TESS
Transactional Environmental Support System

COOPERATION

Grant agreement no.: 212304

TESS: Transactional Environmental Support System

Policy Recommendations and Guidelines

Sharp, RJA[1], Ewald, JA[2], Kenward, RE[2]

[1] European Sustainable Use Specialist Group of IUCN-SSC; [2] Anatrack Ltd

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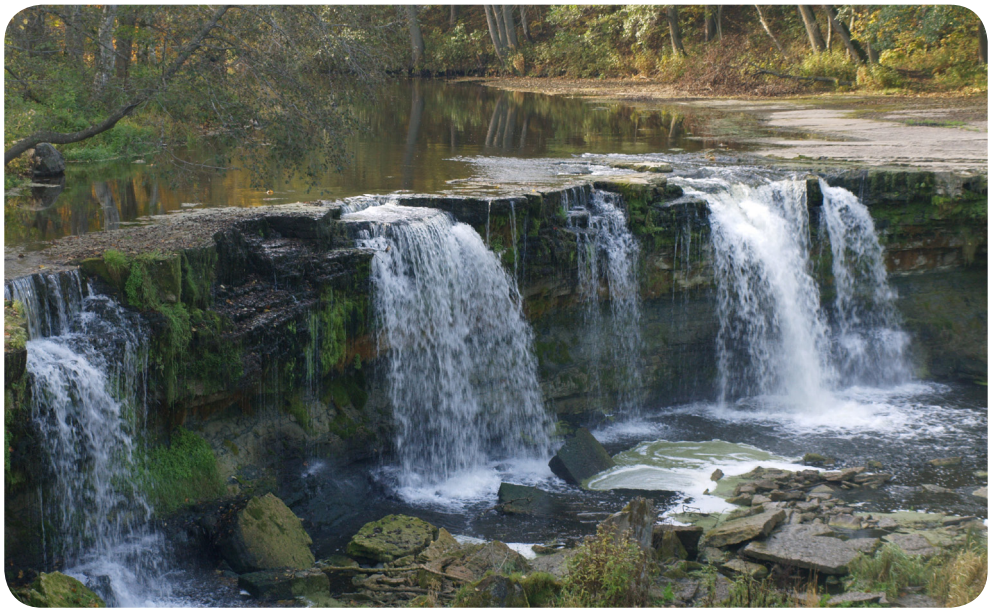

Introduction

Can we halt the decline in the abundance and variety of Europe's wildlife merely by safeguarding individual species and designating protected areas? Most experts think we cannot.

But if we must look beyond protection, can the people who make a living from the land and those who use it recreationally be motivated to combine their traditional activities with active monitoring and biodiversity restoration within the framework of wider strategies? Can environmental assessment processes help?

These are the overarching questions to which the TESS project has attempted to contribute some answers.

Working with central policy and local planning to help livelihoods and biodiversity

TESS is a Pan-European research project supported by the 7th Framework Programme of the European Commission. It aims to assist policy makers to integrate information about biodiversity and related environmental matters from the local level into strategic planning, while at the same time encouraging local people to collect such information in order to maintain and restore biodiversity and ecosystem services. To achieve this, the design of an environmental decision support system should link central policy planning to benefits for local livelihoods.

What is TESS about?

Computer aided predictive modelling to support environmental decisions

For 50 years, subsidies at continental and state level have successfully driven cultivation of a few species in Europe. Intensive monocultures, replacing the former diverse local land-use, continue to degrade ecosystem services that sustained Europeans for centuries. Wild species have disappeared locally through habitat loss, fragmentation and chemical inputs, so that biodiversity has declined at an unprecedented rate. Animals and plants that once fascinated or fed people have vanished from many communities.

The European Union and national Governments now require Strategic Environmental Assessment (SEA) for strategic plans and programmes and Environmental Impact Assessment (EIA) for specific projects, sometimes also with sustainability assessments. SEA and EIA depend on experts to collect data and make predictions, and are therefore used for only a minority of the myriad decisions that impact on our environment.

However, the ability to predict change and present options has increased through the use of sophisticated computer modelling. Such models may incorporate behavioural mechanisms of key species and can be spatially-specific through linkage to habitat and socio-economic data. TESS argues that by making the computer models work for anyone, with environmental information gathered by local people, the principles of environmental assessment can assist decisions affecting development and management of land at all relevant levels right across the countryside.

Worked towards the design of a software tool to aid environmental assessments and to encourage the wider public to participate in biodiversity conservation

TESS has worked to design a decision support system related to environment and land-use that will make it easy for policy makers to integrate local knowledge into their decision making, while also guiding and encouraging local activities in ways that maintain and restore biodiversity and ecosystem services.

The duration of the project was nearly three years – running from October 2008 to June 2011. During its first year, pilot surveys were carried out in nine countries by the main project partners in order to list and analyse the existing government information requirements at national and intermediate levels and to identify the local level information needs of both local municipalities and stakeholders in making assessments and decisions for land-use management. The results of these studies were presented in an international workshop in London in autumn 2009, to inform the planning of a Pan-European Survey on similar lines.

This Survey was carried out between late 2009 and mid-2010. The ambition was to have identical questionnaires completed in all 27 EU member states plus some others. For each country there was one questionnaire aimed at the national government level, five aimed at randomly selected rural municipalities and one aimed at a local land-user from each of 5 stakeholder categories in one of the selected municipalities. The aim was to identify current best practice for incorporating biodiversity and wider environmental information into decision-making on land-use across Europe. A large amount of data suitable for quantitative analysis was gathered and has been made available. This survey also identified priority areas for internet-based decision support and local monitoring to benefit livelihoods and biodiversity.

Following this, statistical association techniques were applied to try to assess how the use of biodiversity and environmental information in EIA, SEA and sustainability assessment has affected ecosystem services and biodiversity.

During the summer of 2010 project partners conducted case studies of local communities to test how best to meet local decision support needs in exchange for local monitoring that meets central policy requirements. They examined whether local monitoring (based on schools, local community groups or individuals motivated by use of wild resources) can supply the extra environmental data that are needed. To achieve this, non-expert participants experimented with mapping tools for their local environments.

In parallel to these direct surveys and case studies a separate exercise created a data-base of models suitable for bio-socio-economic predictions and examined where there are gaps in the supply of models and data, compared with the demand for information.

The role of guidelines derived from a scientific research project

TESS has aimed to be a scientific research project. This means that among other things it has striven to be objective and rigorous in gathering and analysing information. It has benefited from financial resources provided by the organs of the European Union and the cultural richness which comes from collaboration among a range of European research institutions. At the same time the project was constrained by formal requirements to follow programmes of work prepared long in advance, which do not allow for "adaptive management".

When the object of study is not the behaviour of a restricted number of animals or plants in a laboratory but, in effect, the 500 million strong population of Europe the challenge to achieve rigour and objectivity is all the greater. Much of the work in TESS has been about exploring the capacity and willingness of ordinary people using or managing land to record scientific information in a way that will assist their decisions and those of others to be more favourable for conserving wildlife. This encompasses farmers and gardeners, as well as those who hunt or fish, walk in the countryside or enjoy observing nature.

Asking relevant questions either directly or through representatives is subject to a range of limitations such as possible misunderstanding of what is intended on the part of the respondent or their lack of knowledge or reluctance to take seriously "yet another survey" whose relevance is obscure to them. Nevertheless TESS has done its best, within quite modest human and financial resources, to conduct its enquiries on the same basis in over 130 randomly sampled local communities in 27 European countries, as well as carrying out 10 local case studies involving direct socio-economic surveys and experimental mapping by non-experts.

One of the keys to the success of the Pan-European surveys was the network of Country Co-ordinators developed by the European Sustainable Use Specialist Group of IUCN/SSC during the previous GEMCONBIO-UNWIRE study. This network provided a combination of translation skills with expertise in the subject of the questionnaires and was crucial in persuading local communities and land managers to participate. This relatively inexpensive methodology appears to be fairly unusual or perhaps even pioneering, at least in the general area of science in which we have been operating.

Having made this claim to objectivity in a sphere of social enquiry where precision is inevitably elusive, we should perhaps indicate the broad approach which lies behind TESS. This is a general conviction that conservation of biodiversity needs to be addressed within a wide context of human activity as recently encapsulated in the Malawi and Addis Ababa Principles adopted by the UN Convention on Biological Diversity (CBD). These principles and guidelines of an ecosystem approach and sustainable use of biodiversity recognise that, to coin a phrase, "we are all in this together".

Thus, without ignoring the importance of protected areas and species, the TESS project has focused on what is referred to as the wider countryside. This is the roughly 80% of land and inland water bodies in Europe that is not subject to special designation, where people have to earn a living or wish to practice a variety of pursuits that do not have conservation as their primary objective. Unless their impact on biodiversity is taken into account and unless their use of it is sustainable then conservation risks being confined to isolated islands surrounded by a sea of intensive land-use.

Going beyond this we see the potential for such use to provide incentives for conservation, when people recognise the social and economic benefits which derive from it. To put it another way, governance objectives are normally achieved either through carrots or sticks. Regulation, which remains necessary in many contexts, is the stick, whereas incentives are carrots. We have been concerned mainly with carrots, that is to explore the extent to which people can be motivated to integrate conservation goals or environmentally friendly use into their day-to-day activities on land or water, as well as what are the information needs to make this possible.

Another important aspect of the thinking behind TESS is explained in a paper derived from the GEM CON BIO project, prepared by a number of TESS participants and others and published in the Proceedings of the National Academy of Science (PNAS) in 2011. This paper "Identifying governance strategies that effectively support ecosystem services, resource sustainability, and biodiversity" shows the importance for biodiversity conservation and sustainable use of adaptive management and knowledge leadership, as exemplified in the CBD Principles mentioned above. TESS can be said to have designed a system to deliver (automated) knowledge leadership while facilitating adaptive management.

These are the principles and findings which have guided TESS as it has sought to draw policy conclusions and guidelines for action out of the scientific work which has been undertaken, with all its acknowledged and unacknowledged shortcomings. If you think that the investigation and reporting of scientific facts about nature is best left to experts whether in universities, government agencies or NGO's or if you consider that preservation of so-called "biodiversity hotspots" or the rapid extension of protected areas should be the priority for conservation effort, then the following guidelines may be of little interest. We might also add that it is not our wish to repeat here the kind of broad principles and guidelines already mentioned, which stand at a higher level. Indeed, these higher-level concepts, rather than the findings of TESS as such, are what have influenced us to conduct TESS in the way we have.

The recommendations and guidelines

In framing recommendations and guidelines (in bold type) we have tried to consider different audiences such as various levels of government and local users, as well as those who commission and carry out research and monitoring. The order adopted is related to the way in which the project was implemented and should not be seen as having any further significance. We offer summaries of key findings and then propose guidelines or recommendations which arise from them.

In the TESS project we first considered higher echelons of governance at the EU and national or immediately sub-national government levels.

a *Information for higher-level assessments*

The EU Directives on Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA), though not integrated into a single instrument as originally intended and as would still be desirable, are based on sound principles which oblige those formulating national strategies or proposing large physical projects to assess their impact on the environment in the short and longer terms.

The Directives have been translated into national laws, using permitted differences in scope and procedures, but are applied with a surprising degree of variation. It is not clear what purpose is served by such variation, other than a claim to have met a political demand for a degree of subsidiarity. It would be expected that the annual number of large new projects coming forward for assessment in each country would be loosely related to the size of its economy. However, although there were relationships with country size and population density, there was no sign of a relationship with GDP; the reasons for this remain elusive, though our investigations have revealed some unexpected correlations. Among these were relationships that suggest de-tiering at local level, which makes consultation and the contribution of genuinely local knowledge into higher-level decision-making more difficult, is not environmentally beneficial.

It is, nevertheless, clear that the vast majority of land use planning decisions are made outside any formal impact assessment system as laid down by the Directives. In many cases these decisions will involve informal environmental assessment but, since many small cases may have as much impact as a few larger ones, there is an argument for requiring the principles of such assessment to be embedded into national planning law generally.

It should also be noted that those who frame the laws, whether at EU or national level, do not themselves directly require the environmental information set out in the assessments. They require developers or bodies formulating strategic plans to gather the information and the deciding authorities to assess if it is adequate and what role it should play in influencing the outcome of the process. This has relevance for the "transactional" ambitions of TESS, since it means that there are not simple upward and downward flows of information related to decisions which affect the environment and biodiversity.

Biodiversity information, which is available in a wide variety of formats on the internet in many cases, is gathered together in ad hoc fashion for these assessments but then dispersed rather than being added to national or EU level databases. In spite of praiseworthy requirements for public involvement in SEA and EIA processes, they remain formidable and many local municipalities, much less ordinary land managers, have no experience of them at all.

EIA requirements for assessment of conversion of semi-natural habitats into intensive agriculture could in theory be valuable instruments for conservation in the wider countryside. Regrettably they are generally by-passed, but there is a gradual though non-quantified movement towards environmental assessment based on mapping as a condition of single farm payments under the CAP. It seems probable that the huge number of management decisions taken by farmers, horticulturalists and gardeners are of more significance for the health of Europe's natural heritage than the large-scale developments currently caught by formal EIA. As long as agricultural support systems continue they may be a more effective tool for assessing and influencing land management changes of environmental significance.

Accordingly the following recommendations are proposed when considering how environmental and sustainability assessment should be carried forward through incentives and regulations.

1. **The SEA and EIA Directives should be reconsidered with a view to their integration and formal application at the same level in all member states.**

2. **Member States should be required to give regular accounts of how their planning and other decision-making systems incorporate the principles of environmental and sustainability impact assessment in cases which lie outside the scope of formal SEA and EIA.**

3. **The Commission and Member States should develop environmental cross-compliance requirements to include assessments of significant changes in agricultural and forestry land use and management, which are currently covered by the EIA Directive, while promoting the integration of biodiversity and other environmental information into single farm payment regimes.**

While the requirements for formal assessment are a top-down flow from international and national implementation levels, there is no corresponding flow of information from participants to these levels about the relevant impacts and the effectiveness of the processes. Just as participants often have difficulty in finding the information they need, which is available in a variety of forms and from a range of sources, so authorities setting the rules or enforcing them are in effect discarding the information gathered at considerable expense for each individual assessment. While there has been effort in some countries to harmonise and digitise biodiversity records this has been mostly to assist conservation projects rather than to facilitate decision making by land users. So far there has been little evidence that

national level governments appreciate the contribution that information from non-experts or "citizen science" could make to policy or policy outputs in biodiversity related fields. This is probably due to the widespread mindset that information about wildlife is only reliable if provided by experts.

The need for local, regional, national and European frameworks to integrate data and make it easy to use by non-experts is evident. The work of the EEA in this endeavour is of critical importance at European level. In the national context Biodiversity Action Plans (BAP) have brought together government departments and agencies, local government, business interests, land managers and NGO's to assess the state of biodiversity and to devise and implement plans to restore it, a process which is impossible without data gathering and monitoring over time. In a few countries this collaboration and the necessary structures have been adopted voluntarily at regional and local levels, each with their own targets for habitat and species restoration and thus the need and indeed motivation for appropriate information gathering. If local BAP consortia could be put in place more widely, they could provide the ideal frameworks for harmonizing biodiversity data and making it genuinely accessible to non-experts. Equally data provided by citizens could be integrated into the various formal environmental assessments, thus promoting a genuine two-way transactional approach.

4 **Member States should increase co-operation with the European Environment Agency by ensuring that information gathered for formal assessments is shared with them and the wider public and by supporting efforts under the INSPIRE Directive and other initiatives to improve the quality and compatibility of environmental data generally.**

5 **The Commission and Member States should consider encouraging the Biodiversity Action Plan model of collaboration between stakeholders for biodiversity restoration to provide regional and local frameworks for information gathering and monitoring.**

6 **Steps should be taken to integrate knowledge and data provided by individual land-users into formal environmental decision making to support SEA's, EIA's and assessments for land-use planning decisions.**

b *Understanding information needs and making information available*

Although TESS examined national level requirements for environmental assessment and information its main focus was on local decision-making and the need for information to support these decisions. It looked at the various categories of local users of environmental information such as local governments at the "lowest" level (parishes/municipalities:LAU2 in Eurostat classification) and in some countries at the second "lowest" level (districts: LAU1), foresters, farmers, nature-watchers, anglers, hunters and recreational access groups.

The categories of information identified related to habitats, species, socio-economic issues, hazards and tourism/income generation potential.

Sources of information were extremely varied, with local government, national government and government agencies making the most significant contribution, along with their own records being important for local stakeholders, especially foresters and nature watchers. Scientific studies, consultants, local knowledge and NGO's played a lesser part. Although there is plenty of environmental information of varying quality available on the internet, local land managers do not yet use it strongly. On the other hand local authorities in about half of EU countries carry out an appreciable amount of systematic recording of biodiversity and/or use geographic information systems. Overall the picture is complex and apparently little studied.

The different categories of users of information had greater or lesser requirements for some types of information but all needed data on species and ecosystem services. The most local governments were more concerned than others with hazard issues, while "district" or sec-

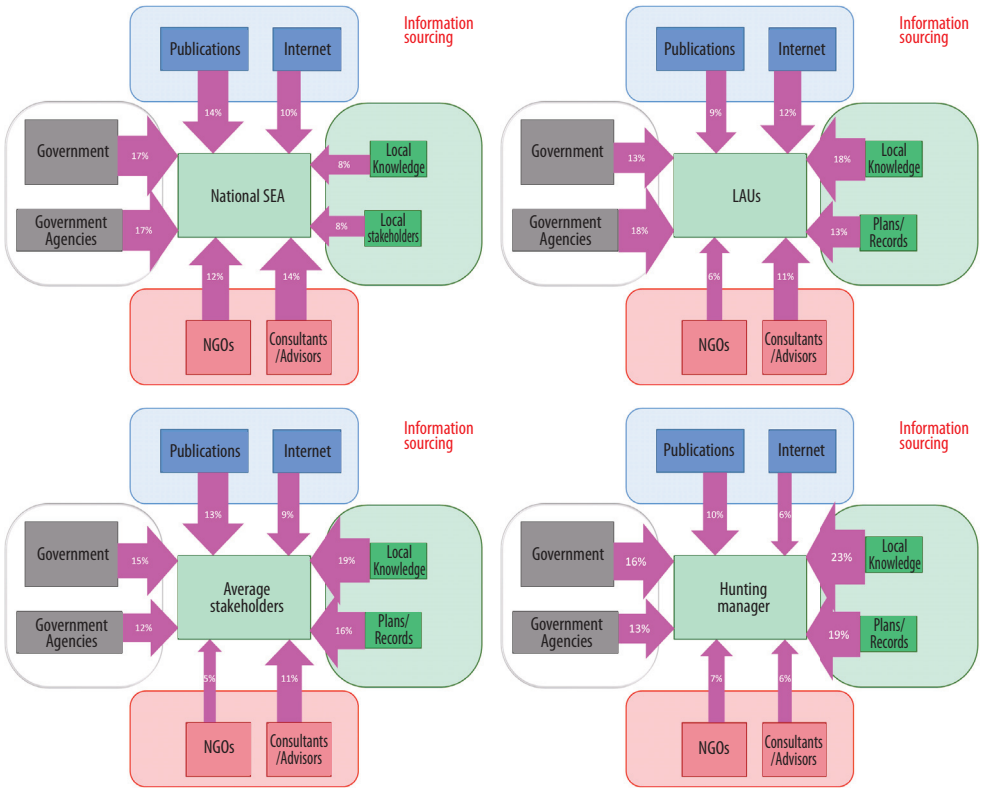

Fig.1 The proportion of information on biodiversity & ecosystem services that was sourced from different suppliers by (in central boxes) (i) national government, (ii) local authorities, (iii) private managers of land and species in general and (iv) hunters in particular.

ond level-up councils were more focused on biodiversity issues than parishes and municipalities, almost certainly because formal responsibilities were allocated at the higher level.

In seeking to identify local authorities at the lowest level in different countries to meet our survey criteria, we were struck by an increasing tendency over the last thirty years or so for the lowest tier of authorities, parishes or municipalities, to be abolished, made optional or merged for all serious functions into ad hoc consortia. So-called efficiency, derived from McKinsey type analysis, is being promoted at the expense of genuine localism, citizen involvement and listening carefully to what an increasingly educated and curious population has to say about what is going on around it. This trend is directly counter to what TESS has identified as valuable for biodiversity conservation and doubtless for other public goods of the non-monetary type.

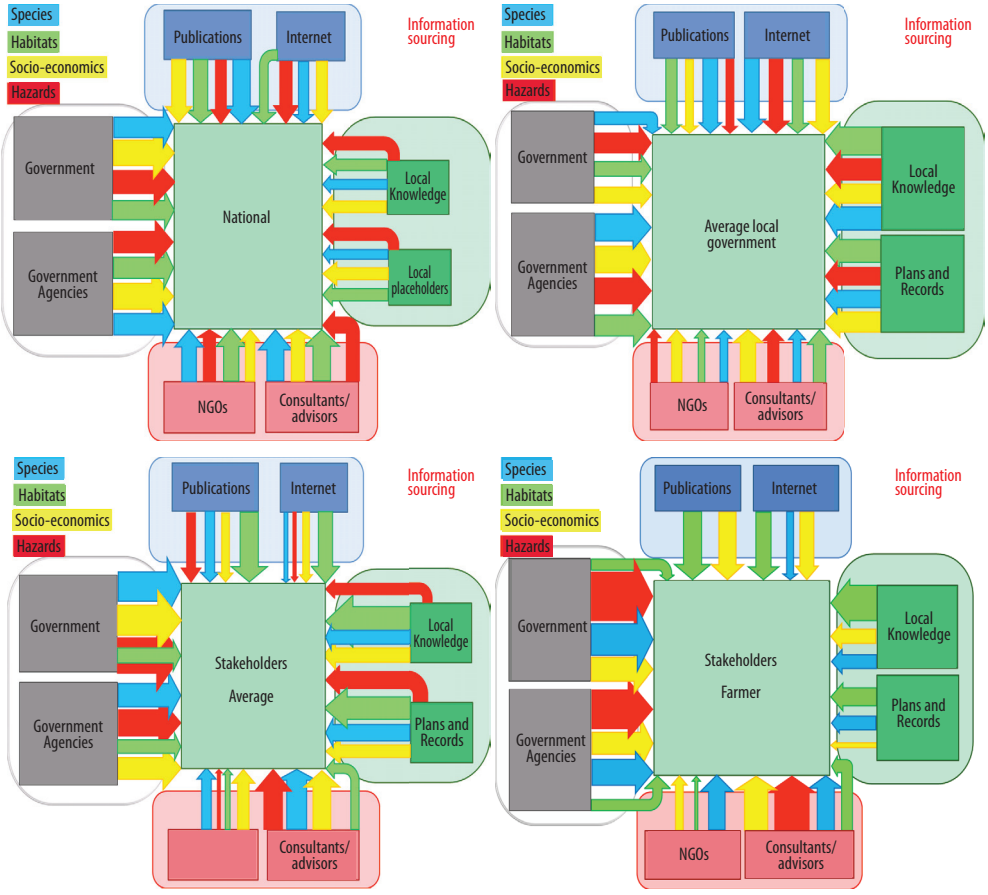

Fig.2 The proportion of information on species, habitats, socio-economic considerations and hazards that were provided from different sources to national government, local authorities, private managers in general and farmers in particular.

The drivers of information needs were fulfilment of statutory duties, local policy formulation and the need to guide management decisions. Local stakeholders tended to get most of their information on socio-economics, species and hazards from government and consultants, but to generate most of the information on habitats themselves; yet this local knowledge was relatively little used at national government level.

As already noted, SEA+EIA assessments were not very significant for those surveyed at local level in many countries, which is perhaps not surprising when in many countries there are fewer than 200 formal SEA+EIA's annually. When informal decisions were also considered, individual private local stakeholders took many more decisions than local authorities, doubtless mainly of a management character, but it was not feasible to distinguish between the importance of various decisions. Apparent needs for information may be influenced by the type of decision and the extent to which stakeholders consider that their participation in formal processes conducted by local governments is genuine. Difficulties in obtaining adequate information for decision-making were widely reported by user groups, especially at regional and local levels. Where data existed, accuracy, spatial scale and age of data were noted issues.

Local authorities were also asked about the information that was needed on biodiversity and ecosystem services and what was actually available. There was great variation in both the need and availability of necessary information.

At local level decisions were also assessed in terms of the areas estimated to be affected per decision. Informal decisions, probably mostly affecting council amenity land, related to much smaller areas than did statutory assessments, so that on average council decisions

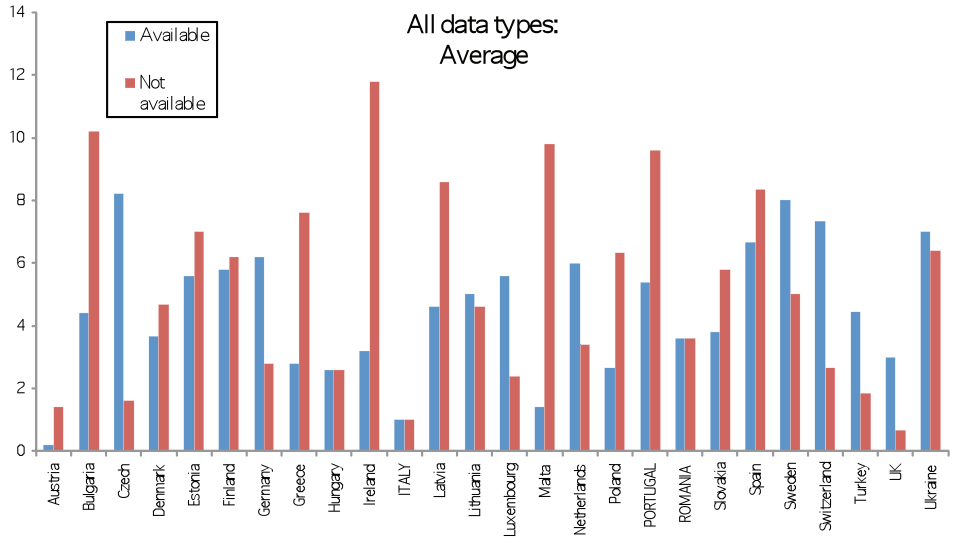

Fig.3 The relative demand for data needed to make environmental decisions that was available, and unavailable, in local administrations across Europe.

affected smaller areas than other stakeholders. Taking into account the greater average area affected by decisions of private managers and the greater number of them than of councils, all except managers of fisheries had a decision density 4-5 orders of magnitude greater than that of local authorities.

Information requirement on ecosystems for provisioning (crops, medical, biofuels), regulating (flood/fire/disease hazards) and supporting (water/air/ soil quality) services was also highly variable, whereas information on cultural services (amenity, recreation, tourism) was generally in high demand (except in a country where local authorities were most interested in natural hazards). Information on biodiversity (protected and harmful species and habitat maps) was also generally in high demand.

We may conclude from these considerations that decision making within the environmental sector is a complex process that relies on dense patterns of data exchange between stakeholders and local, regional and central levels of government. Accordingly the following guidelines are suggested:

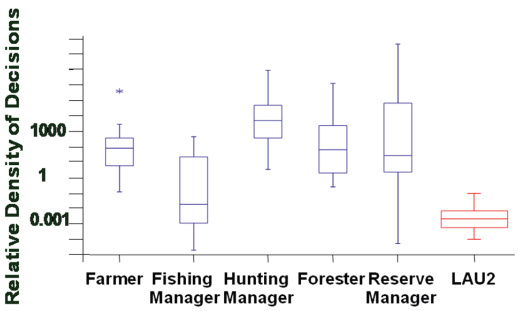

Fig.4 The density of decisions, taking account not only of decision numbers per management unit but also the area covered by each decision and relative abundance of different management units, indicates greater importance of private decisions than of those taken by local governments.

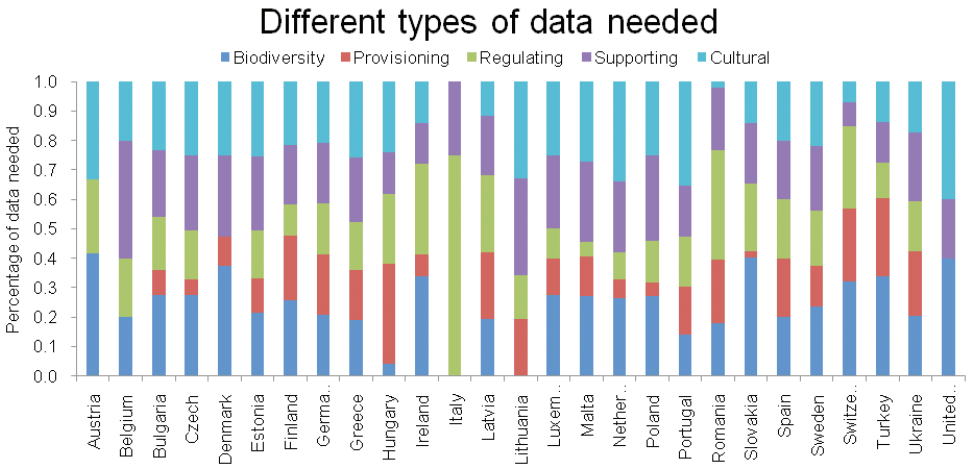

Fig.5 The proportions of different types of data for making environmental decisions that were needed by local administrations.

7 The design of an effective environmental information system needs to standardise and centrally collate a wide variety of ecological and socio-economic data that can be scaled for delivery at all levels. However, the precise data requirements need to be understood and, as far as possible, quantified in more detail.

8 In order to refine information needs for different statutory authorities and stakeholder groups further Pan-European survey work will be needed. This would be enormously facilitated if Eurostat were able to establish rigorous sampling frames across Europe for the groups of land users identified by TESS and for local governments with specific functions.

9 Pending the creation of any widely available interactive decision support system, simple guides to what information is available at local level and what purposes it is suitable for would be of value for many users and would save both time and the expense of hiring consultants to extract routine information. Central coordination would assist the production of such guides.

C *Participation in and attitudes towards wildlife-related activities*

The local authorities also produced estimates of the prevalence in their communities of households involved in land-use activities. There was very considerable variation between

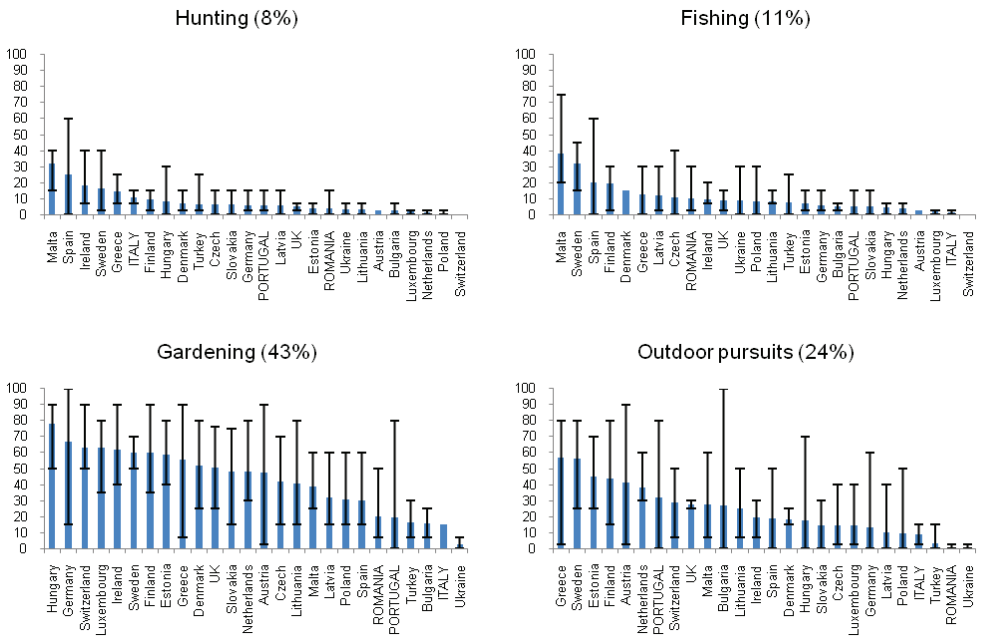

Fig.6 Histograms show the average % of local households estimated by LAU2s to have participants in selected activities dependant on land or species (bars are range of values).

countries in the estimates for every activity. However, the averaged estimates across countries were that 43% of rural households engaged in gardening, 23% in farming, 16% in gathering wild fruits, fungi and invertebrates, 11% in fishing, 8% in hunting and 7% in forestry. Although on average only 5% were thought to go on excursions to watch wildlife, 11% were thought to feed birds at home. The smallest proportion of households (3%) was thought to have members riding horses, but 23% were estimated to use the countryside for other exercise activities.

When compared to the non-randomly selected rural areas in the local case studies carried out by TESS, where households were directly interviewed by surveyors, these participation rate estimates appear to be very low. Direct interviews revealed 53% of households engaged in gathering, 35% in fishing, 18% in hunting, 11% in horse-riding, 32% in wildlife watching, 47% in attracting wildlife with food and 57% in taking exercise in the countryside (see Fig.7 below). This underlines the importance of direct interviewing of individuals by random sampling across EU countries, rather than relying, as TESS perforce had to, on local government estimates of their activities. It also re-inforces the findings of the UNWIRE study that many millions of EU citizens benefit from wildlife-related activities and spend their own money on them.

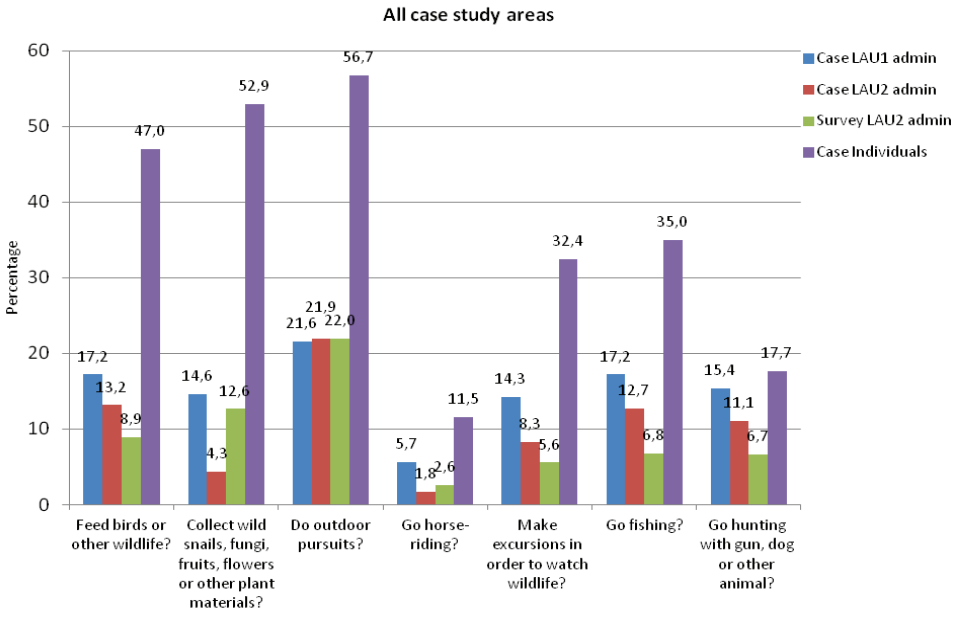

Fig.7 Participation rates in wildlife-related activities comparing individual interview results with those from local authority (LAU1&2) estimates.

10 **The relevance of participation in wildlife-related activities by millions of EU citizens and the direct and indirect spending associated with these activities should be appreciated by policy-makers.**

11 **Accordingly Eurostat should be invited to carry out assessments of these activities across EU Member States by appropriate sampling methods, as has been practised for a number of decades in the United States.**

As already mentioned the socio-economic surveys carried out in the local case study areas demonstrated much higher participation rates in wildlife-related activities (feeding birds, gathering fungi, angling, hunting etc) than did the Pan-European surveys which relied on local administrations for their best assessment of such participation. What is also interesting is that local people took a balanced view of the benefits and disadvantages of wildlife, though with a clear inclination to seeing it positively. Clear majorities valued biodiversity for use as food and for recreational activities associated with it. Thus their attitudes appeared to be pragmatic rather than sentimental, in contrast to what is sometimes seen at national level where well-organised groups with a non-pragmatic approach may have an undue influence on conservation policy. Engagement in countryside activities was minimally affected by educational level.

12 **Biodiversity conservation policies need to take full account of the perceptions and attitudes of the people who live closest to wildlife and the countryside if their support for and active participation in conservation is to be secured. These attitudes should be regularly surveyed by the Commission, using the highly developed tools available to Eurostat.**

d *Citizen capability for biodiversity mapping*

As well as surveying local attitudes to the importance of wildlife, the local case studies encouraged local volunteers to test the use of specially purchased digital tablets suitable for use in sunlight in order to map biodiversity and land use information at local level. This experiment was constrained by the development of the technology available at the time when planning took place (late 2009) and the resources of country partners to engage local people in the experiment. Even though only 46 people in 8 countries eventually took part the results were both interesting and encouraging. The majority of helpers had no previous experience with mapping equipment, which makes their comments especially interesting.

76% rated the mapping hardware favourably and 67% the software. Suggestions for improving the mapping facilities from the users included a need for better GPS capabilities (20%), improved maps (20%), more sensitive touch screens (9%), more visible screens (7%), less weight (7%) and longer battery life (4%). 80% of helpers considered they had gained

significantly in knowledge from their participation in the project and a similar proportion would be likely or very likely to participate in such projects in the future. 97% of participants considered that their governments should support mapping projects of this kind. It was notable that the rural case studies showed high interest and competence in citizen-science mapping of habitats and species, together with a high level of engagement in wildlife-based recreational activities which could inform and motivate mapping. Accordingly we make the following recommendation:

13 **Noting the rapid progress made in the development of digital tablets, the fall in prices and their dramatic uptake by the public over the last two years, European institutions, national governments and agencies should promote further experiments and training for local people in mapping for the monitoring and conservation of biodiversity and related socio-economic purposes.**

e *Biodiversity trends associated with high-level assessment practices*

At the opposite end of the spectrum to these surveys of attitudes and activities at local level, an attempt was made to relate perceived trends in biodiversity, conservation and human development indicators at European level with information derived from the TESS and GEM-CON-BIO projects in order to see whether any potentially significant correlations occurred. This is not an easy task but it is important not just to accumulate information but to see where it may be leading and to take corrective action where feasible. Even where correlations seem surprising or implausible, fresh analysis of Europe-wide indicators may give cause for reflection.

This need for reflection applies particularly to recently available CORINE data relating to land cover change across the Continent. Protection status does not yet appear to have any positive effect in reducing the mean rates of conversion from other land-cover categories to artificial surfaces across countries. Artificialisation increased significantly between the periods 1990-2000 and 2000-2006, with no significant differences between areas inside and outside Natura 2000.

In view of the very strict constraints which the Directives impose on development in protected areas, this information suggests the need for investigation. It also calls into question what assessment processes may have been followed in the cases concerned. It is not surprising that growth of artificial surfaces is linked both to population and economic growth, but one of the main purposes of the Directives is to shield the most precious elements of Europe's natural heritage from the adverse impacts of economic growth. Another unexpected CORINE finding is that the area of semi-natural habitats increased between 2000 and 2006, possibly at the expense of intensive agriculture.

14 **Land-use changes are of fundamental importance for conservation policy. Those recorded by recent CORINE data merit urgent investigation. A locally-based recording and mapping system such as is being developed by TESS could rapidly feed information to higher governmental levels, enabling policy adjustments to be made as appropriate.**

Correlations also showed that the proportion of hunters in the population was generally highest in countries with low human density and an abundance of semi-natural habitat. These were also countries with more positive species conservation status. Since separate studies have established that habitats which are modified for shooting pheasant, partridge and grouse are good for a whole range of non-target species, this is a useful piece of corroboration. While it may not be clear why a prevalence of anglers is linked with knowledge of species' conservation status and strong influence of NGO's, it may be reassuring that these phenomena can successfully co-exist.

15 **Conservation policy and practice should recognise the legitimate interests and, indeed, positive contribution of such users of land and water as recreational shooters and anglers. Stakeholder partnerships using monitoring and adaptive management will maximise the input of human and financial resources.**

The TESS survey asked local administrations to score how strongly residents perceived benefit from biodiversity (in terms of food, materials, recreation, tourism, etc), and also how strongly their perceived costs (in terms of pests or risks from disease or wildlife, etc). The scores for perception of benefit and cost were used to derive a 'nature positivity' index.

This index, which was available for 28 countries, proved to be strongly related to different capacity, priority and process variables which were in turn associated with SEBI 2010 indicators. The strongest relationship was with the World Bank governance capacity variable 'Political Stability'. Fifty percent of the variation in nature-positivity (controlling for population density) was explained by the 'Political Stability' variable. This was an improvement on a recent Gallup survey where knowledge of the word "biodiversity" was used as a proxy for nature positivity; recognition of the word "biodiversity" provided no significant positive correlations with any impact variables used in the TESS analyses.

16 **Further examination of the nature-positivity index is needed. This should cover both the elements that make it up and the external factors that may influence it.**

f *Working towards a decision-support system*

TESS trawled widely for decision support models already in existence that might be useful for local land managers, and could perhaps be made easily available in exchange for mapping. Of 198 models volunteered or selected as suitable for TESS from about 2,400 in databases, 72% were still traceable on line, 49% were suitable for consultation at a local level and 39% were accessible as downloads or web-services. However, only 5% were considered usable by ordinary people for local level (a proportion which fell below 3% in a larger sample). Only 2 of the 205 traceable used large external databases (both of these were based on data in the USA). The conclusion was that the only substantial decision support available was for agricultural and forestry production. There was little on biodiversity and almost none for non-experts to use. The technology transfer gap in this area is large.

There is also a major language gap. Only one of the models for decision support at local level by ordinary people operated in a language other than English, although there may be models not yet found which do so. To support management decisions to the same standard across Europe requires a system operating in many languages, and bringing together the best models and practice in many languages.

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The case for a comprehensive decision support system for local land users to integrate environmental, social and economic goals is very strong. However, it will take substantial resources and time to achieve such a system in practice. There are some decision support tools available to use in the short-term but they are limited in application, coverage and the availability of languages other than English, with the consequence that much development work is needed to improve technology transfer in this area.

While a sophisticated technological tool would be at the heart of a fully-fledged Pan-European environmental decision support system, it would also be essential to consider demand and supply for the information in that tool, the ease of its use for field-based practitioners, what would motivate users to use and possibly pay for it and the costs of building and maintaining it long term. TESS considers that to re-diversify land-use and hence support biodiversity we need a tool that is attractive to a full range of partners: government at different levels, local communities, voluntary associations and individuals. All have contributions to make to assembling information which can lead to knowledge-based decisions, with scientists guiding and helping to organise the process. Maps are increasingly used by all these groups for data collection and are a convenient lingua franca between people in different countries. Ultimately, an intelligent web-GIS could link knowledge to maps in ways that are analogous to those by which spelling and grammar are built into word-processors.

Funding issues are likely to inhibit the building of a comprehensive super-model to deliver decision support across all European countries, land-uses and socio-economic variables. Even more pertinent is the constraint that current technological development cautions

against this approach, since there has been little technology transfer of extensive scientific modelling. While higher level processes such as EIA or Natura 2000 designations can afford to assemble site-specific data and the EEA is able to present comparable country information for some biodiversity indicators, the big gap in mapping biodiversity information for monitoring and decision support is at the local level. This is because the current Pan-European maps of land-cover, in the CORINE system, are developed from satellite images to represent habitats in blocks of 250m x 250m. However, for population modelling of the smaller animal and plant species, local mapping at scales of 5m and less is needed.

The building of detailed GIS coverage for field and garden scale at local level would have great advantages for forecasting biodiversity at all levels. However, like the development of decision support to motivate such mapping, it would be a gradual process. The challenge is to start that process. A practical first step could be to provide a one-stop site for ideas and knowledge that can attract individuals and communities, to which existing and new toolkits and decision support systems can be linked in a user-friendly way.

To investigate how such a site might be made attractive as it develops capabilities, national and sub-national organisations representing land users across Europe were asked to complete a questionnaire via Survey Monkey about their and their members' requirements for web-based advice and information. 50 usable responses from 22 countries were obtained. 48% were from hunting bodies, 18% from agricultural and water management organisations, 18% from nature watching associations, 8% from anglers' groups, 6% from dog-training bodies and 4% from gatherers of wild resources. Together the bodies concerned had some 1.7m members.

Two consecutive questions asked (i) "Which of the following services are on your web-site?" and, for the same list of 15 services, (ii) "How would you prioritise services for your members on an ideal site?" The resulting scores for presence and priorities were ranked, with the difference indicating the strength of aspiration for the service. Thus, although news-feeds on conservation, discussion boards and e-shopping facilities were widely present, they were not strongly prioritised and thus rank as low aspirations for a portal. Opinion-polling was quite widely available and also popular. On the other hand, examples of best practice, links for decision support (since few organisations used these directly) and monitoring systems were quite widely present and strongly prioritised, while advice on production and wild resources was highly desired but relatively unavailable; services for conservation mapping were also highly required relative to their availability.

Although these samples were small and not statistically representative at a European level, the responses support the thesis of TESS that internet-based decision support on land management related to biodiversity and livelihood interests, with provision of mapping advice and decision support on resources, would find a substantial take-up across Europe. It is also clear that any portal needs to be developed with a responsive attitude to the needs and wishes of a variety of users. Accordingly the first stages of the portal www.naturalliance.eu have been developed within TESS and will be taken forward by some partners after the conclusion of the project. The approach to this initiative can be characterised by the following guideline:

18 **In developing internet-based advice and support for land managers using simple mapping tools, attention should be given to what works and is practical for them, using feedback and market testing and bringing together best practice guidance from a wide variety of sources.**

A survey of organisations is relatively easy to arrange on SurveyMonkey, but may not indicate the same information requirements as a survey of individuals. Nor can a survey of organisations reveal what individuals might subscribe to in order to help develop a portal for mapping and decision support.

The final TESS survey is therefore now using the portal to find out what information and support individuals want and to provide mapping tools. Resource users and others are also being given the opportunity to contribute to further development of the decision support, best practice examples and mapping tool that will initially be provided. The intention is to present material in about 25 European languages, building on the network of Country Co-ordinators who provided translations of questionnaires and linked with national and local governments in the TESS Pan-European surveys. The portal also presents links for information on how to benefit from the riches of nature, and how to avoid costs, in order to help develop positive perceptions of biodiversity.

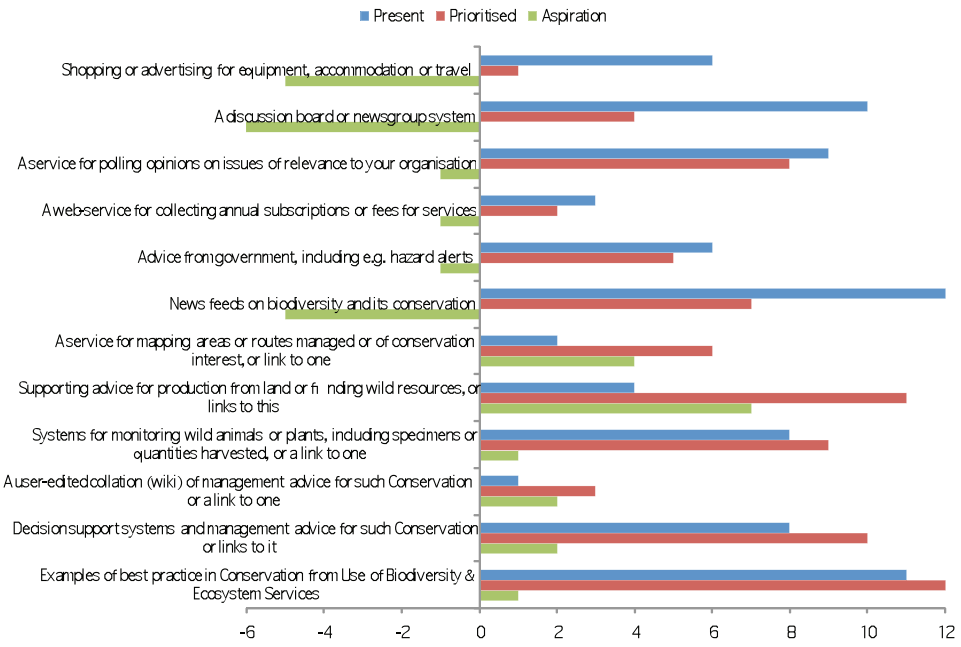

Fig.8 Web-services ranked by availability to organisations (blue) and as priorities for a site (red). High requirement relative to availability (green) indicates services important in a new portal.

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Support should be given to the portal for ideas and knowledge exchange via

(a) publicity aimed at land-users from governments and national associations,

(b) data and best practice case study material from researchers and environmental institutions and,

(c) where feasible, appropriate finance from any quarter.

Conclusions

Overall TESS has been a thoroughly Pan-European collaboration with all 27 EU Member States and four non-EU states involved and within them many officials in central and local governments and stakeholder organisations and private individuals for whose time and interest we are extremely grateful. Although much more research about information needs and technical development of decision-support mechanisms is required, we are moving into a practical implementation phase.

In this we look forward to strengthening partnerships with existing colleagues and entering into new ones. In particular we are deeply appreciative of the offer of the Executive Director of the European Environment Agency at our final conference in Brussels on 25th May 2011 to provide a home for TESS after the project period has ended. We will be exploring the implications of this in due course, but we remain convinced that environmental information needs to be gathered and used by ordinary citizens subject to safeguards about what is sensitive at an individual level and within a common EU-wide framework. We believe that such an approach will demonstrate that those who manage and benefit from land and species are not the problem but the solution to conserving and restoring Europe's biodiversity.

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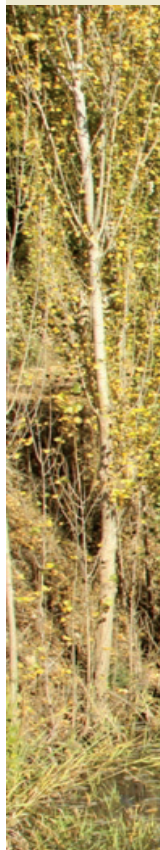

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