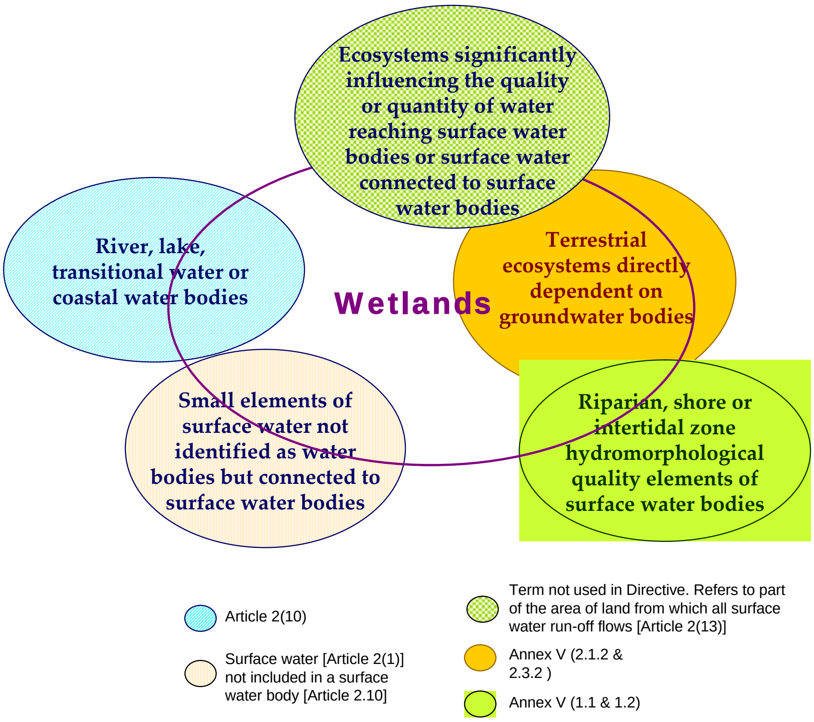

Figure 3. Aquatic ecosystems within a river basin that may be relevant to the achievement of the WFD's objectives

(Source*:* Common Implementation Strategy for the Framework Water Directive (2000/60/EC)-Horizontal Guidance on the Role of Wetlands in the Framework Water Directive (Final Version 8.0/ 17.12.2003) as adopted by the Water Directors during their meeting in Rome, 24/25 November, 2003). See Figure 4 for their application to a hypothetical landscape.

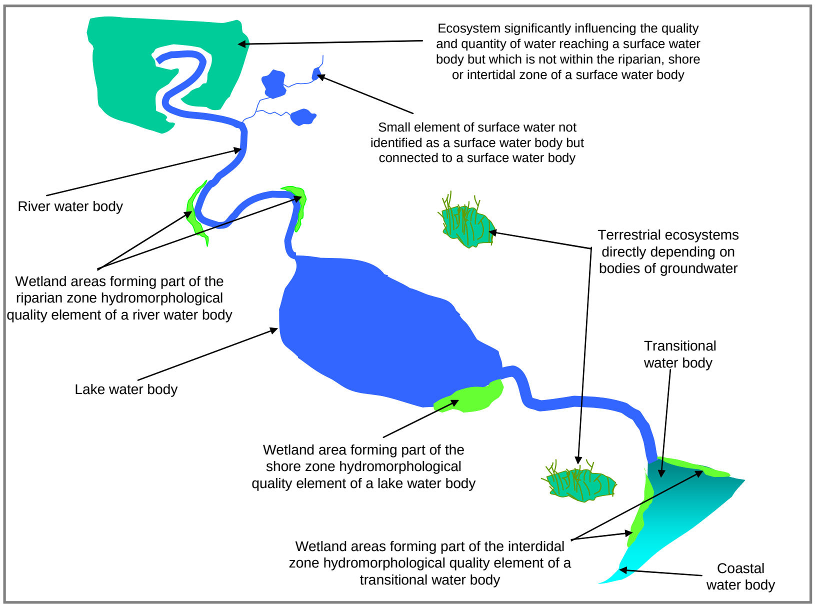

Figure 4: The relationship of ecosystems within a hypothetical landscape.

The WFD (Annex II) proposes that, when defining surface water typology, the identification of water bodies should reflect the ecological significance of surface waters within a river basin district using additional criteria designated to take account of local circumstances and therefore assist in the river basin management planning process.

5.9. Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) Directives

Environmental assessment is a procedure integrating the environment into decision-making in a transparent way. Environmental assessment can be undertaken for individual projects such as a motorway, harbour or factory

(Environmental Impact Assessment) or for plans, programmes and policies (Strategic Environmental Assessment). The process involves an analysis of the likely effects on the environment, recording those effects in a report, undertaking a public consultation exercise on the report, taking into account the comments and the report when making the final decision and informing the public about that decision afterwards.

The 1985 EIA Directive (85/337/EEC) requires that the assessment of environmental impacts be carried out at the individual project level on major projects. The EIA Directive outlines which project categories shall be made subject to an EIA, which procedure shall be followed, and the content of the assessment. The directive was amended in 1997 (97/11/EC) by specifying minimum requirements for the information to be supplied by the project developer.

According to the EIA directive the direct and indirect effects of a project upon fauna and flora should be addressed but it does not make explicit reference to the concept of biodiversity. However, the Convention on Biological Diversity requires that EIA be applied to development projects that have the potential to cause adverse impacts upon biodiversity. The Convention on Biological Diversity has adopted guidelines on incorporating biodiversity issues into impact assessment in 2002 (UNEP/CBD/COP6/7). Practical experience with the EIA Directive has shown that the provision of data in environmental assessment is sometimes defective. According to the European Commission's five-year report on the application of the EIA Directive (European Commission, 2003), EIA systems in Member States give consideration to the impacts on flora and fauna but the broader biodiversity perspective is lacking. Research based on the EIA report analysis in Member States has indicated that there are several problems with biodiversity impact assessments in the EU countries (Byron 1999; de Jong et al. 2004; Söderman 2004; Thompson et al. 1997; Treweek 1999; Treweek 2001): the data necessary to identify and assess the main effects on biodiversity is not included in the EIA reports; there is failure to identify cumulative time or space-crowded effects; impacts are not evaluated in a wider context such as on a landscape level but only in a close vicinity of the project; and quality of the EIA reports is low.

There are both information-related and process-related reasons for shortcomings of EIAs, but a deficit of relevant data makes it difficult for stakeholders to make appropriate decisions. Scientific information does not reach the consultants carrying out the practical assessment work and money available for carrying out impact assessments on biodiversity is insufficient in most cases to allow the use of state-of-the-art methods. Therefore the collected data pose severe limitations to the inferences that can be drawn from them regarding likely effects on biodiversity. The problem is aggravated by the fact that in some countries neither the quality of the data nor the soundness of the inferences drawn from them can be challenged in court. Rather, inappropriate EIAs can be challenged only on procedural grounds. Furthermore, EIA reports come too late in the decision-making process, when all crucial decisions for the project have already been made and options for significant change are often limited (de Jong et al. 2004). As a consequence, the decision-making should not be seen as a formal decision-making but as a process during the whole project planning. EIA case studies in Finland (Hokkanen 2003) have shown EIAs to have a significant influence on the decisions made during the formulation of the project and its alternatives. Therefore, the quality of the data on biodiversity related issues should be better and biodiversity related issues and stakeholder involvement should be incorporated in the project planning at the earliest possible time and updated during the whole project.

Box 2. EIA of the motorway in Liptov Basin (Northern Slovakia)
In the early 1990s, motorway construction started in eastern part of the Liptov basin in northern Slovakia. This area is located between the Tatra NP and the Nizke Tatry NP and lies in the buffer zones of both NPs. This area is home to many valuable habitats e.g. bogs, fens, wet grasslands and wet forests, and is a main migration route for game and other animals.

The first part of this motorway was prepared and built before EIA law had come into the force in Slovakia. Therefore, methods of EIA were not applied. As a result, some valuable wet meadows and fens were lost – partly because they were located in the motorway route, partly because they were used as material deposits. The next part of the motorway was build during first years of EIA application in Slovakia. As a result of insufficient experience, the developer performed the scoping phase of the EIA process without adequate biological data. This led to the motorway going through some important habitats – fens with significant populations of endangered species, wet alluvial meadows, etc. The second phase of EIA – assessment report – was produced using field research and the habitats mentioned above were identified. However, because the alternatives were selected during the scoping phase, only minor modifications of route were possible. Such modifications were made in order to keep biologically important habitats outside the motorway route. In some sites it was not possible and habitats in such sites would be lost. In other sites, habitats dependent on specific water regimes were located in vicinity of the motorway route and the damages connected with changes of groundwater regime could not be excluded.

Experience from the first years of EIA application have led to changes in EIA legislation in Slovakia. For example, a paragraph on the need to have EIAS only on motorway and road projects greater than 5 kilometres was changed to EIAs in any highway and main road project. The Ministry of Environment has reinforced quality control of EIA reports, but requirement of sufficient field data on biota in scoping phase (when significant changes in road routes can be done) is not always stressed sufficiently.

The 2001 Strategic Environmental Assessment (SEA) Directive (2001/42/EC) obliges public authorities to systematically consider environmental impacts when preparing plans or programmes likely to have significant effects on the environment. The SEA offers solutions to some of the shortcomings encountered at project level impact assessment. At project level the choice of alternatives and project site may already have taken in the context of plans for a whole sector or geographical area. Unlike project EIAs, SEAs deal with cumulative impacts of multiple activities on a larger geographical scale and enables to assess the ecological impacts of proposed activities at the earliest possible stage, where options for different solutions and possibilities to engage many stakeholders are best. For example, a SEA case study in municipal planning in Estonia (Jalakas 1998) demonstrated that timely and early information of the public avoided the creation of conflicts, found new creative solutions and resulted in receiving new information on the preferences of interested parties and inhabitants. SEA should be integrated into the development planning and the planning system should be reviewed to check that all its elements contribute to the maintenance and positive enhancement of biodiversity. So far this has not been done systematically in SEA (Slootweg 2003). SEA is a relatively new procedure and the methods by which biodiversity considerations would be incorporated into SEA have not been elaborated. In SEA the multi-functionality of biodiversity should be emphasized and the separation of nature conservation from economic activities should be avoided. The SEA should provide data on both of them objectively. Baseline information related to biodiversity and local economic policy should be used in a versatile way to engage stakeholders.

5.10. Nitrate Directive

Council Directive 91/676/EEC of 12 December 1991 has the objective to reduce water pollution caused or induced by nitrates from agricultural sources and to prevent further such pollution.

Under the Directive, Member States shall designate as vulnerable zones all known areas of land in their territories that drain into the waters affected by pollution and also water bodies and water courses which could be affected by pollution. This should be followed by establishment of code or codes of good agricultural practice, to be implemented by farmers on a voluntary basis and action programmes in respect of designated vulnerable zones. The Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with the Directive.

Box 3. Agricultural land use and implementation of the Nitrate Directive in the upper Vistula basin

The upper Vistula basin (194,500 sq km) in Poland comprises of mainly permanent meadows and pastures, with agricultural lands constituting about 53% of the area., and forests occupying almost 40%. Based on the methodology recommended by the Nitrate Directive, an evaluation was made of the nitrogen content in surface and subsurface water. Based on the nitrate balance, the maximal value – 127 kg per ha – was recorded in Proszowice country. This value is lower than the limit established by the Nitrate Directive (150 kg N per ha). Nitrate concentration in surface waters was also evaluated. Only two rivers (Dlubnia and Szreniawa) showed annual average concentrations of nitrate higher than Directive limit (50 mg*dm^{-3}). However water quality studies in rivers and major artificial lakes showed that the main pollutant (phosphorus) originated from non-agricultural sources.

Application of the Nitrate Directive in the upper Vistula basin showed that agricultural land use practice in Southern Poland was environmental friendly. This confirms low input agriculture production in this region, which includes the Polish Carpathian Mountains. This is mostly an upland region with 36 % of the area in altitude between 500 and 1100 m. The extensive farming is a practice of high natural value that is a favourable phenomenon, because soil erosion is limited and soil-water environment is protected. Non-agriculture point pollution is the major threat to the environment in this area and should be taken into consideration in spatial planning within this region.

5.11. European Networks of Important Biodiversity Sites

Natura 2000

In January 2004, the Natura 2000 network already comprised more than 18,000 sites and over 17% of the EU 15 territory. The network is co-financed through Community finance instruments. The sites combine long-term biodiversity conservation with economic and social activities. Although not necessary in all cases, management plans are identified as a major way to achieve integration of conservation and human activities in the sites. The Member States also have a choice in the mechanisms they use to implement the conservation measures. They can be statutory (e.g. making a nature reserve), administrative (e.g. providing the necessary funds to manage the site) or contractual (e.g. signing a management agreement with the landowner).

The Habitats Directive sets out a general preventive duty to avoid habitat deterioration and significant species disturbance within the site. This duty is permanent and concerns any past, present or future (albeit predictable) activities. This is relevant for existing activities that may negatively affect a site, e.g. overgrazing by sheep or recreational damage from 4WD vehicles.

The protection framework set out in the Habitats Directive includes also a series of procedural and substantive safeguards that have to be applied whenever there is a proposal for a new plan or project potentially threatening to a Natura 2000 site. If there is a likelihood that the plan or the project will have a significant effect on the species and habitats for which the site is designated, an appropriate assessment of the implications of the plan or project for the site's conservation objectives has to be carried out. It is recommended (European Commission, 2000) to use the EIA Directive (85/337/EEC) as a reference, since it lays down the methodology for carrying out an impact assessment. If, following the assessment, it is found that the plan or project will not adversely affect the natural value of the site that is the reason for its inclusion in Natura 2000, the authority may allow the proposed activity. If the plan or project will adversely affect the site, the plan or project can be approved under three conditions: there are no alternative solutions, the plan or project represents an overriding public interest, and the Member State has to compensate the loss of the site. In this case all conditions have to be satisfied.

Natura 2000 is intended as a tool for integrating conservation and economic activities in a sustainable manner. The aim is not to set up a general conservation regime for the whole site and to block economic activities in and around the sites, but to take measures focused on the species and habitats that justified the selection of a site as part of the Natura 2000 network. However, this flexible integration of conservation, social and economic activities has created confusion and intentional or non-intentional misunderstanding among different stakeholders. In Finland, for example, Natura 2000 caused a conflict between the environmental administration and landowners, between the Central Union of Agricultural Producers and Forest Owners (MTK) and the environmental administration, between the Finnish Association for Nature Conservation and the environmental administration and landowners (Jyry 1988; Kiijärvi 2002; Saaristo 2000; Sairinen 2000; Söderman 1999). The environmental administration that prepared the proposal of the sites to be included involved landowner views but kept to strictly scientific facts. Many social and economic aspects remained unclear, and due to the flexible conservation practices there were no straight answers to what restrictions applied to activities in the sites. The landowner organization took advantage of this and the conflict became further exacerbated (Kiijärvi 2002). In the end, landowners feared losing their right to use their own lands and having to stop all activities on the sites without any financial compensation. As a result, during the preparation years 1997-1998, Natura 2000 caused over 20,000 claims and complaints, mainly from landowners. These had to be processed legally, and as a consequence the preparation process of the national network was delayed.

In the Natura 2000 sites, maintaining biodiversity is not necessarily in competition with human activities, but rather a new way of taking natural values into consideration without strict protection but with well-managed human activities. In fact, many of the sites are highly dependant upon certain human activities for their survival (e.g., traditional agriculture). The sites can even provide additional opportunities for human use activities, e.g. for ecotourism (Fotiou et al. 2003). However, these potentials and opportunities passed almost unnoticed in the conflict, which drew strength from old perceptions and prejudices created already in connection with the preparation of the earlier protection programmes aiming at strict nature protection in the preceding 20 year period.

The procedural requirement to carry out an appropriate assessment also caused minor conflicts between stakeholders in Finland. Natura 2000 sites and the requirement of an appropriate environmental assessment before a change in land use have been seen as a block to all projects or plans. The assessments have not been perceived as a tool to design a plan or project which would take into account the conservation values (e.g., through mitigation measures), but as an extra burden caused by the Habitats Directive. Thus the assessments have been inappropriate, that is they have not provided the required information needed by the decision maker to be able to consider whether the project or plan should be allowed to proceed (Söderman 2001). Also public involvement in the assessment has been scarce. Therefore, the projects or plans have been approved or rejected on the basis of inadequate information.

The Finnish Natura 2000, as a source of conflict, shows that in particular with regard to biodiversity issues it is a challenging task to involve all stakeholders in an atmosphere of mutual understanding and trust. The social aspects have to be taken into consideration from the very beginning of the planning of activities that concern land use. Unbiased socio-economical data is needed of the eventual consequences of the conservation activities. Economic, social and conservation activities all compete for the same natural resources and the integration of them in a sustainable manner demands practices that take account of all these aspects.

Natura 2000 sites as tools for conflict management

The Poprad Landscape Park, Poland: The Poprad Landscape Park is a proposed site in the Nature 2000 network, forming part of the basin area of the Poprad river (about 2100 km^2), which is a trans-border river with sources in the Slovak Republic. It represents an important refuge for large predators and native mammals. The region is used for a wide range of outdoor recreation including tourism, walking and skiing. In addition, several attractive spas (balneology) are located in this area, including Krynica, Muszyna, Piwniczna, Zegiestow. However, environmental quality, particularly of surface water, is low. The inflowing waters from the Slovak Republic are of poor quality, with a high content of phosphorus and sometimes of nitrogen. There is a need for joint efforts on the both sides of the Polish and Slovak border to stop and reverse unfavourable processes in land use and spatial planning. There is also a border crossing at Muszyna (road and rail) and the majority of people arrive by car, causing a great concentration of traffic on the roads and the parking areas. This is causing a high emission of noise that is in conflict with the Birds Directive. The solution for the problems mentioned above could be solved in connection with the designation of the Natura 2000 site.

Evolution of land use and conflicts in the Calimani NP (Romania): The Calimani NP in northern Romania (36 000 ha) was established in 2000. It is located in the high Carpathian mountain range (1500-2200 m) and has more than 18 forest ecosystem types and alpine pastures, and 4 water influenced habitats. The majority of the forest has been protected as a primeval forest since the 1970s for scientific purposes (about 15 endemic plant and animal species). Some other areas were declared in the 1980s as geological reserves, e.g. as volcanic karst. The local population used a substantial part of alpine pastures for extensive livestock management. After WW2, large areas of dwarf pine (*Pinus montana subsp. mugo*) were cut to transform them into pastures. About 350 ha of the mountain Negoiu Romanesc was disturbed by surface mining for sulphur. More than 46 mil. m^3 of rock was extracted and important changes in air and water chemistry occurred influencing ecosystem health. All these areas were included in the Calimani NP as disturbed areas needed ecological restoration. The Forest Research Institute – on the grounds of long-term experiments – supported technical restoration of damaged habitats. If in beginning of the 1990s the local population accepted limitation of grazing in the NP, but now (as result of poverty) the pressure has become more and more important. Fenced areas are destroyed and restored areas have been compromised. After the construction of new roads for different purposes (forest harvest, mining), new areas were subjected to impacts. The protection measures introduced to limit some long-standing activities (grazing management of pastures, tree cutting, burning the herbs etc.) have become unacceptable to the local population.

Emerald Network

Another new and creative way to work together on the conservation of biodiversity is the Pan-European Biological and Landscape Diversity Strategy (PEBLDS). This instrument, endorsed in Sofia (Bulgaria) in 1995 by the “Environment for Europe” Ministerial Conference has been set up as an original and effective cooperative effort among governments, international organisation, agencies, and NGOs. The Strategy seeks to conserve ecosystems, habitats, species, their genetic diversity, and landscapes of European importance through the development of the Pan-European Ecological Network (PEEN) within ten years. Natura 2000 and the Bern Convention Emerald initiative are currently the two main European instruments on which this network is based.

Even though the EU directives and the nature conservation conventions covering Europe provide a Pan-European legislative framework, they generally do not explicitly state how this framework should be implemented into national policies. In 1987, the CORINE classification system was introduced followed by the Palaearctic habitats classification in 1993. These two classifications led to the EUNIS (European Nature Information System) classification, which has become a standard tool to classify habitats within Europe.

To maintain coherence between the network of Areas of Special Conservation Interest (ASCI) under the Bern Conservation and the network of Special Areas of Conservation (SACs) under the Habitats Directive, the Standing Committee to the Conservation adopted Resolution No.3 (1996), in which it resolved to “set up a network (the Emerald Network), which would include the Areas of Special Conservation Interest designated following its Recommendation No. 16”. The idea for the establishment of the Network of ASCI, also known as the Emerald network, was brought up for the first time in June 1989.

The experience gathered under the CORINE project forms the basis for the core data fields of the Natura 2000 standard data form, amended and expanded in the framework of the EU Birds and Habitats Directives. The Emerald concept is Pan-European, open for specific details and using standard coding (e.g. EUNIS codes for species, Physisis codes for habitat types, CDDA codes for designation status). The Emerald Network of ASCI should be a complementary exercise to the Natura 2000 network, making the whole process Pan-European. In EU Candidate Countries, Emerald is a perfect tool to prepare for Natura 2000: data gathering and management at the national level, selection work, definition of sites, designation of boundaries, filling in Standard Data Forms, steering scientific work, and enhancing public participation.

Important Bird Areas

The European Important Bird Area Programme aims to identify, monitor and protect key sites for birds all over the continent through joint efforts of staff and volunteers at local, national and international level. The European IBA programme strives to ensure that the conservation value of the over 4,000 Important Bird Areas in Europe is maintained, and where possible enhanced. This is to be achieved through maintaining an up-to-date inventory of IBAs, monitoring their status and carrying out conservation actions on the ground and advocating policy changes at local, national and international level. The IBA Programme is co-ordinated by BirdLife International; the first inventory of IBAs was published in 1989 (Grimmitt and Jones 1989), and the second one in 2000 for all European countries (Heath and Evans 2000).

Important Plant Areas

Important Plant Areas (IPAs) are natural or semi-natural sites exhibiting exceptional botanical richness and/or supporting an outstanding assemblage of rare, threatened and/or endemic plant species and/or vegetation of high botanic value. The main aim of IPA identification is to contribute to Target 5 of the Global Strategy for Plant Conservation: "protection of 50% of the world's most important areas for plant diversity assured by 2010."

The IPA Programme is co-ordinated by Plantlife International. The programme for IPA inventories in seven Central and East European countries is currently running with support from the government of The Netherlands. It is planned to publish final list of IPAS for these countries in 2005. The next steps of the IPA programme are to:

- Identify IPAs in other countries and regions of Europe and the world;
- Ensure effective legal and practical protection for identified IPAs and encourage appropriate management;
- Ensure that IPA data and analyses are disseminated to decision makers and stakeholders.
- Identifying IPAs provides easily accessible information on the locations of, and threats to, the best sites for wild plants and their habitats.

6. Analytical methods (Towards scenarios)

6.1. Ecological modelling and spatial planning

Within the framework of BIOFORUM, ecosystem management and biodiversity conservation have to be placed in the context of spatial planning at different geographical scales, from minor habitats to broad landscapes. Within this context, ecological models can play an important role in analysing and understanding as well as predicting ecosystem changes, stability and vulnerability throughout time and across spatial scales. Ecological models for spatial planning are characterized by their ability to handle spatial and temporal dimensions.

According to Malczewski (2000), "One should emphasise that the purpose of any GIS-based decision analysis is to provide insights and understanding, rather than to prescribe a 'correct' solution". To put this into a BIOFORUM context, one could say that the purpose of GIS-analysis and ecological modelling within spatial planning is to provide information and insight, thereby supporting the spatial planning process, in order to manage and avoid conflicts between human activities and biodiversity. Modern GIS techniques allow an easy superposition of information layers about current and desired future land use and their relationships to landscape functions. A simple overlay analysis helps to identify areas of conflicts and of critical pressures as well as areas of good opportunities for increasing biodiversity and ecosystem health (figure 5). Combining GIS and ecological modelling enables us to include ecological knowledge into the GIS and requires some reflection about ecological modelling as a means to formalise ecological knowledge.

Perceiving ecosystems as real world phenomena means dealing with systems of almost unlimited complexity, which may be defined precisely only by a very large number of variables and still will leave some uncertainty due to their fuzziness. Knowing exactly what to expect from complex systems is a nontrivial challenge and models are essential to meeting this challenge and to help focus on main factors influencing ecosystem health and sustainability (Christensen et al. 1996). The term *model* in a very general understanding is rather diffuse and may be used for almost any kind of data structuring to produce information readily understandable. In this sense, models cover any type of analysis from simple diagrams that provide a means of organising data to show information or to express connections, up to development of complex computer simulations of systems and processes operating through time and across landscapes. However, it seems impossible to determine which complexity level of modelling would be the most appropriate and important regarding spatial planning. A simple visualisation of, for example, distribution of endangered species in combination with a land use map may be as informative to planners and stakeholders as the output of a heavy computational, individual-based computer model.

Relevance and reliability of a model may be the main issues to consider when choosing a modelling framework for spatial planning and political decisions. A decision about a model should take into account that the data used and the theoretical basis for the models ought to be challengeable in court.

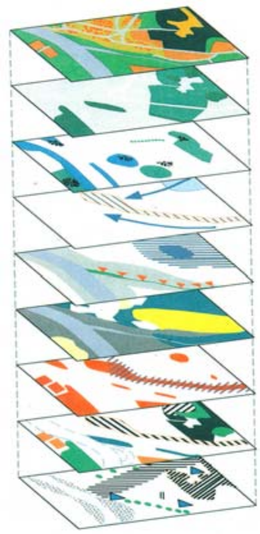

Figure 5. Integration of diverse human land use interests and their combined effects
(Source: K. Henle)

As mentioned earlier biodiversity changes are caused by a wide range of driving forces and pressures, both natural and those introduced by human activities. Monitoring programmes and research activities produce a rapidly increasing amount of data and knowledge, supported by fast development of computer technology, data collection devices, storage capacity and analysis capabilities. However, it is not possible to design monitoring programmes to measure the dynamics of every species and ecosystem process. Efforts to preserve biological diversity must focus increasingly at the ecosystem level because of the immense number of species, the majority of which are currently unknown. An ecosystem approach is also the only way to conserve processes, habitats or even whole landscapes (Franklin, 1993). Models can be used to assist the ecosystem approach by aggregating data and identifying indices or indicators describing a broad variety of ecosystem properties or highlighting particular sensitive ecosystem components. Finally, models can help in spatial planning by setting up development scenarios and deciding between different development options.

6.1.1. Ecosystem approach to modelling

According to Dale et al. (2000), “ecosystem management is the process of land-use decision making and land-management practice that takes into account the full suite of organisms and processes that characterise and comprise the ecosystem”. This includes sustainability of ecosystem structure and function and also spatial and temporal diversity and dynamics, where ecological sustainable systems should persist over time. It is important to keep in mind that a certain ecosystem may maintain or preserve itself in a sustainable state, while drawing upon external resources from other ecosystems. This could cause losses and deterioration in these other ecosystems and thus would not be seen as sustainable at a larger scale. Care must be taken when determining the boundaries of an ecosystem: whilst we might propose a solution to a degraded landscape for a restoration project, if another system has to donate resources (e.g. soil, water) then it is debatable as to whether we are presenting anything better than other planning strategies. In a policy context, the role of Spatial Decision Support Systems (SDSS) is to explore the trade-offs among conflicting objectives (Bazzani 2005). An important area under development is the application of SDSSs in ecosystem modelling. The following guidelines define what we should expect from ecological models and analysis supporting spatial planning.

1. Provide sound, comprehensible, spatial and non-spatial ecological information.

For any application, it is important to choose the right model with respect to available knowledge, resources and purpose. Model selection and type is always a trade off between the wish to represent the real world in its infinite complexity and to set up a working model within a limited amount of time and resources (Oxley et al., 2002). There is a choice to make between models used in research and those used in policy. Research models are designed to test hypothesis and to gain further understanding. With respect to spatial planning, they may contribute to further understanding of patterns and processes in landscapes. On the other hand, policy models are primarily aimed at supporting the solution of practical policy problems. Concrete political targets, data availability and finances often determine the modelling approach. In general, policy aims at simple and robust solutions, and models are used to help stakeholders to explore options for future development and possible effects of policies.

Table 4. Distinctive contrasting characteristics of models originally developed for scientific research or policy exploration and analysis (Source: Oxley 2004)

Research oriented	Policy oriented
Accurate representation of processes	Adequate representation of processes
Complexity and resolution reflect processes	Complexity and resolution reflect data
Accurate representation of spatial variability	Adequate representation (reflects existing data)
Scientifically innovative	Scientifically proven
Raises more questions than answers	Provides simple (?) and definitive (?) answers
Interesting and worthwhile in its own right	Interesting and worthwhile only through its output
Process centred	Input/output centred
Numbers validatable	Outcomes validatable
As complex as necessary	As simple as possible
Interfacing issues	
Model centred	Interface centred

2. Use reliable input data - garbage in, garbage out

An ecosystem approach requires modelling that attempts to present a way of sustaining or restoring a functioning ecosystem. This means that data capture and modelling may need to work outside of the area/system under immediate study. It also means that additional modelling data may be required with a wider application that focuses on land-use and land-management practices e.g. chemical, water, and nutrient cycles.

3. Link to geo-references sites or include spatial processes

Rather than the use of models that look at species or habitats in isolation, an ecosystem approach applied to spatial planning requires working with data that is derived from a range of disciplines (economic, cultural/social and environmental). This helps to ensure any innovative scenario suggested is more likely to be implemented into land-use and land-management practices that are equally compatible with human economic and cultural practices and values.

4. Handle temporal changes in ecosystems and processes

Time plays a very important role in ecosystem modelling, as these systems are usually dynamic and find themselves in a stable or labile equilibrium or in a state of transition. Old ecosystems many have reached climax and be rather stable in terms of species abundance and competition, nutrient state etc, even though processes going on inside the system and between different parts of a habitat or landscape region still are highly dynamic. Depending on the resilience of the system, shifting pressure or new impacts may bring the system into an unstable phase, seeking for a new equilibrium. Processes leading to a new stable or meta-stable state may include such time-consuming processes as species dispersal or they may be delayed by the systems buffering capacity for nutrient etc. Besides that, changing pressures and impacts themselves may have a temporal component.

5. Remember the models area of validity

Most models have a limited range of applications and should not be applied outside their area of validity. The problem for using the set of reliable input data has already been discussed. Other important aspects to mention are that models have usually been set up and validated for certain types of ecosystems only. Models like K-LIS and the Biotope Model, assigning vegetation types in semi natural grasslands according to physical geographical settings and agricultural land use, may not be used for assessing vegetation on set aside land, as secondary succession is not part of the model. Transferring this model to another bio-geographical region requires at least some updating with local vegetation types and their ecological settings.

As an example, the LANDIS models of forest and landscape disturbance and succession, originally developed within the US northern Great Lake region, has been spread far beyond this region to many places in Northern America, Europe and China (Mladenoff 2004) by adding ecological knowledge and/or impacts important for these other regions.

6. Choose appropriate complexity, spatial resolution and temporal scale
Simple models may be useful to answer simple questions in a satisfying way. More complex models may be able to provide better answers, but at the same time their dependence on reliable knowledge about processes and input data will increase. This makes complex models harder to control and validate and their soundness does not necessarily increase, as uncertainty increases with complexity and requires more skilful approaches to validation (e.g. Wiegand et al. 2004).

There are two main types of models used for ecological modelling (Venterink and Wassen 1997). The first group is classified as 'expert-knowledge based models'. Such models typically produce a ranking of plant communities derived from association of vegetation with homogeneous landscape units. The ranking lists are on ordinal scales and are mainly compiled from expert knowledge rather than statistical analysis of empirical data. The other group of models is characterised as empirical-statistically founded 'regression models'. In this type of models the ecological site requirements of plant communities are described as a function of – continuous – habitat variables. Model output typically gives percentages of plant communities, computed according to landscape unit characteristics. Venterink and Wassen (1997) concluded that such empirical-statistical models, due to their dependence on empirical data, usually are valid only for restricted, intensively studied areas (Münier et al. 2001).

7. Include or link to analysis regarding driving forces, pressures and responses

Spatial planning is one of the societies responses on loss of biodiversity, areas for recreation or against environmental pollution. As spatial planning set a framework and encourages human activities, it influences individuals and sectors activities in space and time. It's the question of what to do where and how, and ecological modelling in this context must take into account the driving forces and pressures triggered by people, together with natural processes themselves (figure 6). This may be obtaining by either generation impacts on the ecosystem as input to the model, or by using an integrated modelling approach bridging societal, physical and ecological models.

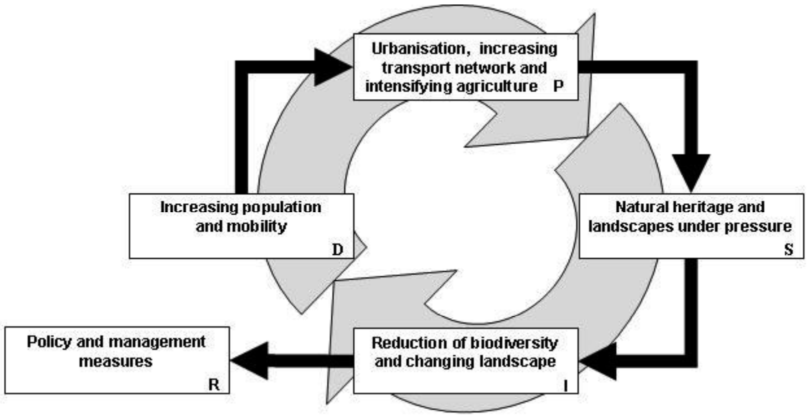

Figure 6. Example of the DSPIR framework used to indicate the relationship between spatial pressures and policy measures
(Source: Ben Delbaere (2004), in ESPON Project 1.3.2: Territorial Trends of the Management of the Natural Heritage.)

<u>8. Use ecological modelling for ex ante (forecasting & scenario analysis) and ex post assessments (monitoring and evaluation)</u>

There are applications of models in spatial planning that work towards resolving land use management conflicts. However, it is not clear to what extent the modelling systems' outputs actually influence political decisions. Whilst the benefits of informing a range of stakeholders has merit in its own right, what is required is a measure of whether this will bring about real change in the way the natural resources are managed. The modelling tools need monitoring as to the number of project applications or management changes the tools are applied to, but more importantly about whether the modelling has brought about real benefits to society.

6.2. Data

6.2.1. Data fit for purpose

Modelling tools are dependent on geographically referenced data. The development of these data is both costly and time consuming and many of the systems developed have had to use data from other sources. This has meant that the primary purpose of the data captured can influence or indeed compromise subsequent applications of a model that had never been considered when the data were originally collected. This can relate to:

- Scale of capture and scale of interpretation,
- Accurate within one [application] but not in another
- Data 'shelf life' e.g. how long is data accurate for
- Degree of confidence in data
- Reliability of data (existence of meta-data/knowledge about how data have been collected and processed)

As long as sufficient consideration is given to the data and any limitations understood then the use of other data sources within another application is acceptable, but caution is required.

6.2.2. Data confidentiality

The use of modelling scenarios to resolve a conflict presumes that the data will be accessible to a wider audience. This raises the question of confidentiality. If one is using data gathered for one purpose in another application then legislative protection of personal identifiable data may cause difficulties. Another concern is allowing access to data on protected endangered species that could compromise the safety or protection of the species. This issue can create difficulties for publicly funded data, given that some public bodies may have an obligation to make data available to the public. Data can also have a commercial value that restricts its uses in secondary applications of a model. Licensing conditions need to be resolved prior to the development of other applications. Data that have been collected by researchers is often, due to research procedures, ‘kept secret’ until they have been published – leading to limited access to the data, if any.

6.2.3. Interpretation and presentation of data

The most important factor in the presentation of the data is how they will be interpreted and applied by the audience. If they are used to assist with decision-making at a local land management level for example, then each application of a model will require a different visual output. This could be a matter of scale, complexity, and accessibility or a need to present supporting documents or images to reinforce the message.

Clearly the data in raw coding is of limited value but the ability to present the data in the most appropriate way to inform, enthuse, or offer choices to a viewer is one of the most valuable contributions that the modelling systems can make. The geographically referenced data can be presented not just as a map, but as a way of interacting with the intended public. There are limitations as to how “real” the models can be in representing the landscape but a number of solutions have been developed. This ranges from complex manipulations that present a 3D visualisation of a virtual world to “draping” map-based data over terrain data that adds a simple alternative to two-dimensional images. There are models that have developed future landscape scenarios that require less precision in the image produced, but are still generated from a range of complex data sources.

The ability to present a “changed” landscape is a powerful tool in relation to new wetlands or woodlands and can help engage with a range of stakeholders. The subtlety of a changed pastoral landscape from intensive to extensive management can, however, present an audience with nothing more than a different shade of green! Additional supporting imagery can help bridge the gap between standard map-based views and the more complex technology required for 3D images. This could be a combination of photographs including important habitats or key species and aerial views of similar landscapes elsewhere. This approach could also show the human interaction within the new landscape, for example educational activities within a proposed local nature reserve.

6.3. Conclusion

The use of spatial data tools to analyse complex information and increase understanding amongst a range of users can make a significant contribution to reducing land use conflicts. The high dependency on potentially costly data will however reduce the opportunity for 'off the shelf ' solutions as the area under scrutiny may have limited data available requiring the use of data captured for other purposes with the inherent limitations or the investment of time and resources to generate new data. The number of available approaches to spatial modelling present two facets 1) that there are a number of approaches to help resolve the diversity of conflicts and 2) it is difficult to determine which, if any, existing approaches will present the answers sought. There is no doubt that the continuing development and refinement of the analytical tools can make a significant contribution to spatial planning and the resolving of conflicts.

7. Stakeholder involvement

Stakeholder participation in decision-making puts into practice several Ecosystem Approach principles:

- Principles 1 and 2 state that ‘the objectives of management are a matter of societal choice’ and ‘management should be decentralised to the lowest appropriate level’, and
- Principles 11 and 12 state that ‘decision making should consider all forms of knowledge’ and ‘involve all relevant sectors of society’.

The BIOFORUM e-conference on the Ecosystem Approach concluded with 10 points (see Table 1B) based on extensive stakeholder involvement and incorporating a code of conduct. This chapter outlines the benefits of such inclusion and explores a more positive role for scientists and environmental managers in managing conflicts that almost inevitably emerge through spatial planning processes and act as a trigger. Conflict management is further explored in a separate BIOFORUM report.

7.1. Who are stakeholders?

Stakeholders are the people who have a stake in the decisions being made or plans being prepared – either because they will be affected by the outcome or because they have an interest in the issues. The word ‘stakeholder’ is not just used to describe local people. If environmental decisions are at a strategic level (international, national or regional) the stakeholders will be at the strategic level too.

At the strategic level, stakeholders are more likely to include public, private, and voluntary sector professionals along with research and academic experts. At a local level, stakeholders will include many of these sectors along with community groups, land managers, site users and other local people. In spatial planning, this will also be affected by the stage the plan has reached.

In spatial planning, as with other environmental decisions, different stakeholders can be involved in the process in different ways at different stages. This is all part of planning a good participation process that is inclusive but does not waste stakeholders’ time.

Involving stakeholders should always be done in a principled and thoughtful way when they have a genuine opportunity to shape outcomes and thus their involvement will make a real difference.

7.2. Why involve stakeholders?

Environmental reasons

Ecosystems are complex systems and yet efforts to understand the environment have led to a reductionist approach with ever increasing specialism and fragmentation of knowledge. Whilst specialism may help with developing detailed knowledge about certain aspects, it does not help with understanding the system as a whole – and even less with making decisions about how to manage it through the planning process.

The only way this can be achieved is to bring environmental specialists together with other stakeholders to share knowledge and work at trying to understand the whole system. This includes understanding the socio-economic and cultural aspects of the system that have been set to one side in past efforts to manage the environment. By integrating knowledge in this way it is possible to minimise unforeseen consequences, address real rather than assumed problems and develop plans that have wide acceptance.

The idea that stakeholder participation is vital for the management of the natural environment is gaining increased recognition. An example of this is in Eurosite's Guidance for land managers, which advocates stakeholder involvement in the development of management plans for protected areas and Natura 2000 sites [8].

Social Reasons

Social capital is vital if we want a sustainable future because it results in co-operation and collective action. Pretty and Ward (2001) argue that social capital should be seen as one of five key assets essential for sustainable living alongside the other forms of 'capital': natural, physical, financial, and human. They define social capital as the sum of connectedness, trust and goodwill between people that has four elements:

[8] http://www.eurosite.org/IMG/pdf/newguidance_en.pdf

- Relations of trust
- Reciprocity and exchanges
- Common rules, norms and sanctions
- Connectedness, networks and groups.

Building social capital takes time. Well-run stakeholder participation helps form social capital more quickly and enables stakeholders to co-operate in finding mutually acceptable solutions, including through spatial planning.

Ethical reasons

There is increasing belief that in fair and equitable societies people should be able to 'have a say' in the decisions that shape their lives and the future of their children and grandchildren. The factors that affect the quality and sustainability of life are numerous and not just confined to the quality of the environment. But a well-managed environment underpins cultural and economic well being, and so engaging people in decisions about how and where human uses should take place is as an important step towards increased social choice.

An objective of the CBD is the 'fair and equitable sharing of benefits'. There is now a growing body of research on 'social and environmental justice' which is confirming that socio-economically deprived groups tend to be concentrated in areas with the worst environmental conditions, and are least protected from environmental risks (Lucas et al. 2004). Empowering people and giving them a genuine say in helping to shape the future through spatial planning will go a long way to overcome this inequity.

In some countries participation is being seen as an essential part of reviving democracy in the 21st Century. This is particularly the case in countries where citizens are disaffected and disillusioned with elective democracy. A shift to participative democracy is seen as the answer. This is the case in the UK where the government is undertaking a major programme of reform for the development planning system to strengthen community and stakeholder participation in spatial planning. Under these reforms the first responsibility for Local Authorities will be to prepare 'Statements of community Involvement', and the next will be to put this into practice.

Policy reasons

There are now many European and International commitments that promote or require stakeholder participation in environmental decisions. The list includes:

- The *Aarhus Convention*, that grants the public the right to participate in environmental decisions, to have access to environmental information and access to legal redress on environmental matters,
- *CBD* agreements, which urge parties to '…foster stakeholder participation in biodiversity conservation and sustainable use',
- *Ramsar Convention* objectives, which include the principle of 'participatory multi-stakeholder wetland management',
- The *El Teide Declaration*, that promotes communication and participation at the local level in the implementation of Natura 2000.

Benefits

The main approach to environmental decisions has been to 'decide, announce, and defend'. This is when power holders and experts make the decisions, announce what they have decided, and then put the main effort into persuading others to go along with their proposal. This has the effect of dis-empowering other stakeholders and can lead to mistrust. Other stakeholders have only a limited opportunity to influence what is planned and are usually only consulted when most of the decisions have been made and written in a draft plan. Implementation can be an uphill struggle, especially if some interests or sectors feel their views have not been taken into account. Increasingly, when people feel that decisions are being imposed on them, they withhold crucial information and resist implementation.

The alternative is to take a collaborative approach involving stakeholders in a well-planned and skilfully implemented participation process. This means engaging stakeholders at an early stage when options are open and they have a genuine opportunity to influence the outcome. Everyone shares knowledge and insights. Possible actions and ideas are explored before decisions are firmed up and committed to paper. Using the knowledge, views and ideas of a wider group builds social capital, enriches the discussion and leads to better informed, better understood, and better supported outcomes.

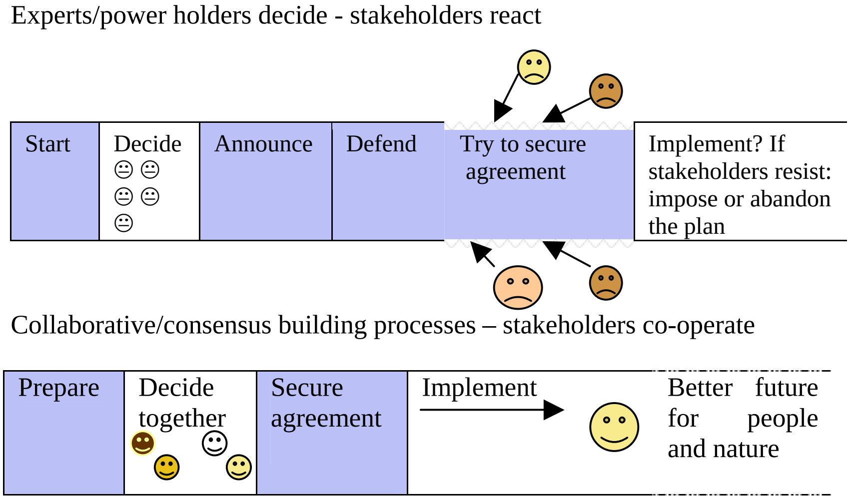

Figure 7. Stakeholder involvement
(Source: Diana Pound 2004 Adapted from InterAct Networks training material 2003)

7.3. How to involve non-science stakeholders with environmental specialists and scientific knowledge

In the past there has been a belief in the impartiality of science, but it is increasingly acknowledged that science is based on framing assumptions that influence the results (Stirling 1999). Whether or not it is regarded as impartial, science can only ever offer probabilities and uncertainties. Science cannot make decisions about what to do. For this, society has to make judgements about acceptable risk through debate and deliberation.

Baruch Fischoff (1995) describes the growing realisation amongst scientists that numbers are not the final authority:

- All we have to do is get the numbers right.
- All we have to do is tell them the numbers.
- All we have to do is explain what we mean by the numbers.
- All we have to do is show them that they have accepted similar risks in the past.

- All we have to do is show them that it is a good deal for them.
- All we have to do is treat them nice.
- All we have to do is make them partners!

Even with this realisation, environmental scientists express doubts that other stakeholders can make a useful contribution to questions of environmental management. Such decisions require a grasp of complex processes, modelling and scientific information. However, there is now a body of action research (Petts et al. 2003; Burgess et al. 2004) that convincingly demonstrates that non-scientists can readily grapple with very complex science, and make intelligent contributions to the debate, provided that the science is presented and explained well. This means that scientists have to use plain language and diagrams and models to explain what they are talking about. Careful design of decision-making processes and good facilitation are key to enabling non-scientists to grapple with the complexities of ecosystem management and spatial planning. Exclusion from the debate is not the answer.

Omitting people who will be affected by a technical or scientific solution can lead to costly mistakes. An example of where scientists thought they had an excellent solution is the GMO (Genetically Modified Organisms) debacle. Monsanto lost many millions because they failed to explore their ideas with other stakeholders and so did not take into account the values, concerns, and willingness to accept risk, of food consumers or those concerned about biodiversity.

In any case non-scientists are also able to bring to the discussion other forms of knowledge that are crucial for effective decision-making. Local stakeholders, particularly farmers, fisherman and foresters, have in-depth knowledge of their local environment and how it works. Just because this is not quantified and presented in scientific ways does not mean it should be ignored. It is still valid knowledge that can help shape future management.

When entering into a dialogue with other parties, each person comes with their own knowledge base and their own view of reality. For example, nature conservationists frame reality through science, tend not to consider the value judgements that have been used to develop that science, and find it hard to understand how others cannot accept this ‘reality’. However, people from other sectors, or the local community, frame reality differently and use different forms of evidence and knowledge to shape their understanding.

Part of a well-run stakeholder process is to develop a shared understanding of reality so that decisions are well informed from all perspectives. Of course, not all of each sector's knowledge will be used, and not all will be accepted, but by working to share knowledge and find agreement more sustainable outcomes will result.

Figure 8 illustrates how each party considers its own knowledge to be the most important.

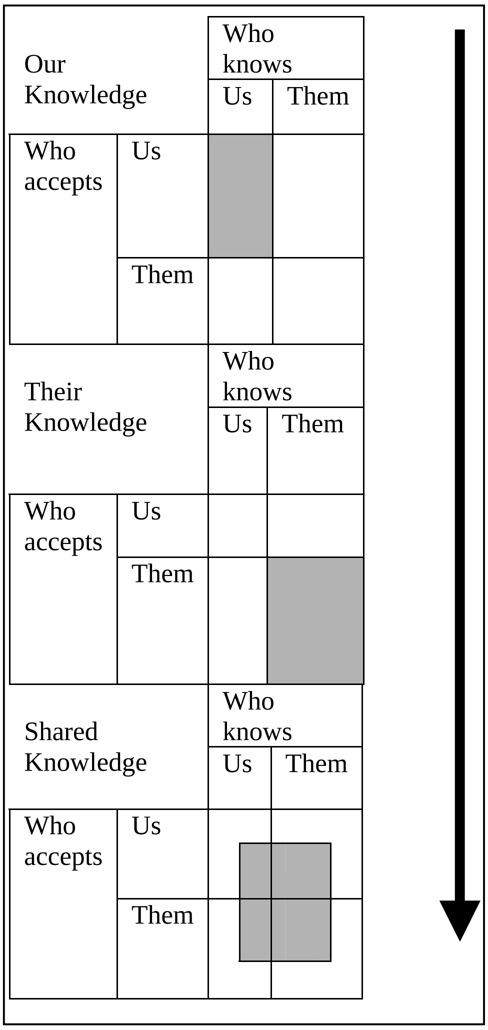

Figure 8. Stakeholder knowledge
(Source: Pound 2004)

7.4. Exploring options and consequences of choices.

A well run stakeholder process will be deliberately planned and include times for information to be gathered and options to be explored. There should be phases for a thorough exploration of proposed actions to ensure that they are acceptable to a broad range of people and interests – including technical experts and regulators.

Another key part of a good process is to expose information gaps and help stakeholders agree how they will manage uncertainty. Options about how to handle uncertainty depend upon balancing the cost of reducing the uncertainty and the importance of doing so. The following model is helpful:

Table 5. Managing uncertainty

		Ease of reducing uncertainty:	
		Difficult to get information	Easy to get information
How important the information is for the decision:	Important	If there is time before the decision must be made, and costs are affordable, put effort into finding information to reduce uncertainty Or make an assumption with a contingency plan	Get the information to reduce the uncertainty
	Less important	Ignore it	Free choice – depends on resources

7.5. Managing conflict

Over the last ten years, stakeholder participation and conflict management has developed as a field of research and expertise in its own right. This includes a focus on developing good practice. It is now clear that managing conflict requires careful preparation to understand the situation, identify all key stakeholders and evaluate existing or likely tension. Having done this, a trained person can design a process that deliberately encourages people to build consensus and focus on common ground (not difference). It should help people to work up from small areas of agreement towards developing trust and finding mutually acceptable solutions.

Conflict is immediately reduced when stakeholders feel:

- They have been involved at an early stage when options are open
- They have a genuine opportunity to influence the outcome
- Their knowledge and insights are respected
- They feel listened too

At a recent IUCN workshop of experts (Managing Change in Conservation and Sustainable Development) people agreed that one of the biggest problems to achieving good ecosystem management was the attitude and actions of environmental professionals. For effective management to take place a shift in attitude towards other stakeholders is needed (see Table 5).

Table 6. Change in attitude of environmental managers

From:	To:
Focus on scientific and technical knowledge	Many forms of knowledge are needed and used
Seeing other stakeholders as the problem	Realising we are all part of the problem
Seeing other stakeholders as a distraction and drain on resources	Realising they are a resource – of information, ideas and endeavour
Telling others what to do	Listening with an open mind
Pushing others to change	Working with others to agree change
Behaving as experts	Behaving as partners
Formal approaches	Informal and interactive approaches
Our ideas and solutions	The best most workable ideas and solutions

(Source: Diana Pound 2004. Adapted from Conservation Results by Managing Change. The role of Communication, Education and Public Awareness. IUCN)

There also needs to be a shift in understanding about how the way decisions are made affects the outcome. A poor decision making process which alienates stakeholders will get poor results however good the quality of scientific information and expert advice. The IUCN workshop concluded that real progress would only be made when environmental managers understand good practice in communication, principled negotiation (the desire to find win/win solutions and mutual benefit) and participation, and when capacity has been built to establish good skills and deliver good practice.

7.6. Scientists as experts and stakeholders

Few environmental scientists are pure scientists - merely gathering data and information and not caring how it is used. Most want ecosystems to be managed in a genuinely sustainable way so that the structure and function is maintained and managed within the limits of the systems resilience. This concern turns scientists and other technical experts into stakeholders. They are not impartial but have a stake in the outcome and want to influence what happens.

Provided the process is well run this is not a problem. Environmental managers and scientists may need to change their perspective towards other stakeholders, as discussed above, but they can participate on the same basis as other stakeholders who bring other kinds of knowledge about what will work.

7.7. Conclusion

Stakeholder participation is vital for the management of ecosystems and the development of spatial plans. Well-designed and well-run stakeholder participation processes can:

- Handle complexity
- Integrate science
- Harness other forms of knowledge and know-how
- Handle uncertainty
- Build understanding
- Integrate agendas
- Be used to plan for the long-term
- Build momentum and support for delivery of crucial actions

A key part of spatial planning and the ecosystem approach will be to build good understanding amongst environmental professionals about the crucial role of participation. It will also be necessary to build the capacity needed to run effective, interactive participation processes with all sides entering into a genuine dialogue to understand each other's perspectives and find an acceptable way forward.

8. Future research needs

8.1. Introduction

The preceding chapters have indicated why it is necessary to incorporate the Ecosystem Approach (see Table 1B, chapter 3.4) into the spatial planning process. They have also provided guidelines as to how this can be achieved. This report and other outputs from the BIOFORUM project have stressed that there is no barrier to implementing this approach across Europe, and indeed have highlighted that this can and should be done as soon as possible.

It is clear that there is a need for better links between natural and social sciences. The implementation of the ecosystem approach into the spatial planning process will therefore act as a focus to bring people together to consider the issues involved in a truly interdisciplinary way. It is also equally clear that further research needs will be identified as the amount of truly interdisciplinary research focussed on this issue increases in the future. The purpose of this chapter is therefore to highlight some areas where it is currently recognised that additional information will be necessary in order to refine and enhance the effectiveness of the approach in the future.

It must be stressed that the outputs from such research are not required before the ecosystem approach can be incorporated into the spatial planning process. It is also important that the reader recognises that the items chosen for highlighting in this chapter are not intended to be definitive but rather to reflect selected priorities seen within the BIOFORUM network and identified by other European documents.

To this end, the contents of this chapter draw heavily on the research needs that have been identified in the previous chapters dealing specifically with the ecosystem approach. The section dealing with each research issue contains a brief rationale of why the issue is considered to be important and ends with a list of research questions that needs to be addressed.

8.2. EPBRS research recommendations

We support the recommendations highlighted by the working group of European Platform for Biodiversity Research Strategy (Lesvos, Greece 2003), which places high priority on research to provide scientific support to the implementation of the ecosystem approach:

- Develop case studies that apply the ecosystem approach in different situations and different scales, evaluate its effectiveness in comparison to other approaches and propose improvements to the ecosystem approach;
- Improve understanding of ecosystem structure and functioning, including increased knowledge of the component species and their role in the ecosystem;
- Be able to detect, when ecosystems are approaching the limits of their natural functioning or productive capacity;
- Develop integrated monitoring programmes for biodiversity and other ecosystem components to assess effects of management practices.

8.3. Ecological proofing of European policies and directives

The need for additional understanding on spatial planning and ecosystem functioning across member / accession states is discussed in the case studies presented in Chapter 5 of this report, which explores, *inter alia*, how conflicts have arisen within the implementation of European policies and directives. It is therefore recommended that the principles of ecosystem functioning and the national implementation of European policies and directives require further study. The question arises as to how member states implement European policies and directives with respect to the ecosystem functioning principles. This research will contribute to the ecological proofing of current and developing European policy:

- Integration of different policies, programmes and legislative instruments in terms of their spatial impact, and dealing with any eventual contradictions in their spatial effects;
- Set up research protocol to ensure that biodiversity / spatial planning research results are communicated to the target group involved in design and implementation of policies, programmes and legislative instruments.

8.4. Relationship between biodiversity and socio-economics

To address the interaction between human activities and biodiversity change in addition to biological sciences we require also a range of social sciences: psychology, sociology, political science, anthropology and economics. They are all important components of the socio-economic dimension to biodiversity. Socio-economic dimension includes an understanding of the different ways in which people value biodiversity and the present limitations on how markets and institutions recognise biodiversity values. These values extend along a spectrum; from the value of biological resources in direct consumption, through the value of biodiversity in supporting ecosystem functioning and processes, to the cultural, spiritual and aesthetic values people place on different species, communities or habitats in different regions and/or countries.

The links between socio-economics and biodiversity change and ecosystem functioning are real and clear to us for the following reasons (Perrings & Ferris 2004):

- There is compelling evidence that biodiversity change affects the rate of ecosystem processes that underpin the production of goods and services;
- The ultimate driver of biodiversity change is human behaviour, and biodiversity change is thus social, economic and political in origin;
- There are direct and strong feedbacks between human behaviour and changes in the production of goods and services, and these interactions impinge on biodiversity.

There are three main sources of uncertainty about the causes and consequences of biodiversity change:

- Uncertainty about the evolution of the main drivers of biodiversity change: climate and the global economic system;
- Uncertainty about the dynamic effects of biodiversity change on ecosystem functioning and processes;
- Uncertainty about the impact of changes in ecosystem functioning and processes on economic activities.

We support the recommendations made by the UK Biodiversity Research Advisory Group, who have highlighted that socio-economic research is needed to deepen our understanding of the following problems (Perrings & Ferris 2004):

- Test the role of biodiversity in sustainable development
- Test the cost of effectiveness/efficiency of existing conservation efforts, and the incentives to conserve biodiversity offered by existing markets and institutions
- Understand the relationship between biodiversity change and the production of ecosystem goods and services
- Develop the socio-economic dimensions of an ecosystem approach
- Improve techniques for valuing the ecological effects of biodiversity change
- Understand people's perceptions of the value of biodiversity
- Improve application of existing decision methods
- Develop decision-methods to deal with fundamental uncertainty, irreversibility and threshold effects
- Understand the consequences for the movement of species of changes in regional and global trading systems, and its impact on biodiversity and ecosystem functioning
- Understand the spatial dimension of interactions between human activities and ecosystem change
- Identify the social rate of return on environmental investments
- Develop natural resource accounts (direct and indirect) for biodiversity as a portfolio of natural assets so as to assure the resilience of ecosystems.

8.5. Integrating consideration of habitats, species and ecosystems at the landscape scale

To-date, a lot of research has considered individual habitats and ecosystems in isolation from each other. Where the existence of other habitats or features has been considered, it is generally only in relation to proximity to or broad influence upon the habitat/ecosystem forming the primary target of the research. However, to implement the ecosystem approach effectively into spatial planning, there is a need to consider landscapes as an integrated whole.

In addition, it is not just simple spatial location in the landscape that determines whether any habitat or feature will be utilised to its full extent and achieve its biodiversity potential. The size and shape of that habitat/feature will influence the conditions occurring within that habitat/feature and thereby influence the range of organisms that can occur within it. Furthermore, the composition of the landscape, especially habitat heterogeneity, can play an important but little understood role for biodiversity. There has been some focus on these aspects in woodland/forestry situations (e.g. directed at increasing edge effects).

Although some species may be very habitat specific, others can and do exist across a range of different habitats and these aspects need to be taken into account more in the spatial planning process (i.e. what species can continue to exist even if an apparently primary habitat disappears and, just as importantly, what species can only survive if a key component is present). Species diversity in many organism groups is poorly known, but their biology is even less known.

- More research is required into the links and inter-relationships between the different components of the landscape, in particular:
    - What contribution does each individual habitat and ecosystem make to the overall biodiversity value of the landscape under consideration?
    - How much similarity in species occurrences exists between these different components in the landscape?
    - Which components provide a unique contribution to the overall biodiversity value of that landscape?
    - How strongly do species depend on the presence of different components in the landscape?
    - How strongly do different habitats within a landscape interact with each other regarding ecosystem functioning?
- More knowledge is needed regarding the effective shape, size, distribution, and interconnection of habitats to preserve biodiversity.
- How are species connected to each other in different ecosystems (not only trophic connections)?
- What are human and natural drivers of changes in landscape structure and land use systems in spatial and temporal terms (ex: TransEuropeanNetwork).
- What models (tools) can be used to make spatial planning more dynamic?

8.6. Integrating landscape history into the ecosystem approach

The importance of time in the study of ecosystems is recognised in the related disciplines of historical ecology (the role humans have played in forming and modifying the environment) and landscape history (the material and cultural evaluation of human use of the land). Such studies bring together social and natural scientists, provide lessons to current problems, and can guide spatial planning principles.

The process of time and human influence on the development of landscapes, and its relation to spatial planning, can be pictured as below:

[1] Natural factors (geology, soils, landform, climate)
↓
[2] Natural land cover/vegetation
↓
[3] Human cultural processes (agriculture, settlement, industry)
↓
[4] Modified land cover (landscape and biodiversity elements)
↑
[5] Spatial planning choices (retain and restore, manage, (re)create)

Only where human uses do not intervene in ecological processes will [2] survive to reach [4] in the form of a truly 'wilderness' ecosystem. Over large areas, however, [3] has been a determining factor in the evolution of ecosystems. Spatial planning can use knowledge of this process and of the important ecological elements to retain in landscapes (see 8.8) to make choices at [5], within the limits of [1]. Because future trajectories of landscapes show a memory of past and present human and natural features, there is a need to research past and current variability of natural features.

Research is needed to understand how human cultural processes have modified natural land cover/vegetation and which important elements of natural land cover/vegetation remain in modified land cover, and how this impacts on ecosystem functioning of modified landscapes.

8.7. The effectiveness and relevance of the agri-environment approach

Over the past 15-20 years, agri-environment measures have been the main mechanism used to try to redress biodiversity declines on agricultural land. There has therefore been much attention devoted to using such schemes to maintain, enhance and recreate habitats of biodiversity value associated with agricultural land throughout Europe. However, usually there are few resources directed to monitoring whether or not such measures are achieving their aim or whether there is likely to be a threshold that the overall area of each new habitat created must get above before that habitat is of any real value. Hence a number of issues need to be addressed with regard to the agri-environment approach:

- Have such measures been successful in achieving their biodiversity objectives?
- What aspects of biodiversity value can be monitored rapidly in such habitats in order to allow a rapid and cost-effective assessment of whether the goals are being achieved?
- Has sufficient attention been given to where such measures should best be located in the landscape in order to maximise their chances of success in enhancing biodiversity?
- How can the measures which are in place on one farm be used to complement and enhance what may be targeted on surrounding farms?
- What amount of any one habitat type needs to be established within an area in order to actually be attractive and serve as a viable resource for the species at which they are targeted?
- Does the cost of placing sufficient amount of that habitat in the landscape reflect the biodiversity benefit of taking that approach?

It is also essential to bear in mind that most agri-environment measures have been designed for implementation at a relatively small-scale on remnant habitats (e.g. field margins, hedgerows, ditches, ponds) within the more intensive agricultural landscapes. However, over much of southern Europe and in many of the new Member States, the habitats and ecosystems still exist at much larger scales, especially in the less intensively managed agricultural landscapes.

Issues of particular importance include:

- What lessons can the Member States in Southern and Eastern Europe learn from the experience of those in Western and Northern Europe (where a greater emphasis has been placed on agri-environment measures per se)?
- What lessons can the New Member States, and the Candidate States in the process of joining the EU, learn from other states that joined the EU earlier about the transitions agricultural landscapes have made?
- How can traditional biodiversity-rich agricultural landscapes be maintained under changed socio-economic demands and agricultural techniques?
- Are such measures relevant for all habitats and ecosystems across Europe?
- Are there different approaches that may be more effective at achieving the biodiversity goals in such areas?
- Should social objectives be given greater emphasis in the development of such approaches?

8.8. Research on the integration of landscape history – case study: lowland UK

8.8.1. Important ecological elements to retain in landscapes

A number of surviving ecological elements that are important to retain in landscapes can be identified. In lowland UK, these may derive from more or less original land cover such as woodland or be the product of human land uses such as field systems and parkland (see Table 6 for examples). Human modification of these elements may in turn create variations on the original theme such as wood pasture. Particular features may be associated with them, such as ditches, banks and verges.

Table 7. Ecological elements derived from land use

	Variations				Associated features
Ecological elements	Woodland	Coppice	Wood pasture Wooded forests	Boundary banks and ditches	Individual trees
	Plantations	Shelterbelts	Windbreaks		
	Boundaries	Assorted fields	Hedges, walls and banks	Parish boundaries	Individual trees
	Open water	Managed lakes and ponds	Mill ponds	Fish ponds	Water supply / exit
	Watercourse	Managed rivers and streams	Ditches	Canals	Banks
	Water bodies	Meres and other natural water bodies	Marl and clay pits	Dewponds	Dams
	Grassland	Pasture	Meadows	Water meadows	Lynchets
	Field systems	Open and enclosed field systems	Ridge and furrow	Commons and heaths	Hedges and banks
	Parkland	Deer parks	Parkland trees		Banks and ditches
	Settlements	Moated farmsteads	Reclaimed land		Earthworks
	Route ways	Tracks and green lanes	Railways and canals	Turnpikes and motorways	Banks and verges
	Extraction sites	Flint mines	Quarries	Chalk pits	
	Amenity land	Golf courses	Country parks	Military training land	
	Agricultural land	Arable and crops	Intensive grassland	Fruit and orchards	

Generally, the closer the ecological element, variation or feature to any original land cover, the more it is held that it should be retained in modern landscapes. Such is the overlay of human processes, however, that even highly modified systems such as lowland permanent pasture are highly prized in both cultural and ecological terms. Also, whole landscapes may be made up of several such elements, interdependent and creating a unity which is itself to be valued. Nor is the situation static, as ecological elements may go through periods of change and reversion, moving from one state to another over time, as pictured below in figure 9.

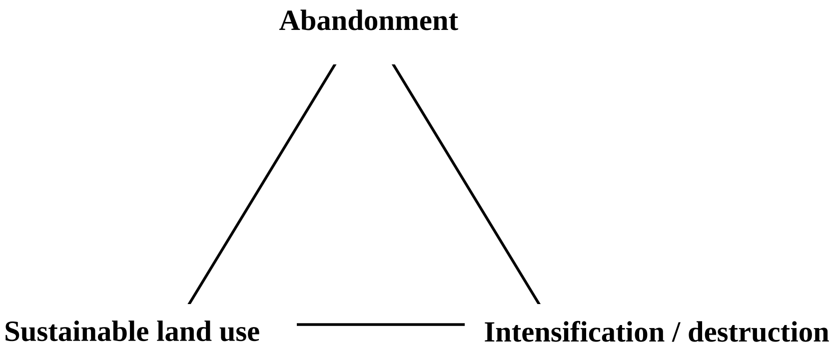

Figure 9. Change in the state of land use

8.8.2. History of management of different parcels

The management of different ecological elements over time and their evolution to their present status is a subject for research in several source areas. These can be broadly divided into documentary, pictorial (map and photo), visual, and oral.

Documentary
In lowland UK, sources of documentary material relating to the history and management of parcels, farms, estates and administrative units indicating presence of ecological elements may be found in among others:

- County archives
- Biological records centres
- County floras and faunas
- Farm and estate records

- Deeds and transfers
- Histories and topographical records
- Surveys, e.g. Domesday 1086, Statistical Accounts for Scotland 1791-99.

Pictorial

- Map sources for lowland UK are various and include:
- Estate maps
- Ordnance Survey maps
- Enclosure maps
- Tithe maps
- Land Use Survey maps.
- Photograph sources can be found among other documentary evidence, or may exist independently such as from large-scale aerial photography. Fixed-point photography is especially useful for showing change over time.

Visual

Ground survey of parcels and management units may reveal evidence of past status or land use. For example, an apparently plantation woodland may have ground flora species indicating an ancient woodland site. Seemingly undisturbed down-land grassland may show features such as fruit trees indicating past use as an orchard. Other 'visual' information may be had from parcels by such means as ring counting from fallen trees, or pollen diagrams from pond or lake sediments.

Oral

Oral accounts from past owners and managers of, and visitors to, land units are useful to historical ecology in detailing previous land uses and changes within human memory. Such accounts can include descriptions, details of management practices and also place and parcel (field) names. While place names may be found on some maps, this is not always the case for field names, yet these may persist in oral history and give clues to origins (Broad Down, Meadow Field).

The combination of a number of research sources will give the best time depth to a spatial planning process. The increasing scope and sophistication of geographical information systems is allowing data from different sources to be combined, so that for example physical data such as soils and habitat types can be overlaid with, for example, Tithe Map or air photo information.

8.8.3. Conclusions on integration of landscape history

Time depth is important to the spatial planning process, as the present status of landscapes and ecosystems may be greatly modified by past human activity. In seeking solutions, mistakes of inappropriate past land uses can be avoided, or choices made to return areas to land uses thought more culturally appropriate or with higher biodiversity value. Surviving ecological elements in a region such as lowland UK are many and varied, and assemblages of historic landscape elements can be the most prized. There is no shortage of source information for time depth, and it is becoming increasingly integrated and useable.

8.9. Conclusion on research needs for the ecosystem approach applied to spatial planning

When considering biodiversity research in an applied sense, ‘biodiversity’ has to be understood from the perspective of nature conservation and habitat management.

The critical question is how – in a spatially compartmentalized world – does one provide for genetic drift; it will be necessary to compensate for habitat loss under the influence of global warming. Many years ago the theme of coastal retreat has been examined in the UK, and the results of their analysis of sea-level rise has been partially incorporated in the spatial planning documents along the coastline: making sure that in some cases wetland areas would be able to ‘move’ inland.

The future for biodiversity will to some degree depend upon the capacity for human society to redesign the natural environment, providing for types of land use at the right place that is appropriate for progressive colonisation of biodiversity adjusting to new climatic parameters. Ecological networks are a good principle, but the approach has to be much more akin to an ‘ecoblanket', to use a phrase from Christopher Imboden[9]. Review of land use from the perspective to examine potential biodiversity has to be more systematic at the landscape scale, and we have only partial methodologies to do so, and certainly little legislation to support such an approach. The economic rationale also has to be strengthened. In any case, the methodology required is not only to work from what *is* there, but also what should *be* there – the essence of any rationale behind an attempt to *design with nature*.

[9] Statement from the floor at the Conference on Ecological Networks in Mastricht, 1993.

9. Case studies

9.1. Case study 1 - Bulgaria:

EU TRANSPORT SYSTEM - Trans-European Transport Networks[10]

The development of the future transport system in Europe creates conflicts between the trans-European transport network (TEN-T) in the candidate countries and the European Union's network of designated natural areas: Natura 2000.

The six cases highlighted in a joint NGO report (RSPB 2003) are the Kresna Gorge in Bulgaria, the D 47 and R 37 roads in the Czech Republic, the highways No. 2, M3 and No. 47 in Hungary, the Via Baltica in Poland and the Danube-Oder-Elbe canal in Slovakia, Poland, the Czech Republic, Germany and Austria. These developments threaten at least 29 existing or future Natura 2000 sites. All areas at risk host a high number of plant and animal species of European importance.

Two of the six conflicts highlighted by the NGOs are among the priority projects for the trans-European transport network. Most of the highlighted projects have already been awarded EU money, or are expected to receive EU Pre-Accession funds or support from the European Investment Bank (EIB). The NGOs are extremely concerned that there has been no assessment of the compatibility of the transport projects with the Natura 2000 network. The projects include a motorway through a 17 km long rocky valley in Bulgaria, the Kresna Gorge, which is a habitat for 17 species of bats and large numbers of reptiles. Another project causing concern is the *Via Baltica* motorway in Poland, which threatens four sites requiring protection under EU legislation.

The NGOs' recommendations to the European Commission as a proposal for the revision of the TEN-T network are:

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[10] A case study by Vlada K. Peneva (vpeneva@ecolab.bas.bg), Central Laboratory of Ecology, Bulgarian Academy of Sciences, Sofia, Bulgaria

- A full Strategic Environmental Assessment of the whole trans-European transport network should be carried out by the Commission with the full cooperation of the Member States;
- The development of the TEN-T must be fully compatible with EU environmental legislation, especially the Water Framework Directive and the Birds and Habitats Directives (with special regard to Article 6). The Natura 2000 network of key natural sites must be protected;
- No EU funds (including EIB funds) should be allocated to any part of the TEN-T network until the full environmental impact assessment and cost of all relevant options are evaluated, in order to avoid damage to the Natura 2000 network.

This is an example of lack of co-ordination between the relevant bodies at European and local scales, as well as the lack of adequate practices according to the current legislation. Furthermore the planning was obviously done without using the existing knowledge on conservation values of the places mentioned above.

The core problem for one of the cases (Kresna Gorge case) was the quality of the Environmental Impact Assessment procedure. The preliminary EIA report was unprofessional, incomplete and contained manipulative information. Bulgarian NGOs presumed that SPEA Ingegneria Europea (the consultancy organisation contracted to prepare the project) had chosen specialists closely connected with the Investor, REA, which prevented them from making an independent assessment. Incorrect and manipulative information was also presented during the public hearings on the EIA report.

Concerning the public hearings, NGOs consider that the practice is in conflict with the EIA procedure philosophy … in particular, to enforce the citizens' rights to receive information related to the activities that could have an effect on the environment and to provide comments on it; and secondly, to provide the investor with a possibility for improvement of the project according to the social need and interest, when considering the local circumstances and with the opinion of a broad range of specialists.

NGOs warn that the average Bulgarian citizen is unfamiliar with the EIA procedure, its objectives and possibilities. For more than 10 years, public hearings on EIA reports have been conducted in Bulgaria. But still the people are not really aware of the existence of such a procedure or the rights and possibilities that it provides. NGOs consider it to be necessary for the public hearings to be changed dramatically by the governmental and local administrations. Sufficient measures for raising people's awareness about this issue should be taken.

9.2. Case study 2 - Finland

Ecological principles in Finnish regional and project planning [11]

Ecological Guidelines

The Finnish ecological guidelines for planning were published in 2003. The guidelines aim to help biodiversity impact assessment in the environmental impact assessment procedure, land use planning in regional plans, local master plans and local detailed plans and in appropriate impact assessments under the EU Habitat Directive.

The guidance is intended for professionals such as the regional environment centres, consultants carrying out surveys and assessments, developers, municipalities and authorities giving permits to projects and approving plans.

It includes guidance, checklists, and interpretation of central legislation affecting ecological impact assessment. It also includes methodological guidance for surveys of several species groups.

The guidelines introduce important ecological principles that should be followed in the planning process of a plan or a project and in the assessment procedure when their ecological impacts are identified and evaluated.

The first and most important is to avoid negative impacts on biodiversity. Positive impacts and enhancement of biodiversity are desirable. It is important to maintain biodiversity on different regional levels and consider impacts on a wider spatial and time perspective than short-term impacts in close vicinity of a certain project or local plan. Minor local impacts can be

[11] A case study by Tarja Söderman (Tarja.Soderman@ymparisto.fi), Finnish Environment Institute, Helsinki, Finland

nationally important if they affect connectivity of ecosystems and habitats and affect species or habitats that are nationally rare. Also indirect and cumulative impacts are especially important in the ecological context since the most ecological impacts are cumulative and only seen after several years or decades. The connectivity of habitats can be maintained e.g. by protecting natural corridors and avoiding barriers. It is also important to maintain ecological ecosystem processes. The ecologically important species should be maintained (e.g. protected species, characteristic species for each habitat). Maintaining these species is useful for many other species. Also the loss of them can affect many other species. Irreversible losses of biodiversity should be avoided by applying the precautionary principle.

Case 2.1: Uusimaa regional plan

The Uusimaa region
The region of Uusimaa in Southern Finland covers an area of 6,767 km2. There are around 1.3 million inhabitants, which is more than a quarter of the country's total population. As a destination for national migration the Helsinki metropolitan area and the rest of the Uusimaa is growing fast. The region is currently growing with 15,000 inhabitants per year. This causes a constant need for new housing and infrastructure. There are still some quite large forested areas but they are becoming fragmented.

Regional planning
According to the Finnish Land Use and Building Act the central role in regional development is played by regional councils. Regional councils are coalitions of their member municipalities, which mainly fund the councils' operations. There are 19 regional councils in Finland. The Uusimaa Regional Council has 24 member municipalities, of which Helsinki is the biggest. Regional councils act as responsible authorities for regional plans. The regional plan acts as a guideline for municipal-level plans and other detailed planning of land use.

The objective of a regional plan is to ensure that the use of land and water areas and building activities on them create preconditions for a favourable living environment and promote ecologically, economically, socially and culturally sustainable development (Land Use and Building Act, section 1).

The regional plan proposal consists of a map, a key to the symbols, written regulations and a report that provides information on the goals and alternatives of the plan and their impacts.

The Uusimaa regional plan proposal was ready in September 2003 and has been presented to the public. At the moment the council waits for opinions from the 24 municipalities, the ministries and other authorities and organizations. After the modifications caused by these opinions and hearings, the regional council will approve the plan before this summer and the objective is that the ministry of the environment would ratify the plan by the end of 2004.

Plans must be founded on sufficient studies and their environmental impacts must be assessed to the necessary extent (Land Use and Building Act, Section 9). Impacts on plant and animal species and biodiversity must be assessed in order to safeguard the ecologically sustainable development.

The Uusimaa regional ecological network

The regional ecological network was studied in detail in the planning process. The objective was to define how wide the ecological network should be to maintain ecological functions in a densely populated and constructed urban area. The data included digital local master plans of the 24 municipalities and data of 16 common mammal species (moose, white-tailed deer, roe deer, brown hare, arctic hare, squirrel, fox, raccoon dog, marten, badger, stoat, small weasel, otter, mink, hedgehog, bats) whose home rages, mobility, adaptability and biology varied. A group of species experts assessed the effects of different land use on the species movements. The edge effect and disturbance were modelled in three distances from the forest edge, 20 meters, 100 meters and 200 meters. The present land use and plans were evaluated. On the basis of this analysis, the core areas, the present ecological corridors and the areas, where the connection between core areas was broken and needed to be restored were identified.

The core areas are quite large forests that are important for species dispersal and movements. However, they are dominated by agriculture and forestry. They may also include protected sites, Natura 2000 sites, nationally important wetlands, protected habitat types and habitats of protected species by national or EU legislation, ground water areas and recreational areas. There are also other land uses such as settlement, roads etc. The human impact is visible in these areas but is less intensive that in areas surrounding the core areas and they can be considered important for maintaining biodiversity in urban areas.

The ecological corridors are forested corridors of varied width and chains of forests and meadows, river valleys or forest island chains crossing the large agricultural fields. They maintain the ecological functions of the core areas, connect them and act as dispersal and e.g. seasonal movement routes for the species.

The ecological network of Uusimaa is formed of green belts that radiate from the Helsinki metropolitan area and green connections, which connect these linear areas.

The objective of the plan is to maintain the ecological network by retaining green areas and connections and the connectivity of the network, e.g. by creating new recreational routes and areas in road planning by bridges and tunnels in improving present roads. The planning regulations state that in general the green connections should not be too narrow, tunnel-like, but more like an area, which secures the movement of animals.

The extensive forest areas

The extensive forest areas - in total 15 areas and 137,000 hectares - were identified during the regional planning. The ecological base of these extensive green areas is forest regardless of whether they are used for forestry, recreation or protection. The areas are important for dispersal and population dynamics of plant and animal species. The largest part of these areas is privately owned with active forest management and wood production. The rest are nature reserves or recreational areas.

The goal of the Uusimaa regional plan is not to break these continuous forest areas to fragmented isolated patches. The green structure with the extensive forests is presented in the annex map in the planning report. The green structure is a guideline to the more detailed planning but its legal status is not the same as of the main regional plan.

Case 2.2: EIA of Loviisa-Hikiä electricity power transmission line

The formal EIA procedure

The Loviisa - Hikiä EIA an environmental impact assessment of a 400 kV electric power line according to the Finnish Act on environmental impact assessment procedure. The assessment was more detailed in every respect than project EIAs usually because it was connected to the construction of the fifth nuclear power plant in Finland. There were two alternative sites for the new plant: Loviisa and Olkiluoto. The environmental impact assessments of the needed power lines were started in January 2003 in both locations. Finally in October 2003, it was decided that the plant would to be placed in Olkiluoto. Regardless of this, the EIA between Loviisa, where two of the present reactors are, and Hikiä electricity transmission station, was completed after the decision. The route from Loviisa to Hikiä will be marked in the new regional plan of Itä-Uusimaa. If there is a need for a new power line it can be realized without a new EIA or only with some updates of the EIA data.

Loviisa is in southern coast of Finland and the power line reaches 110 km from the coast inland. It uses partly the existing power line corridors. Depending on the alternative, the new corridor also passes through 46-52 kilometres of forested or valuable cultural landscape areas.

According to the Finnish EIA system both the assessment programme and the assessment report are obligatory. In the assessment programme six alternatives were identified. Some of them were eliminated, because they would have broken nationally important nature reserves or Natura 2000 sites based on the EU Habitat directive. After this, two alternatives remained. The alternatives were the A, passing through forest areas and the B, crossing cultural landscape area.

*Ecological survey*s

The ecological studies were carried out by an ecological sub-consultant hired by the main consultant carrying out the EIA for the power line company Fingrid, which is responsible for the national grid and the power transmission. The field work lasted 28 days, of which the flying squirrel survey took the largest part, 20 days. Eight days were reserved for identifying ecologically valuable sites.

The flying squirrel is a threatened species in Finland. It is classified as a vulnerable species. It has been evaluated that its population has reduced 10-20 % in the last ten years. It is also a species of the Annex IV (a) of the EU

Habitat Directive and thus protected also by national legislation. The destruction and deterioration of breeding sites or resting places used by the flying squirrels is prohibited. It is a good species for wider purposes to maintain biodiversity because it needs non-fragmented forests, which are suitable for many other boreal forest species.

Five breeding sites and resting places were identified during the field surveys. Four of them were in the new corridors. Also one regionally valuable wetland site and locally valuable other sites (meadows and streams) were identified.

Impact assessment and route changes

After the flying squirrel survey the ecological consultant and the route planner of the power line company designed new routes that would circle/ avoid the flying squirrel sites and some of the valuable nature sites. After this an independent flying squirrel expert from the Helsinki University evaluated the routes and wrote an opinion stating that the power line does not affect significantly the flying squirrel places.

Conclusions

In both cases the ecological planning principles were applied successfully. One important goal in the Uusimaa regional plan was to maintain ecological functions in a densely populated area by using recreational areas and routes side and nature reserves. Regardless of the lesser legal status, the green structure guides the detailed planning and should be taken into account in subsequent planning.

In the power line project the flying squirrel was chosen as a valuable ecological component, i.e. it was considered to be important or valuable and merit detailed consideration in the EIA process. The assessment was detailed and carried out correctly. Appropriate data was collected to answer clearly defined questions. However, the long-term and cumulative impacts were ignored. At the moment, there does not exist any strategic level planning system through which the cumulative ecological impacts of power lines are assessed.

9.3. Case study 3 - UK

The Kent method of using ecological rules in spatial planning [12]

Introduction

Modern land use planning, both locally and in the strategic sense, requires integrated advice on the targeting of habitat re-creation and restoration. Such advice should take account of landscape structure but also of other demands on the land, and additional requirements from policy such as access to green spaces, housing and infrastructure. The case study in Kent developed a rules based approach to determine the best locations for the creation of key habitats and the counties strategic level structure plan promotes such an approach. However further work is required at the local planning policy level as it responds to the pressure for more housing in Kent that originates from national policy. The use of the model in determining the potential use of land that is currently predominately agriculture presents additional challenges with landowners preferring the more profitable alternative of housing as apposed to the creation of wildlife habitats or restored landscapes. Current agricultural policy would suggest that we have surplus land under agricultural production and land managers will find it much harder to justify uneconomic land management whether intensive or extensive as agricultural subsidies reduce. The Kent case study presents the rationale and technical process to determine the 'best' habitat location, whilst delivering real change on the ground will continue to be influenced by other drivers such as housing and agricultural policy. It is hoped, however that the results of the work will be used to maximise the limited resources available and target to the best locations based on the ecological principles presented.

Models based on rules that determine possibilities and limits

Ecological rules have been derived aim to take account of the current landscape structure and the network of protected and high-value habitats currently in existence. The rules are aimed at expanding and buffering this network, using parcels that are most likely to respond well due to their current low-intensity land use. The rules select against small, isolated parcels that are currently under an intensive agricultural land use.

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12 A case study by Laurence Tricker (laurence.tricker@kent.gov.uk), Environment and Economy, Kent County Council, Kent, UK

These rules have been implemented on a per-parcel basis within a GIS framework for the whole of Kent. Current habitat information was derived from the Kent Wildlife Habitat Survey. All current BAP habitats and habitat parcels deemed unsuitable for habitat creation were excluded. Designated area information and the Ancient Woodland Inventory were supplied by English Nature. To identify the opportunities for specific types of BAP woodland, use was made of a series of 'habitat capability' layers, which define the capacity of the physical environment for supporting specific habitats, based on soil, elevation, hydrology and geology. These layers were used to filter the results of the parcel-level ecological rules.

Subsequent to the field-level modelling, modifiers to parcel scores were implemented at a higher spatial hierarchy, that of the Landscape Description Unit. These modifiers ensure that opportunities for habitat (re-) creation are identified in areas where their development is appropriate from a human perspective, and fit in with the historical character of the landscape. For use of the resulting information by strategic decision-makers, area-weighted scores for the parcels were summarised at the LDU level. This allows the relative opportunity for each larger unit to be identified before examining the spatial detail of the location of individual opportunities.

Because the habitat opportunity layers are used within a system that will have many non-expert users, a simple quantile-based method has been implemented for their visualisation.

The implementation of ecological modelling results in an interactive framework provides flexible access to information to decision-makers at all levels from strategic to local. Access to additional layers of information, and to underlying physical and geological data, facilitates both the understanding of the modelled data and decision making based upon this. However, at present the rules used to generate the modelled data are based upon a fixed set of values, limiting the user to exploring a single interpretation of habitat opportunity across Kent. This limitation is purely technological, since the time required to generate new habitat opportunity layers is prohibitive to making this an interactive process at present. The future development of new habitat opportunity layers taking into account other factors (such as socio-economic factors, landscape resilience or public access) will allow the user more flexibility in exploring where habitat opportunities occur when the emphasis is on other factors than ecological suitability alone.

Derivation of ecological rules

Concept
The concept behind the ecological rules follows that of the Suffolk Coasts and Heaths Lifescapes project, and has been discussed in more detail in the final report for Phase 1 of the K-LIS project. In essence, the rules are aimed at identifying those areas that:

- Offer the best scope for buffering, especially priority BAP habitats or protected areas, and protect water resources
- Offer the best scope for linking existing priority habitats
- Offer the best scope for successful habitat (re-)creation because of their size, historic habitat and existing land use
- Have public access

The rules dealing with BAP priority habitats are based on the concept that the establishment of any new high quality habitat is beneficial to species within the entire network of priority habitats at the landscape scale, and does not just benefit those priority areas that are of the same type.

The size and distance rules for each habitat have been derived by first of all considering the ecological optimum, and secondly by carrying out a landscape analysis on the Kent Wildlife Habitat Survey data (first draft of the 2000 data). In this analysis, all habitat polygons of the same broad habitat were amalgamated to give a ‘broad habitat’ map. The sizes of and distances between each amalgamated habitat polygon were then estimated. From this analysis, statistics were derived for each habitat type that were used to define what a ‘large’ or ‘medium-sized’ habitat patch was in the Kent context, and what ‘close’ and ‘intermediate’ distances between habitats are in the Kent landscape. The results of these analyses are described below for each habitat. Appendix I shows the grouping of habitats into the six broad habitat categories used here. Appendix II shows the size and distance distributions that were derived for each of the habitat groups.

When scoring, scores are only allocated to those fields that are not:
Already under a BAP priority habitat,
Under urban development

Unable to sustain habitats (e.g. bare rock)
Outside zones identified as suitable by the Habitat Capability Mapping.

Generic rules – non-habitat specific

A number of rules within K-LIS have been devised specifically for the habitat they apply to. However, many of the rules are generic rules that do by their nature not take account of the habitats that are being modelled. These are:

Closeness to designated sites
Because of the susceptibility of designated areas to edge effects and disturbance from outside, a score of 10 is given to any field that is adjacent to a designated area (buffering effect)

Current land use
The current land use of the parcel being modelled defines the ease with which a high quality habitat can be developed on a piece of land. The highest score (10) is given to a non-BAP semi natural habitat. An intermediate score (5) is given to low intensity agricultural land uses. No score is given for fields under a high intensity land use.

Closeness to BAP priority habitat
The rules for distance to BAP priority habitats are partly governed by the current distribution of BAP habitats, and partly by the need for priority habitats, like designated sites, to have a large core area and be buffered from outside influences. The highest score (10) is given for any field that is adjacent to a BAP priority habitat and could fulfil a buffering role as well as expand the core area of habitat. An intermediate score (5) is given to any field that is within 100 metres of a BAP priority habitat, which could still provide a buffering function but does not add to the core area.

Joining potential for BAP priority habitats
This rule identifies how the parcel being modelled contributes to the cohesion and defragmentation of the landscape, and whether it might function as a stepping stone. The highest score (10) is given to parcels that are directly adjacent to two or more BAP priority habitats. An intermediate score (5) is given to parcels that are adjacent to one BAP habitat, and within

500 m from another. Finally, a score (2) is given to parcels that are within 500 m of two or more BAP habitats.

Closeness to river corridor
The ‘river corridor’ in this case has been defined as those BAP habitats that are directly or indirectly (via other BAP habitats) connected to streams and rivers. Rivers and streams provide an important connective function across the landscape, are an important habitat in their own right, as well as providing an essential resource to the human population. Therefore, the highest score (10) is given to those parcels that add directly to this connective function, as well as providing buffering from outside influences, by being adjacent to the river corridor. An intermediate score (5) is given to all parcels that are within 100 metres of the river corridor and still provide some of this connective and buffering function.

Time elapsed since loss
The time that has elapsed since a habitat of the type that is being modelled was present will define how easy it will be for such a habitat to re-establish. Data layers describing the habitats of Kent are available for 1961, 1972, and from the original Kent Wildlife Habitat Survey of 1990. In this analysis it is assumed that if a parcel was under a semi-natural habitat in 1961, this habitat had been present for a considerable time before that point.

The highest score (10) is given to those parcels that were under the target habitat from 1961-1990. An intermediate score (7) is given to those parcels that were under the target habitat from 1961-1972, but not in 1990. A low score (5) is given to those parcels that were under the target habitat in 1961 but subsequently lost the habitat.

Other rules that should be considered:

<u>Focal-species approach.</u>
This approach (Lambeck 1997; Watson et al. 2001) relies on the identification of one or more species for all habitats, the habitat requirements of which will be incorporated into the models. The selection criteria for such ‘focal species’ are that they are sensitive to changes in the quantity or quality of their habitat. The assumption is made that when their requirements are met, the requirements of the majority of species typical for the habitat are met.

To develop the focal species approach for the K-LIS, such focal species need to be formally identified for each habitat. It is possible that the BAP priority species could represent a first selection in this context, although this would need to be reviewed carefully. Detailed information about habitat requirements for these species then needs to be collated, after which rules can be developed for incorporation in the targeting models. Knowledge of the present distribution of these species will be highly desirable for the development of this approach.

The definition of focal species is a resource-intensive exercise. Detailed information on species requirements may not be available, hampering the effectiveness of this approach. Additionally, species distribution data are not currently available for Kent at a resolution suitable for inclusion in this approach. However, the approach presents a rigorous and objective method for defining ecological rules for habitat restoration / re-creation targeting if sufficient data are available.

Data availability and data access (confidentiality, protection of species, degrees of confidence)

Data and licensing issues
A number of the datasets proposed for inclusion in the K-LIS are owned by, or based on spatial data owned by, outside organisations. Although most of these data are currently licensed to KCC for internal usage, publication of the source or derived data on the Internet is likely to be outwith the current licences terms and conditions. The following table includes references to these data owners and the main issues for data licensing are identified.

Habitat-specific rules.

The habitat-specific rules deal with habitat sizes and distances between habitats of the same type. The results from landscape analysis were used to inform these rules, and are discussed here for each habitat type.

For the rules dealing with size, a two-tier scoring was used. An ‘ecologically optimum’ size was identified, informed by the work done by Carrie Howard for the Suffolk Coasts and Heaths, which was given the highest score (10). The intermediate scores (5) were then informed by the habitat analysis, with the largest 10% of habitat areas used to define a ‘realistic’ size.

For the rules dealing with distance, three categories have been identified. The highest score (10) is given to parcels adjacent to similar habitats. The intermediate score (5) is given to parcels that are within a distance experienced by up to 75% of current habitat parcels across the landscape for that habitat. A low score (2) is given to parcels that are within a distance experienced by up to 90% of current habitat parcels across the landscape for that habitat.

Woodland Types - Because woodland is a widespread and common habitat across Kent, and because of the importance of ancient woodland in the county, the rules for woodland are somewhat different to those for the other habitats. A high emphasis has been put on the protection of ancient woodland, and the criteria for identifying parcels within optimum distances have been tightened.

Closeness to same habitat: For woodlands, the main consideration is the buffering and expansion of existing ancient semi-natural woodlands. Therefore, a maximum score of 30 is given to any parcel that is adjacent to an ancient woodland site. A high score of 10 is given to parcels adjacent to non-ancient woodlands. An intermediate score of 5 is given to parcels within 50 metres of an existing woodland (the distance between other woodland habitat experienced by up to 50 % of woodlands in Kent). A low score of 2 is given to parcels within 200 metres of an existing woodland (the distance experienced by up to 90% of woods in Kent).

Size of adjacent same habitat: As an optimum, woodland habitats of 50 ha or greater are given the highest score (10) as they represent the recommended minimum viable woodland size. However, woodland in Kent is typically small and fragmented (although there are some notable exceptions). Therefore, an intermediate score of 5 is given to all parcels adjacent to woodlands of 7 ha or more, which represents the largest 10% of woodlands in Kent.

Size of potential habitat: An optimum of 50 ha or greater has again been used to identify the best possible sites, with a score of 10. However, field sizes in Kent are generally much smaller than this. An intermediate score of 5 has been given to all parcels over 5 ha, conform to the Suffolk Coasts and Heaths methods.

Freshwater habitats - Freshwater habitats in Kent are relatively uncommon, and spread evenly across the county. Therefore, the average minimum distance between freshwater habitats is much larger than that for woodlands (almost 250 metres). In addition, freshwater habitats in Kent are typically small, leading to the development of relatively low targeting thresholds for size and distance.

Closeness to same habitat: A high score of 10 is given to parcels adjacent to any freshwater habitat. An intermediate score of 5 is given to parcels within 350 metres of any freshwater habitat (the distance between other freshwater habitats experienced by up to 75 % of freshwater habitats in Kent). A low score of 2 is given to parcels within 750 metres of an existing freshwater habitat (the distance experienced by up to 90% of freshwater habitats in Kent).

Size of adjacent same habitat: As an optimum, freshwater habitats of 20 ha or greater are given the highest score (10). However, freshwater habitats in Kent are typically very small. Therefore, an intermediate score of 5 is given to all parcels adjacent to freshwater habitats of 2 ha or more, which represents the largest 10% of freshwater habitats in Kent.

Size of potential habitat: An optimum of 20 ha or greater has again been used to identify the best possible sites, with a score of 10. However, both field sizes in Kent and current freshwater habitats are generally much smaller than this. Therefore, an intermediate score of 5 has been given to all parcels over 2 ha.

Saltmarsh / mudflat habitats - Saltmarsh and mudflat habitats in Kent are generally larger areas that are within short distances of other habitats of the same type. Therefore, the rules devised for these habitats are some of the most stringent ones in the K-LIS.

Closeness to same habitat: A high score of 10 is given to parcels adjacent to any saltmarsh or mudflat habitat. An intermediate score of 5 is given to parcels within 50 metres of any saltmarsh / mudflat habitat (the distance between other saltmarsh / mudflat habitats experienced by up to 75 % of such habitats in Kent). A low score of 2 is given to parcels within 150 metres of an existing saltmarsh / mudflat habitat (the distance experienced by up to 90% of such habitats in Kent).

Size of adjacent same habitat: As an optimum, saltmarsh and mudflat habitats of 100 ha or greater are given the highest score (10). This equates to the largest 8% of these habitat areas in Kent. An intermediate score of 5 is given to all parcels adjacent to saltmarsh and mudflat habitats of 50 ha or more, which represents the largest 10% of these habitats in Kent.

Size of potential habitat: An optimum of 50 ha or greater has been used to identify the best possible sites, with a score of 10. However, as stated previously, field sizes in Kent are generally much smaller than this. Therefore, an intermediate score of 5 has been given to all parcels over 5 ha.

Neutral grassland - Areas of neutral grassland in Kent are generally small, and scattered across the county. It is a relatively rare habitat and its wide dispersion means that the rules for distance for this habitat have relatively low thresholds.

Closeness to same habitat: A high score of 10 is given to parcels adjacent to any neutral grassland habitat. An intermediate score of 5 is given to parcels within 250 metres of any neutral grassland habitat (the distance between other neutral grassland habitats experienced by up to 75 % of such habitats in Kent). A low score of 2 is given to parcels within 550 metres of an existing neutral grassland habitat (the distance experienced by up to 90% of such habitats in Kent).
Size of adjacent same habitat: As an optimum, neutral grassland habitats of 50 ha or greater are given the highest score (10). However, this equates to only the largest 0.8% of these habitat areas in Kent. Therefore, an intermediate score of 5 is given to all parcels adjacent to neutral grassland habitats of 7 ha or more, which represents the largest 10% of these habitats in Kent.

Size of potential habitat: An optimum of 50 ha or greater has been used to identify the best possible sites, with a score of 10. However, as stated previously, field sizes in Kent are generally much smaller than this. Therefore, an intermediate score of 5 has been given to all parcels over 5 ha.

Chalk grassland - Chalk grassland in Kent is restricted to a distinct band on the chalk geology across the county. Even so, chalk grassland is a relatively scattered resource, and the average distances between sites are relatively large (around 250 m). Field sizes are similar to those for neutral grassland, and so the field size rules for these two habitats are identical.

Closeness to same habitat: A high score of 10 is given to parcels adjacent to any chalk grassland habitat. An intermediate score of 5 is given to parcels within 300 metres of any chalk grassland habitat (the distance between other chalk grassland habitats experienced by up to 75 % of such habitats in Kent). A low score of 2 is given to parcels within 600 metres of an existing chalk grassland habitat (the distance experienced by up to 90% of such habitats in Kent).

Size of adjacent same habitat: As an optimum, chalk grassland habitats of 50 ha or greater are given the highest score (10). However, this equates to only the largest 0.4% of these habitat areas in Kent. Therefore, an intermediate score of 5 is given to all parcels adjacent to chalk grassland habitats of 7 ha or more, which represents the largest 10% of these habitats in Kent.

Size of potential habitat: An optimum of 50 ha or greater has again been used to identify the best possible sites, with a score of 10. However, as stated previously, field sizes in Kent are generally much smaller than this. Therefore, an intermediate score of 5 has been given to all parcels over 5 ha.

Acid grass and heath - Acid grassland and heathland is an uncommon habitat in Kent, with only just over 800 distinct areas occurring (amalgamated habitat areas). Parcels are generally small and further apart than either neutral or chalk grassland areas (on average around 350 metres). Therefore, the ecological rules for acid grassland and heathland have the lowest thresholds within the K-LIS.

Closeness to same habitat: A high score of 10 is given to parcels adjacent to any acid grassland or heathland habitat. An intermediate score of 5 is given to parcels within 400 metres of any acid grassland or heathland habitat (the distance between other acid grassland / heathland habitats experienced by up to 75 % of such habitats in Kent). A low score of 2 is given to parcels within 800 metres of an existing acid grassland or heathland habitat (the distance experienced by up to 90% of such habitats in Kent).

Size of adjacent same habitat: As an optimum, acid grassland and heathland habitats of 50 ha or greater are given the highest score (10). However, this equates to only the largest 0.1% of these habitat areas in Kent. Therefore, an intermediate score of 5 is given to all parcels adjacent to acid grassland or heathland habitats of 5 ha or more, which represents the largest 10% of these habitats in Kent.

Size of potential habitat: An optimum of 50 ha or greater has been used to identify the best possible sites, with a score of 10. However, as stated previously, field sizes in Kent are generally much smaller than this. Therefore, an intermediate score of 5 has been given to all parcels over 5 ha.

For access to more information regarding this case study please go to the BIOFORUM website (http://www.nbu.ac.uk/bioforum/)

9.4. Case study 4 - Slovakia

Landscape–ecological plan in system of spatial planning in Slovakia[13]

"The Regulation of the Ministry of Environment No. 55/2001 on landscape planning survey and documentation" defines principles used in preparation of landscape planning documentation and specify contents of individual hierarchical types of documents. Four hierarchical levels are distinguished: 1) Concept of the spatial development of Slovakia; 2) The landscape plan of region; 3) The landscape plan of municipality (cadastre); 4) The landscape plan of zone.

The concept of the spatial development of Slovakia (KURS) is based on the Regulation of the Slovak government No. 528/2002. KURS includes:

- Proposal of concept, protection and restoration of the cultural and natural heritage, concept of nature conservation and landscaping, inclusive of ecological stability of the Slovakia
- Evaluation of the quality of environment including requirements for evaluation of expected impact to environment

The obligatory part of KURS has 12 parts and "contains proposal of principles of spatial and functional utilization of territory that regulate the sectorial concepts and strategies in harmony with principle of sustainable development and with principles of protection of the environment". The part 5 is directly devoted to "ecological aspects of the territory organization, conservation of nature and natural resources, and landscape structure generation". Also in some other parts of KURS can be found some elements related to biodiversity conservation, e.g. in parts 3 (rural development and town-rural relation); 4 (maintenance and utilization of the cultural heritage); 7 (agricultural production and forestry), and 9 (recreation and tourism development).

<u>The landscape plan of the municipality</u> (cadastre) must include (among others): proposal of the functional land use; delineation of protected sites and buffer zones; proposal of nature protection and landscaping, including elements of the Territorial System of Ecological Stability and eco-stabilizing measures; concept of environment tending, eventually evaluation of predicted effects on environment; delineation of sites, requiring stricter

[13] Case study by Luboš Halada (Lubos.Halada@savba.sk), Institute of Landscape Ecology, Slovak Academy of Sciences, Nitra, Slovakia

protection; evaluation of proposed solution on the basis of environmental, economic, social and territorial effects; proposal of obligatory part. The obligatory part contains proposal of regulations of the territorial development with precisely formulated principles of spatial organization and functional utilization of the land. Thus includes obligatory rules for activities in the territory, conditions for land use and location of building activities.

The landscape-ecological plan
The landscape-ecological plan is an obligatory part of spatial planning documentation in each level: "Landscape-ecological plan propose, on the basis of analysis of natural conditions of the territory, the most suitable form of utilization, ensuring regardful use of nature, natural resources, maintenance of biodiversity and support of ecological stability of the landscape". Reasons why landscape-ecological plan was included into land planning documentation:

- Tradition of landscape-ecological school in Slovakia
- The methodology of landscape-ecological planning (LANDEP) developed and used
- The concept of "Territorial system of ecological stability of landscape" (ÚSES) included into legislation: the Act on nature and landscape conservation No. 287/1994 Z.z. and 543/2002.

Case study of the landscape-ecological plan of Povazská Bystrica town
The landscape-ecological plan was developed in scale 1:10 000 by team of 10 persons in 2002. This plan has 3 parts: analyses, syntheses and proposals. The structure of each part is given bellow.

1. ANALYSES
1.1. The basic spatial division of the landscape
1.1.1 Natural regions
1.1.2 Current landscape structure
1.2. Abiotic attributes of landscape
1.2.1 Geology
1.2.2 Relief
1.2.3 Soils
1.2.4 Climate and hydrology
1.2.5 Abio-complexes
1.3. Biotic attributes of landscape

1.3.1. Reconstructed natural vegetation
1.3.2 Analysis of the real vegetation
1.3.3. General description of fauna
1.3.4. Analysis of selected taxonomic groups of animals
1.4. Socio-economic attributes of landscape
1.4.1 Human activities characterization: Urbanization; mining, energetic, industry, waste management; transport and transport infrastructure; agriculture; forestry; water management; tourism, recreation, sport; nature and landscape conservation
1.4.2 Negative factors influencing environment
Air pollution, surface and groundwater pollution, soil pollution and degradation, damage of forest, threat of biodiversity, noise, radioactivity etc.

2. EVALUATIONS
2.1. Positional relationships micro-basins
2.2. Abiotic stability of landscape and resistance against selected morpho-dynamic processes
2.2.1 Landscape resistance against land-slide processes
2.2.2 Landscape resistance against water erosion
2.2.3 Landscape resistance against substrate and groundwater pollution
2.2.4 Abiotic stability of landscape
2.3. Biotic quality of landscape and territorial system of ecological stability
2.3.1 Evaluation of urban vegetation
2.3.2 Evaluation of non-urban vegetation
2.3.3 Evaluation of forest stands
2.3.4 Evaluation of selected taxonomic groups of animals
2.4. Threat and damage of landscape
2.4.1 Threat and damage of landscape by natural processes
2.4.2 Threat and damage of landscape by anthropogenic activities
2.5. Landscape productivity
2.5.1 Geo-potential
2.5.2 Water potential
2.5.3 Forestry potential
2.5.4 Agricultural potential
2.5.5 Urbanisation potential
2.5.6 Recreation potential
2.5.7 Ecosozological potential

3. PROPOSALS (LANDSCAPE-ECOLOGICAL PLAN)
3.1. Principles of land use in existing documents
3.2. Principles and regulations of sectorial management of landscape
Urban landscaping; mining, energetic, industry, waste management; transport and transport infrastructure; agriculture; forestry; water management; tourism, recreation, sport; nature and landscape conservation
3.3. Proposal of principles and measures for nature and landscape conservation
3.3.1 Principles of land use and spatial organization of land reserves
3.3.2 Management of ecologically important sites – nature and landscape conservation, territorial system of ecological stability
3.3.3 Hydro-ecological measures – proposals for restoration of water courses
3.3.4 Improvement of environment in settlement – elimination of damage of environment, generation and maintenance of urban vegetation
3.4 Appraisal of the development plans in the territory

The chapter "Principles and regulations of sectorial management of landscape" sets the framework for the regulation of existing and proposed activities. The chapter "Proposal of principles and measures for nature and landscape conservation" suggests specific proposals for improvement of environment and landscape quality.

The appraisal of the development plans in the territory was focused on the following fields: (a) perspective residential sites; (b) sites of planned services and facilities; (c) sites of proposed industrial parks and enlarging of existing areas of industry; (d) other plans. This reassessment was performed through the setting of limits for planned activities. The limits were specified in scale: 0 – no limit (proposed activity is suitable); 1 – existing limit (proposed activity is conditionally suitable – only certain forms of proposed activity are possible or specific measures must be taken); 2 – strong limit (proposed activity is not suitable). For each planned area of development, categories of limiting criteria were specified from following points of view: L1– stability of geological sphere and slope processes; L2 – natural resources protection; L3 – water sources and important areas of water management protection; L4 – soil productivity protection; L5 – occurrence of soils of protected categories; L6 – biodiversity and biotic quality conservation; L7 – possible violation of residential or recreation functions of site. If the activity in respective locality had reach value 2 (strong limit) in any criterion or value 1 (existing limit) for several criteria, the activity was rejected. If the value 1 was obtained for one or two criteria, the activity was characterised as conditionally possible if certain measures would be taken.

The elaboration of the landscape-ecological plan is a complex process of mutual harmonization of spatial requirements and other human activities with landscape-ecological conditions. Realisation of goal-oriented changes in commercial landscape utilisation represents the main aim of principles and measures formulated in the landscape-ecological plan. They should lead – through influence on structure and function of landscape system – to consolidation of ecological quality of landscape, reinforcement of its auto-regulative ability and restriction of unfavourable anthropogenic impact to landscape. Because of parallel preparation of the Povazská Bystrica town plan, results of landscape-ecological plan were directly incorporated into town plan.

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