Costs and benefits assessment of monitoring approaches for measuring progress towards the EU 2020 biodiversity target

DG.ENV.F.1 TL/ka Ares (2009)

Client: European Commission - DG Environment

Rotterdam, 8 October 2010

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Client: European Commission - DG Environment

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Disclaimer:

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Rotterdam, 8 September 2010

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Summary

The European Union failed to reach its target to halt biodiversity loss by 2010. One reason was the lack of an adequate monitoring system with the capacity to measure progress and lags in biodiversity protection on a European scale. With the EU new biodiversity target now set for 2020, monitoring needs to improve significantly in order to judge progress towards achieving the headline target, as well as all sub-targets.

This report has been prepared for the European Commission – DG Environment and maps out the current monitoring landscape in relation to the targets set by the EU towards halting biodiversity loss by 2020. It disentangles the complex structures of existing biodiversity monitoring, maps gaps between existing monitoring structures and required monitoring needs for the new target, and examines the costs and benefits of choosing various approaches for improving monitoring over the coming years. The results show how European biodiversity monitoring is a patchy landscape with scattered, insufficient and incomparable data; however, with glimpses of good examples of well-monitored biodiversity indicators and initiatives to consolidate information.

EU's 2020 target consists of a headline target and six sub-targets. The headline target is to halt biodiversity loss and degradation of ecosystems services and the sub-targets deal with; sustainable use of resources; overexploitation; fragmentation; nature conservation; invasive alien species; and global biodiversity, respectively. The targets are interlinked and for sufficient monitoring of the headline target, the six sub-targets should also be well covered.

The results of the study show that existing schemes to monitor the targets diverge significantly. Further, possibilities for improvement in future monitoring also differ significantly in costs, coverage and feasibility of implementation over the coming years.

- Monitoring the headline target faces great challenges in terms of coordination and comparability problems between data. National and sectoral monitoring schemes and data are often rich on relevant information but lack the coordination needed for measuring progress towards the 2020 target. The EU has launched several initiatives – such as BISE, LifeWatch and EBONE – to tackle the problem in a comprehensive manner. Monitoring of ecosystem services poses, however, larger hurdles as a clear status baseline is still lacking and adequate monitoring schemes need to come in place.

- The sustainable use of resources in the EU targets for 2020 is represented by HNV farmland and forestry. HNV farmland struggles with streamlined definitions and accurate measurements of spread across the EU. The risk of abandonment and intensification is particularly high in the EU-12 and often due to socio-economic causes. National monitoring schemes are scarce with the exception of Germany which runs a simple yet effective programme. Forestry keeps being a relatively well monitored indicator due to its economic implications; however, the link between forestry sector data and biodiversity is still weak. Forest certification schemes offer a promising additional monitoring tool for the future (at least for the areas under certification) as they require sound monitoring of forest biodiversity status as well as monitoring related to payments for ecosystem services. Finally, any improvements in monitoring should be linked to the upcoming CAP reform process, which could then ensure appropriate funding and support from the sector.

- Overexploitation of fisheries continues to be among the most challenging goals of the new 2020 target to monitor. Current monitoring schemes are unlikely to yield the data needed; however, new initiatives such as the Census of Marine Life and the European Marine Knowledge 2020 Initiative could potentially ameliorate the situation. In a similar vein as with sub-target 1 there is an upcoming revision of the policy, expected in 2013, which should more strongly include action related to monitoring.

- Fragmentation and green infrastructure are relatively new concepts in EU policy. A comprehensive strategy is still lacking and monitoring has yet to begin. An exception is the SCALES program which is a FP7 initiative and aims to start the mapping of biodiversity across scales. Progress in monitoring should be linked to the development of the EU Strategy on Green Infrastructure, which is set to be launched in 2011.

- Nature conservation might be the best covered target in terms of existing monitoring structures. Due to regulation and impressive NGO schemes, some species and habitats – such as birds and butterflies – are well monitored across the EU. However, there is still a substantive amount of work to be done and the expansion of an EU Red List would enable current monitoring schemes to include more species and habitats. Another item is the successful designation of Natura 2000 areas which now covers approximately 18% of EU surface. Challenges remain, however, on how to monitor management practices in these areas.

- Invasive alien species (IAS) lack – like fragmentation – a comprehensive EU policy. The costs of IAS' damage to economic interest in the Union are immense and containing the spread is pivotal and undoubted the most cost-efficient way to deal with the problem. A now finished FP6 programme, DAISIE, mapped out 10,962 alien species in up to 63 countries/regions and 39 marine and coastal areas regions in wider Europe. The continuation and expansion of this programme is urgently needed to get a grip on the situation and assess the success of policy interventions.

- On global scale, the EU is doing best by aiming to get a comprehensive picture of the regional situation and then feed it into larger databases and regimes. The development of an ecological footprint and the DOPA project are steps in the right direction. Also, proper reporting and support to the CBD's monitoring function are essential to improve the situation in global biodiversity monitoring.

In terms of approaches the report concludes that regulation, voluntary/community driven schemes and economic relevance have an impact on biodiversity monitoring. It also shows that Member States often allocate large resources to environmental monitoring and this data collection needs to be harnessed by the EU to improve the EU-level picture of biodiversity monitoring.

Five immediate recommendations for improvement can be made:

1. **Improvements in integration, coordination and comparability of data are essential.**

The collection and integration of data that is collected on all different levels (local, regional, global…) is essential to improve future monitoring. Continuous funding opportunities and support from both Commission and associated institutions and organisations is essential to ensure success in the large-scale data gathering needed to cover the headline and sub-targets.

This report also shows that considerable gains could be made if sectoral datasets - such as fishery and forestry - are made biodiversity relevant. Indicators related to economic activity – such as invasive alien species – are expected to be widely covered as effects from biodiversity loss are relevant for private interests. These synergies should be utilised in a transparent manner in order to avoid bias and utilise readily available data.
Finally, improvements in the current BAP reporting system would likely improve not only the quantity and quality of data collected (i.e. submitted by Member States), but also aid the data integration and data access efforts.

2. **Voluntary and community schemes have great potential to provide low-cost and large-scale monitoring; however, they need to be supported with appropriate resources.**

The challenges of voluntary schemes are to receive data on species and habitats that are not susceptible for amateur monitoring, and to secure resources to include more species and habitats. It is also unclear to what extent and how the promotion of voluntary schemes can be promoted on a European level.

3. **Ecosystem services monitoring is and should be a high priority for improved EU monitoring.**

There is still great uncertainty on which indicators to use and how to measure them. Since ecosystem services have now been included in the 2020 target, monitoring needs to step up its game significantly.

4. **Who pays matters.**

The analysis in this report showed that it is essential that the provider of funding must be ready to allocate continuous funding opportunities. While funding on a time-constrained project basis can be useful for generating a first new attempt at monitoring, overall success of a new or improved monitoring scheme hinges on the provision of continuous funding over a much longer timeframe. Funding sources for existing and potentially new or improved monitoring approaches can generally be divided into: EU schemes, national schemes and co-funded schemes.

5. **Vast differences and unknowns remain with regard to potential costs and coverage of improved monitoring approaches.**

For many of the sub-targets, there are monitoring schemes in place which need to be up-scaled and extended, with secured long-term funding. Given the short timeframe and limited additional budgets and political will available for these types of improvements, this is more important than launching new programmes and initiatives at this stage. The scattered and incomparable nature of much of the data supports this conclusion and advocates consolidation instead of expansion.

1 Introduction

Rich biodiversity[1] offers great benefits for the economy and well-being of Europe. It enables ecosystem services including the production of food, fuel, fibre and medicines, regulation of water, air and climate, maintenance of soil fertility, cycling of nutrients. Biodiversity is in essence instrumental for a prosperous and sustainable Europe.

However, the state of European nature, in terms of variety and extent, is in decline. Changes in agricultural practices, urban sprawl and pollution destroy habitats and change entire ecosystems. Tackling biodiversity decline requires multi-facetted, wide ranging policy actions and has to consider a long range of policy impacts to become effective. These policies in turn, require a broad range of indicators and monitoring tools to know if we are on the right track.

Politicians and policymakers need to know if the decisions and actions that they take and the instruments that they use and develop are effective for the protection and sustainable use of biodiversity. They must also know how other policies are affecting biodiversity and if new or amended policies and decisions are needed.[2] Monitoring of biodiversity with a restricted set of simple and plausible biodiversity indicators[3] is therefore of vital importance.[4]

1.1 Pre-2010: Towards European biodiversity targets

Over the past decades, Europe has been active in biodiversity policy both regionally and globally. In 1998[5], a European Biodiversity Strategy was adopted and followed up by related Action Plans in 2001[6]. At the European Council held in Gothenburg 2001, EU Heads of State or Government agreed "to halt the decline of biodiversity [in the EU] by 2010" and to "restore habitats and natural systems". In 2002, they joined some 130 world leaders under the Convention on Biological Diversity (CBD) in agreeing "to significantly reduce the rate of biodiversity loss [globally] by 2010". As policy response, the European Union adopted in 2006 a Communication on *Halting the loss of biodiversity by 2010 - and beyond - Sustaining ecosystem services for human well-being*, which outlined a holistic action plan. It came about after a call from the CBD to speed up action towards the global 2010 target and aims to complement the European Community's National Biodiversity Action Plans (NBSAP)[7]. In the 2006 BAP reporting, the EU established four policy areas and 10 key objectives, which in turn were translated into over 150 individual priority actions. In addition the BAP identified four supporting measures and stressed the need for improved monitoring and review.

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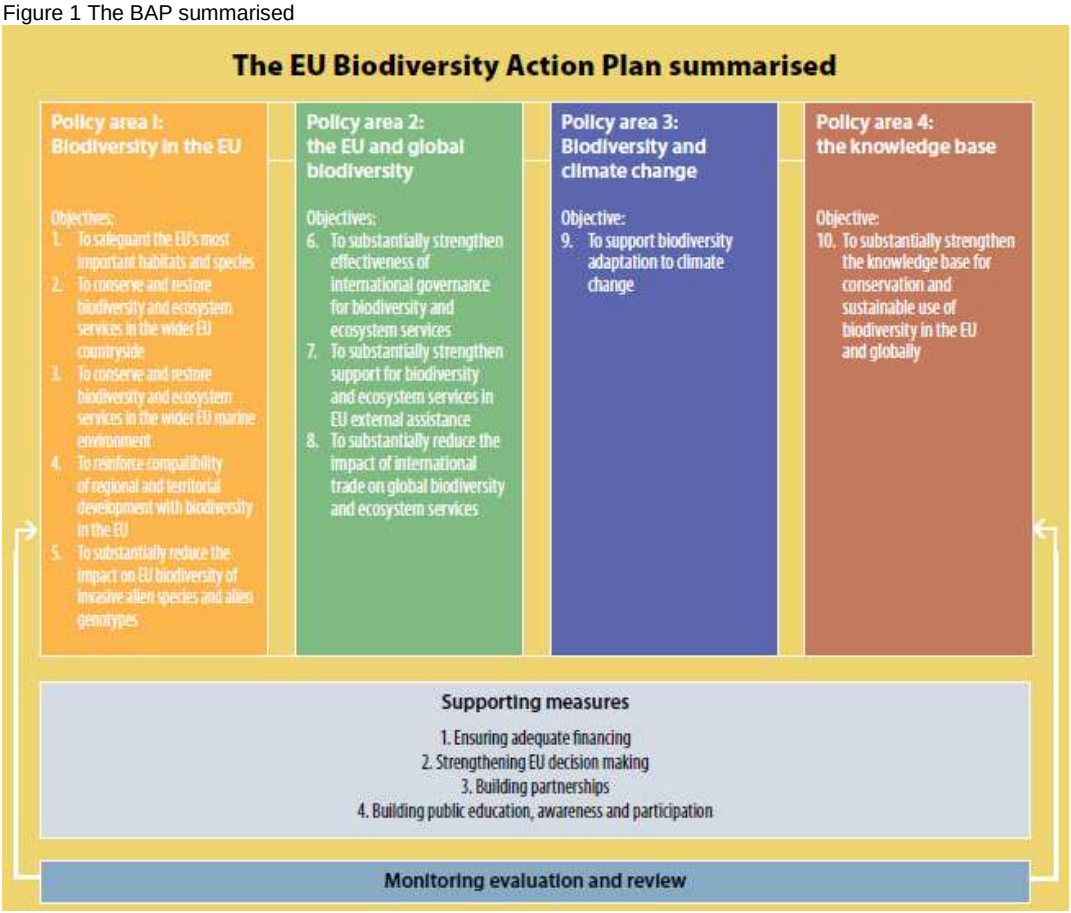
[1] Meaning the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part, also including diversity of genes, species and ecosystems.
[2] ECNC (2003) Are we halting the loss of biodiversity in Europe? ECNC-European Centre for Nature Conservation, Tilburg
[3] Indicators are used to quantify and communicate complex phenomena in a simple and clear way; they should form the basis for future action and should be framed in order that they can be effectively communicated to internal and external stakeholders.
[4] Bibby, C.J. (1999) Making the most of birds as environmental indicators. Ostrich 70: 81-88
[5] COM (1998) 42 final
[6] COM (2001) 162 final
[7] Under Art. 6 in the CBD are Contracted Parties obliged to produce NBSAPs that sets out the use and conservation of biological diversity.

Figure 1 The BAP summarised



While these actions showed political will to turn the tide on biodiversity decline, a 2008 mid-term assessment of progress in implementing the EU BAP concluded that "the EU is highly unlikely to meet its 2010 target of halting biodiversity decline", and that "intensive efforts will be required over the next two years, both at the level of the EC and by the Member States, if we are even to come close to achieving this objective".[8] Nevertheless, the report argued that the legislative framework provided a strong basis to work toward the target, however, implementation was too weak.

Nevertheless, much progress has been accomplished since the 2010 target was adopted – in particular with the establishment of the Natura 2000 network, now covering 17% of the EU territory, which is the largest network of protected areas in the world.[9] Despite this progress, EU biodiversity policy continues to suffer from a credibility deficit and is not seen as being as tangible as other environmental policies (e.g. climate, waste, water or air).

While this may be due in part to the complex and cross-cutting nature of the biodiversity challenge itself (which cannot be captured in a single metric, as it has been done for climate change) assessments carried out to date point to a number of shortcomings related to (1) the policy and (2) the action plans themselves which, in spite of their respective merits, have lacked several features that, in hindsight, seem indispensable in order for the plans to be operational and effective.

[8] http://ec.europa.eu/environment/nature/biodiversity/comm2006/bap_2008.htm

[9] In addition, according to evidence published in *Science*, the Birds Directive has had a significant, positive impact in protecting many of the continent's most threatened birds, which perform far better on average than other bird species in the EU; and the same species outside the EU.

1.2 Post-2010: Process and ambitions

On 15 March 2010, the Environment Council agreed on a new vision and target for biodiversity, reflecting the most ambitious option (option 4) set out in the European Commission Communication *Options for an EU vision and target for biodiversity beyond 2010* adopted in January.[10]

The Spring European Council subsequently endorsed the vision and target on 26 March, 2010, noting that "there is an urgent need to reverse continuing trends of biodiversity loss and ecosystem degradation". The European Council is committed to the long term biodiversity 2050 vision and the 2020 target set out in the Council's conclusions of 15 March 2010.

VISION

By 2050 European Union biodiversity and the ecosystem services it provides – its natural capital – are protected, valued and appropriately restored for biodiversity's intrinsic value and for their essential contribution to human wellbeing and economic prosperity, and so that catastrophic changes caused by the loss of biodiversity are avoided.

HEADLINE TARGET

Halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss.

To deliver on this biodiversity target, a new EU strategy is to be developed, taking into account international deliberations on the new global biodiversity policy framework to be adopted in October 2010.

In its conclusions, the Council has indicated that it expects the EU post-2010 Biodiversity Strategy to:

- set a limited number of ambitious, realistic, achievable and measurable sub-targets for different ecosystems, driving forces, pressures and responses;
- ensure their integration into relevant internal and external EU sectoral policies;
- promote the use of best practices and the use of flexible approaches in line with existing legislation;
- set a clear baseline outlining the criteria against which achievements are to be assessed;
- strengthen the evaluation tools and indicators;
- ensure coherence with the results of the CBD and international negotiations on a global target and framework for tackling biodiversity loss in setting EU action; and
- identify the necessary, feasible and cost-effective measures and actions for the sub-targets.

Given current knowledge gaps on the state of biodiversity and the need to ensure that the measures adopted would achieve the sub-targets, it may be more effective to base sub-targets on a mixture of **status-based and effort-based sub-targets and indicators** rather than focus on the status of biodiversity only.

[10] COM(2010) 4 final.

The current policy landscape and future European biodiversity targets need comprehensive, accessible and policy relevant data to measure progress. To establish robust indicators and create effective yet cost-efficient monitoring schemes thus become highly relevant efforts for policy makers, which brings us to the objective and scope of this study.

1.3 Objective and scope of the study

No matter what exact policy approaches and targets will be adopted by the EU, one of the key elements of the post-2010 EU Biodiversity Strategy will be the need to establish a reliable starting point against which to measure and cost the loss of biodiversity. Delivery of any future post-2010 biodiversity policy will only be successful if it is fully supported by clear targets, a sound status baseline with information on the current state of biodiversity, robust indicators and adequate monitoring systems.

To this end, the purpose of this study is to focus on exploring measures for improving the monitoring for the 2020 headline target and sub-targets. As a first step, status baseline, existing indicators and monitoring schemes need to be mapped against the 2020 targets. As a second step, it is then possible to identify gaps between what the current monitoring schemes can monitor and what needs to be monitored to be able to assess progress towards the 2020 targets. Lessons learned from existing schemes will then help analyse what could be improved in future monitoring in order to be able to assess whether the new targets are being met. In addition, new monitoring approaches or adjustments of old schemes as proposed by experts across Europe are assessed in terms of their costs, benefits and coverage potential.

1.4 Structure of the report

This report is divided into six chapters.

1. Chapter 1 introduced the path towards EU biodiversity targets and presented the objectives of this study.

2. Chapter 2 describes the methodology applied to carry out this study.

3. Chapter 3 includes a mapping of the (possible) sub-targets for a European post-2010 biodiversity strategy and links it to possible indicators, existing monitoring schemes and what needs to be improved in the current situation (i.e. the remaining monitoring gap).

4. Chapter 4 briefly introduces the alternatives to the status-quo by presenting three scenarios with various degrees of ambition, costs and benefits. It starts with a Business-As-Usual scenario of existing monitoring schemes and continues with new ideas or improvements to current schemes (scenario 1), and finally, an optimal scenario (scenario 2) that would allow detailed monitoring of progress toward the headline target as well as all sub-targets for 2020.

5. Chapter 5 offers an analysis of the various options for improved monitoring in terms of their costs, benefits and coverage. This analysis is carried out per (sub)-target and – to the extent possible – linked back to the scenarios identified in Chapter 4.

6. Finally, the report provides recommendations based on previous findings and discussions to guide a future monitoring landscape towards appropriate monitoring of progress for Europe's post-2010 Biodiversity Strategy.

7. The annexes provide supplementary information offering more details supporting some of the analysis carried out throughout the report and provides additional information that has been collected during the project.

    a. Annex A provides an overview of the SEBI indicators
    b. Annex B offers a summary of research initiatives and schemes
    c. Annex C includes brief introductions to selected national monitoring schemes
    d. Annex D contains a list of interviewed experts
    e. Annex E provides a table overview of targets, existing monitoring schemes, gaps and proposed changes
    f. Annex F includes more detailed estimates of the Danish biodiversity monitoring efforts.

2 Methodology

The main methods utilised in this study to review current monitoring systems in light of the new biodiversity target, determine gaps, and assess the costs and benefits of various monitoring options for post-2010 are based primarily on (a) desk research concerning the existing biodiversity monitoring and (b) stakeholder consultation involving key experts in the field of biodiversity monitoring across Europe to gather the relevant options for improved monitoring in the future and the potential costs and benefits of such improvements.

2.1 Overall contributions from Alterra, CBS, ECNC and PBL

The team for this study is in itself composed of (biodiversity) monitoring experts from Ecorys, the Dutch Central Bureau for Statistics (CBS), the Dutch Planning Bureau for the Environment (PBL), the European Centre for Nature Conservation (ECNC) and Alterra, part of the University of Wageningen. Throughout the study, the team has used the expertise available within the said institutions for brainstorming on certain topics and for insights into the field of biodiversity monitoring. An iterative process with the European Commission DG Environment has been employed to exchange ideas on approaches for specific sub-topics, the stakeholder consultation, etc. while making sure the overall direction of the research is kept in line with the expectations of the European Commission. This has been an important, welcome and productive relationship and has helped shape the research accordingly.

2.2 Interviews with experts

Throughout the study various experts on biodiversity and monitoring across Europe have been consulted to provide their review / opinion about current monitoring systems, as well as on ideas for improved monitoring to better judge progress towards the new 2020 EU headline biodiversity target and the various sub-targets. Considering the multi-facetted nature of biodiversity, the expert has been selected carefully to avoid bias and represent the mainstream of a given topic. An overview list with the main experts consulted can be found in Annex D.

2.3 Cost estimations

While some of the more specific research projects and monitoring schemes provide clear budget overviews, others are based on complex interactions between various stakeholders without a known overall budget. For these schemes – as well as for potential future initiatives – cost estimates have been made based on expert judgment as well as extrapolations from cost indications, e.g. national cost estimations could be up-scaled to EU-27 level as a rough estimate for monitoring costs of a certain scheme. In some cases national authorities have been contacted directly to give an indication on Member State programmes and related costs.

3 Mapping of existing monitoring schemes against the EU 2020 biodiversity target

This chapter maps the current monitoring situation of the headline target and the sub-targets. It identifies ongoing monitoring schemes and maps them in terms of coverage, gaps in coverage and financial costs.

The first part aims to briefly introduce the targets and indicators relevant to measure progress. The second part describes problem, policy context, specific target, relevant indicators, existing monitoring schemes and gaps in monitoring of each (sub)target. The final part explores the synergies between monitoring schemes and discusses gaps in indicators.

3.1 Introducing targets and indicators

Already in the previous reporting period, having set targets to halt the loss of biodiversity by 2010, it became essential to define the key attributes of biodiversity to be monitored to assess progress. Key initiatives have been developed at different levels (global, EU, national…) since, because of the complexity of ecological systems, there is no universal indicator which can accurately reflect changes in biodiversity in different ecosystems at different spatial and temporal scales. Subsets of indicators are therefore needed to obtain balanced assessments of the trends of biodiversity.[11]

3.1.1 Indicators for biodiversity: SEBI 2010

In Europe, the EEA coordinated the development of a streamlined set of biodiversity indicators, grouped by themes agreed by the Parties of the Convention on Biological Diversity - CBD focal areas (which included status and trends, threats, ecosystem integrity, sustainable use, etc) called "Streamlining European 2010 Biodiversity Indicators" (SEBI2010) process. SEBI2010 was launched in January 2005 in close collaboration with global, EU and national indicators experts. A list of 26 indicators was annexed to the EU Biodiversity Communication in 2006 and endorsed by PEBLDS in January 2007.[12,13]

It should be noted that SEBI was a comprehensive stakeholder based process that began with the generation of over 140 possible biodiversity indicators, that by 2007 had been reduced *via* the application of rigorous criteria to 26; as such it should be recognized as the most comprehensive, peer group reviewed and validated set of indicators (which also has the support of the European Commission and UNEP, and has been endorsed by the EU and PEBLDS).

In 2008, the 26 SEBI indicators were produced and published as a set of documented fact-sheets annexed to the EU BAP Mid Term assessment. In 2009, the EEA[14] presented a first indicator-

[11] Norden (2009) State of biodiversity in the Nordic countries. An assessment of progress towards achieving the target of halting biodiversity loss by 2010. TemaNord 2009:509.

[12] EEA (2007a) Halting the loss of biodiversity by 2010: proposal for a first set of indicators to monitor progress in Europe. Luxembourg: Office for Official Publications of the European Communities, 2007

[13] See Annex A for a complete list of indicators.

[14] EEA (2009) Progress towards the European 2010 biodiversity target. Report No 4/2009

based assessment of Europe's progress towards its target of halting biodiversity loss by 2010, which confirmed the trends highlighted in the mid-term assessment.

SEBI 2010 indicators are European in essence but need to be validated by data from the Member States, Accession States and other countries within Europe. To be fully functional the indicator set would need to be applied at national level as well. For this effect, the EEA produced a fully documented methodological report in 2007, which is being updated in 2010. According to 2010 BAP latest assessment only Cyprus and Luxemburg are not having national biodiversity indicator sets. Some countries (Belgium, the Netherlands, and the UK) have aligned their indicators to the SEBI framework. Twenty five Member States have some indicators that correspond with the SEBI indicator framework. According to the information available, national indicators that correspond to SEBI 2010 indicators show a bias towards the following SEBI indicators: Nationally designated protected areas (23 Member States); Abundance and distribution of selected species (birds; butterflies) (22); Freshwater quality (20); Species of European interest (19); Habitats of European interest (18); and Invasive alien species in Europe (17). SEBI indicators that have few corresponding national indicators include the following: Fragmentation of river systems (5 Member States); Aquaculture: effluent water quality from finfish farms (2); and Patent applications based on genetic resources (2).

Ideally, national monitoring programme would need to be applied according to a range of common criteria that would ensure cross country consistency, comparability and cost effectiveness.

3.1.2 Indicators from other sectors

Much use is already being made for existing indicators linked to the economic productivity of, for example, agricultural, marine and forest ecosystems, but few indicators are really relevant for assessing sectoral impact on biodiversity. Such collaboration should be maintained and built upon in relation to forthcoming reviews of policy in relation to agriculture and maritime systems, and the implementation of directives in relation to freshwater management (e.g. the Water Framework Directive). Synergies remain to be exploited with sectors such as spatial planning, transport and energy.

Efforts should be made to consider a range of more targeted indicators to be integrated into current sectoral monitoring frameworks. Such indicators would represent cost-effective solutions as they could be measured and incorporated into the ongoing and current implementation of legislation in relation to agriculture, fisheries, regional development, development cooperation and environmental impact assessment.

On a more abstract level, indicators and accounting for ecosystems and biodiversity should be included in a macro context. The TEEB D1 report argues:

> "Ecosystems are badly – and even equivocally – recorded in national economic accounts, at best as an economic resource able to generate monetary benefit for their owners i.e. they feature only in proportion to this private benefit. A range of ecosystem services supporting production are merely considered as

externalities. Free amenities and regulating services supplied by thriving ecosystems are absent from the picture."[15]

TEEB D1 further explores the idea of including natural capital (stocks) and ecosystem services (flows) in national accounting. In this sense, price signals and market forces would better appreciate the real value of biodiversity and ecosystem services. However interesting this idea may be, it is beyond the scope of this report to further explore its potentials.

3.1.3 Targets for biodiversity

Besides the 2050 vision and the 2020 target introduced in Chapter 1, the European Commission has developed 6 strategic sub-target themes that would cover the various aspects of the 2020 headline target in more detail:

- Sub-target 1 - Integration and sustainable use of resources
- Sub-target 2 - Overexploitation
- Sub-target 3 - Fragmentation and Green Infrastructure
- Sub-target 4 – Nature conservation
- Sub-target 5 - Invasive alien species
- Sub-target 6 - Contribution to global biodiversity

In the following sections, each target will be introduced, linked to relevant indicators and existing monitoring schemes.

3.2 Headline target

In Gothenburg 2001 European leaders adopted a target to halt biodiversity loss in Europe by 2010. Additionally, in 2002 world leaders adopted a similar target on a global level within the framework of CBD. It is becoming evident, however, that biodiversity loss continues with unrelenting speed and neither the European nor the global target will be met. Reasons for missing the target are mentioned in the Commission's Communication *Options for an EU vision and target for biodiversity beyond 2010*. Implementation gaps, policy gaps, policy integration, funding, and most relevant, knowledge and data gaps, are listed as possible variables. In particular, monitoring and data gathering to assess progress towards the headline target has not used a comprehensive approach, national reporting has been uneven, and common indicators have been missing.

Monitoring progress towards an overall target is riddled with complexities. Biodiversity is not easily captured in one or even a few variables but by a set of interconnected indicators. The SEBI indicators process already mentioned is one, still ongoing, process to create a comprehensive and common framework for measurement. Moreover, the EEA has launched the Biodiversity Information System for Europe (BISE) and on a global level, the EU is propagating for an Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) imitating the Inter Governmental Panel on Climate Change (IPCC). All these actions are meant to address the shortcoming of the last decade; however, to gain momentum, European leaders have set out to create a new target for 2020.

[15] TEEB – The Economics of Ecosystems and Biodiversity for National and International Policy Makers (2009) p.27.

3.2.1 Towards a target

The European headline target for 2020 aims to direct policy towards a substantial increase in efforts for stopping the current decline in biodiversity but also to restore ecosystems and contribute to reducing global loss. It reflects an increased attention for ecosystem services and human - nature interaction and the need to understand and quantify the benefits derived from our natural system.

The following formulation has been agreed upon:

- Halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss.

3.2.2 Relevant indicators

Capturing biodiversity in one indicator has proven extremely difficult and progress must be measured against a broad range of matrices. Hence, indicators on the headline target include the full SEBI list and other relevant indicators, such as the response indicators provided through the BAP assessment.

3.2.3 Corresponding existing monitoring schemes

As acknowledged in the Commission's communication on future options for European biodiversity policy, a comprehensive monitoring system is currently missing. On a Member State level, the EUMON project collects information on monitoring schemes, systems and methods.

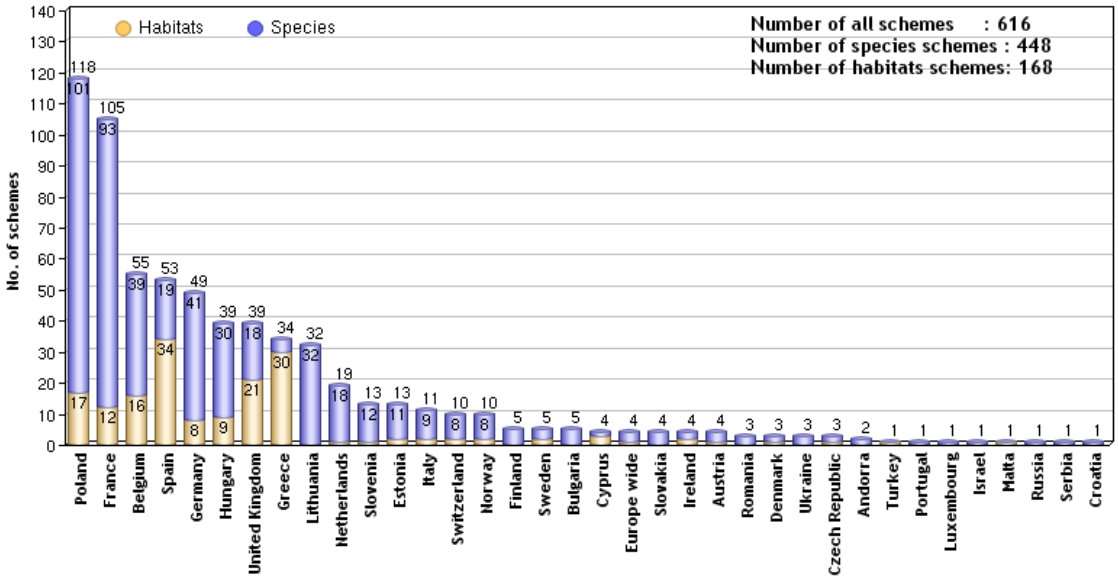
EUMON[16]

EUMON is a project collecting information on EU-wide monitoring methods and systems of surveillance for species and habitats of Community interest – focused on four major aspects important for biodiversity monitoring: the involvement of volunteers, coverage and characteristics of monitoring schemes, monitoring methods, and the setting of monitoring and conservation priorities. It further developed tools to support biodiversity monitoring.

The EUMON project does not specifically examine the gaps that exist between the current monitoring schemes in place across Europe and what is needed to monitor the new EU post-2010 strategy. Rather it analyse current species and habitats monitoring in place across Europe in different countries and provide information on the types of species and habitats being covered by such schemes. In Figure 2, the coverage of monitoring schemes is depicted for different European countries.

[16] http://EUMON.ckff.si/

Figure 2 Number and type of monitoring schemes in Europe[17]



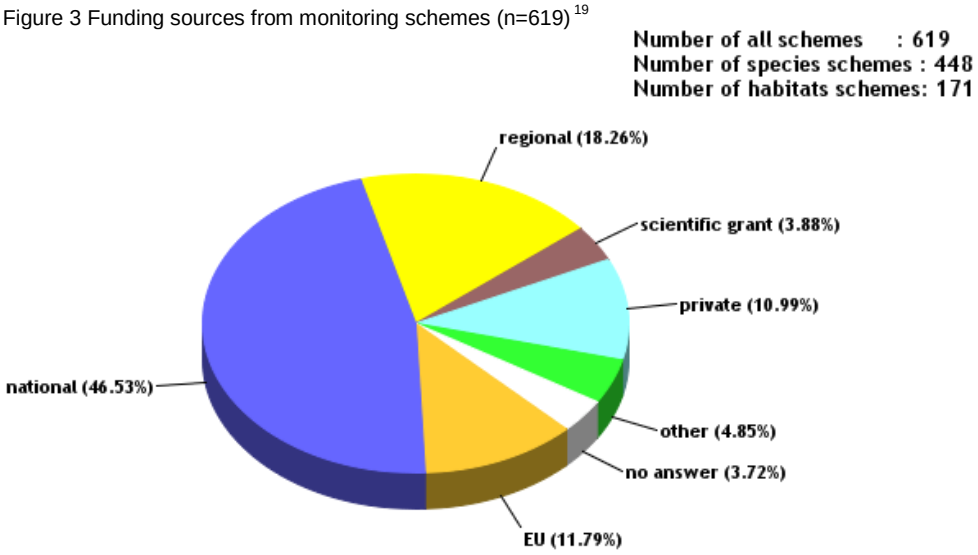
Notably, the EUMON project shows large differences in the monitoring situation across Member States. Poland and France have the largest number of monitoring schemes in Europe, the vast majority of those being species-based monitoring schemes, whereas most countries have less than 10 monitoring schemes while others have.

In a 2007 evaluation of European monitoring systems, using EUMON as base, concluded that of 395 species-monitoring schemes led by 227 in 28 European countries, the total annual cost was approximately €4 million, and engaged more than 46,000 people, who devoted over 148,000 person-days per year to monitoring activities. Only 13.3% of the participants in the monitoring programs were professionals.[18] In September 2010 EUMON comprises 628 monitoring schemes where of 456 species-monitoring and 172 habitat-monitoring. Schemes are in general funded on a national or regional level; only 11.9% are directly funded by the EC.

[17] EUMON

[18] Schmeller D. S., et al 2007 Advantages of Volunteer-Based Biodiversity Monitoring in Europe. Conservation Biology Volume 23, No. 2, 307–316.

Figure 3 Funding sources from monitoring schemes (n=619) [19]



EUMON was an FP6 project run between 2004 and 2008 with an initial budget of €2.22 million out of which €1.5 million came from the EU. A core group of EUMON scientists continues to develop and maintain this portal, with the support of new EU projects: EBONE and SCALES (see sections below).

EUMON is the most comprehensive mapping of biodiversity monitoring schemes in Europe yet. The results showed "*that biodiversity monitoring is not following a standardized approach in Europe, making it difficult to assess the state and trend of biodiversity across geographical and temporal scales from collected raw data".*[20] It also showed that we have a good theoretical understanding on how optimal monitoring would look and that there are several recommendations for improvements that are left unnoticed.

In conclusion, EUMON is an excellent first start to get an overview of existing monitoring schemes covering species and habitats in Europe. It gives a general idea on coverage, costs, funding sources and voluntary/expert ratio. Yet, EUMON omits schemes covering other more complex aspects such as: ecosystem services, connectivity and beyond EU borders.

EUMON also showed that European biodiversity monitoring sports a large number of schemes and initiatives, however, with a number of problems leading to a sub-optimal situation: (1) Monitoring methodology is not streamlined, making data incomparable; (2) Lack of data integration to provide a comprehensive picture; (3) problem with finding the right balance of professionals and volunteers; (4) effectiveness of management efforts are rarely monitored; and (5) tools for making biodiversity data accessible are largely absent.

In relation to the post-2010 headline target, EUMON reveals two pressing gaps in monitoring which researchers have begun to address: (1) knowledge on ecosystem level; and (2) the lack of coordinated, integrated and easily accessible data for biodiversity monitoring.

[19] EUMON 2010-09-07 http://EUMON.ckff.si

[20] Schmeller 2008 European species and habitats monitoring: Where are we now? Biodiversity Conservation (2008) 17: 3321-3326

RUBICODE[21]

The post-2010 headline target starts: *Halting the loss of biodiversity and the degradation of ecosystem services*. Increased focus on ecosystems demands a more complete picture on what actually constitutes an ecosystem service and how to monitor it. While the ongoing Economics of Ecosystems and Biodiversity (TEEB) study is expected to yield a greater understanding of the value of ecosystem services, the actual monitoring and indicators are largely under-developed. An FP6 project, 'Rationalising biodiversity conservation in dynamic ecosystems' (RUBICODE) ran between 2006 and 2009, aimed to identify knowledge gaps in biodiversity and ecosystem services to guide further research. Anton et al (2010) summarised the key findings of RUBICODE with a list of 70 research recommendations listed under seven groups: ecological underpinnings of ecosystem services; drivers that affect ecosystems and their services; biological traits and ecosystem services; valuation of ecosystem services; spatial and temporal scales in ecosystem service assessment; indicators of ecosystem services; and, habitat management, conservation policy and ecosystem services. The shared amount of research areas hints the great uncertainties regarding ecosystem services. On monitoring, the most pressing demand recognised under RUBICODE is the need for indicators. Anton et al write[22]:

> "Indicators for monitoring ecosystem services are an essential tool for communicating complex patterns and processes to decision-makers and measuring the success of conservation actions. However, the majority of existing indicators assess trends in biodiversity and habitat quality for monitoring local or sectoral conservation strategies and do not address ecosystem services directly. Research is needed to develop indicators that cover the functional, structural and genetic components of biodiversity and to test the relevance of trait-based indicators for ecosystem services. Assessments should also be based on scientifically developed and proven benchmarks using standardised sampling schemes at all necessary scales to generate high quality comparable data."

A large number of European universities and institutes participated in RUBICODE. The EU contributed with €1.99 million to the total budget of €2.16 million.

Forest Stewardship Council (FSC)

Another established mechanism that can help in the monitoring and more structured approach for ecosystem services is the Forest Stewardship Council, or other similar certification schemes. The FSC Global Strategy (2007) outlines that "the system of FSC standards and the infrastructure that has been created is also now demanded in other settings, where 'textbook' solutions are lacking, such as in the new markets for carbon sequestration, ecosystem services, biofuels, and green energy. And FSC continues to play a vital role in under-resourced forest regions around the world." Therefore, FSC will "strengthen existing partnerships as a key mechanism in implementing the FSC Strategy and develop new partnerships that support and complement responsible forest management (e.g. carbon credits, commercialization of ecosystem services, sustainable tourism and eco-tourism, sustainable biomass energy). So far only very few FSC certificates have been issued for the purpose of PES (payment of ecosystem services) only, and FSC just started to get more actively engaged in these partnerships. FSC and partner organisations see an important role for FSC in this area. On "The Katoomba Group's Ecosystems Marketplace" FSC as such is already listed under "Other Environmental Markets or Payment Schemes".

[21] http://www.rubicode.net/
[22] Anton et al 2010,. p. 2991

The German development aid Agency GTZ (2005)392 states that “Because the value of the forest to sustainable development lies specifically in the variety of products, forest certification should cover all products and functions. Specifically, forest certification should also include certification of CO2 binding, water storage and purification as well as certification of nature reserves.”

Thus, FSC or other forest certification schemes, could play an important role in the future as regards a more structured approach to ecosystem services, payments for ecosystem services and the monitoring of progress related to these services.

LifeWatch

The outcome of EUMON highlighted the need to gather biodiversity data and integrate it to create a comprehensive picture to be used when monitoring the progress of the headline target. EU funds or co-funds several on-going projects which aim to present a more complete picture of state and progress of European biodiversity.

Firstly, LifeWatch aims to construct and bring into operation the facilities, hardware, software and governance structures for all aspects of biodiversity research. It will consist of: facilities for data generation and processing; a network of observatories; facilities for data integration and interoperability; virtual laboratories offering a range of analytical and modelling tools; and a Service Centre providing special services for scientific and policy users, including training and research opportunities for young scientists. The infrastructure has the support of all major European biodiversity research networks. The total budget of LifeWatch is €6.37 million of which €5 million is EU funded via the FP7 capacity programme on e-science and technology infrastructure for biodiversity data and observatories.

EBONE

Another project is EBONE - the European component of the GEO-BON global programme – which aims at addressing the lack of data as a major constraint on the development and use of indicators for large scale biodiversity assessment (national, European and global). The goal of EBONE is to deliver “a fully integrated system based on key biodiversity indicators and implementation within an institutional framework operating at the European level” by linking, currently separate, databases, develop collection and analysing techniques and make recommendations for improvements. EBONE builds on knowledge developed from other research projects such as AlterNet, BioHab, BioPress and EUMON, and aims to feed global research programs ILTER, GEOSS and Lifewatch. It is a partnership between 18 universities and research institutes and is coordinated by Alterra, Wageningen. EBONE is funded partly by FP7 (€2.7 million) as European Biodiversity Observation Network; a project to design and test a biodiversity observation system integrated in time and space and has a total budget of €3.44 million.

BISE

Finally, the Biodiversity Information System for Europe (BISE) was introduced during the European Green Week 2010 and aims to be a “single entry point” for data and information on biodiversity in the EU. In addition to biodiversity, it will gather data on ecosystem services and link all the information from academia, research, assessments and environmental data centres. The ultimate goal is to support decision-making on biodiversity policy. BISE is a partnership between the

European Commission (DG ENV, JRC and Eurostat) and the EEA. It incorporates the network of the European Clearing House Mechanism within the context of the CBD.[23]

SEIS

Whereas LifeWatch, EBONE and BISE focus on biodiversity, the EU also has created a wider system to integrate environmental data. The Shared Environmental Information System (SEIS) is a collaborative initiative of the European Commission and the European Environment Agency (EEA) to establish together with the Member States an integrated and shared EU-wide environmental information system. This system would tie in better all existing data gathering and information flows related to EU environmental policies and legislation. It will be based on technologies such as the internet and satellite systems and thus make environmental information more readily available and easier to understand to policy makers and the public.

Overview of existing monitoring schemes relevant for the headline target

The following table provides an overview of the existing monitoring schemes relevant for the headline target.

Table 1 Summary typology of existing monitoring schemes addressing the headline target

Type	Name	Costs	Funded via	Coverage
Monitoring schemes mapping	EuMon	€2.22 million	FP6	Provided a good first overview of existing schemes.
(Environmental) data integration	SEIS	?	EU	EU-wide reach. Broader than just biodiversity data.
(Biodiversity) data integration - assessment	EBONE	€3.4 million	FP7	Potentially helpful for the provision of additional indicators relevant for monitoring the headline target.
(Biodiversity) data integration - infrastructure	LifeWatch	€6.37 million	FP7	Helps set up EU-wide infrastructure for biodiversity research.
(Biodiversity) data integration - access	BISE	?	EU	Has the potential to become a comprehensive platform for sharing all knowledge on biodiversity EU-wide.
Ecosystems monitoring	RUBICODE	€2.16 million	FP6	Helped identify knowledge gaps in biodiversity and ecosystems services; guided future research.
Ecosystem services monitoring	FSC (other) certification schemes involving PES	variable	Certificate holders	Has the potential for monitoring part of the ecosystem services component of the headline target.
Ecosystem services monitoring	Mapping of ecosystem services across Europe	?	DG ENV and six PEER institutes	Has the potential for monitoring part of the ecosystem services component of the headline target.

[23] http://biodiversity.europa.eu/

It should be noted that EBONE, LifeWatch and BISE are addressing different problems in coordination and integration of data. EBONE is a program for linking in-situ and ex-situ data assessment, LifeWatch aims to improve data infrastructure and BISE will provide better access to existing information. Finally, SEIS is only indirectly dealing with biodiversity as it is more general in scope, collecting environmental information.

3.2.4 Gaps in current monitoring

Europe's failure to meet the target on halting biodiversity loss by 2010 was partly caused by gaps in knowledge about the state of biodiversity in Europe and the absence of easily quantifiable targets. There are still major gaps in data to monitor progress with respect to the biodiversity aspects (species and habitats) making it difficult to get a complete overall picture of the current state of affairs. RUBICODE, TEEB, BISE, EBONE, LifeWatch and other ongoing research and monitoring schemes attempt to address the apparent problems. In addition, for the post-2010 headline target and sub-targets a number of gaps can be identified, most of them logical, as the target components are new and therefore have not been object of monitoring strategies before.

Habitat and species coverage are only part of the gap in EU biodiversity monitoring. Knowledge gaps related to biodiversity status can be summarised[24] as the following on a European level:

- Diversity – genetic, species, habitats;
- Distribution – inventories, atlas, mapping;
- Abundance – monitoring population sizes and habitats surface area, trends; and
- Quality – structure and function of habitats/ecosystems.

These gaps are addressed and reflected upon in this report.

Moreover, ecosystem services are insufficiently defined, monetised and monitored to provide status updates for the post-2010-headline target. In a recent study[25] the knowledge gaps which need to be filled in order to effectively evaluate ecosystem services include:

- ecological underpinning of ecosystem services;
- drivers that affect ecosystems and their services;
- biological traits and ecosystem services;
- valuation of ecosystem services;
- spatial and temporal scales in ecosystem service assessment;
- indicators of ecosystem services; and
- habitat management, conservation policy and ecosystem services.

Final conclusions will explore possibilities to bridge the gaps in an effective and cost-efficient manner.

[24] Summarised from EEA (2010), "Baseline Knowledge Gaps", Chapter 14.

[25] Anton, C., Young, J., Harrison, P.A., Musche, M., Bela, G., Feld, C.K., Harrington, R., Haslett, J.R., Pataki, G., Rounsevell, M.D.A., Skourtos, M., Sousa, J.P., Sykes, M.T., Tinch, R., Vandewalle, M., Watt, A. and Settele, J. (2010) Research needs for incorporating the ecosystem service approach into EU biodiversity conservation policy. Biodiversity Conservation, 19(10): 2979-2994.

3.3 Sub-target 1: Integration and sustainable use of resources

Unsustainable agriculture and forestry practices exert significant pressures on biodiversity. Intensified farming and forestry, as well as land abandonment, exacerbate these stresses. Additionally, traditional resource management methods, which often generate species rich habitats, are replaced with modern practices less beneficial to biodiversity. On the other hand, sustainable and well managed agriculture and forestry can benefit biodiversity levels and create mutual ecological and socio-economic benefits. Furthermore, large parts of Natura 2000 designated areas are located in agricultural and forestry areas. From a policy perspective, this creates double incentives to maintain sustainable management practices.

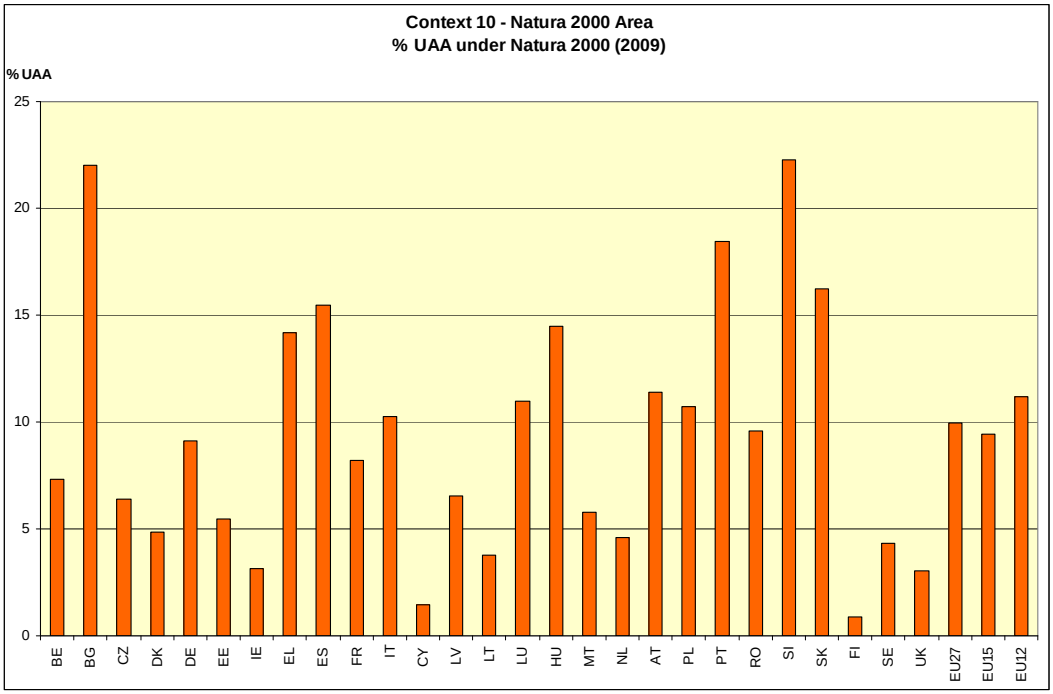
Agriculture

Agriculture is heavily reliant on functioning ecosystem services. Water regulation, pollination and nutrients in soil are among these. Hence, maintaining biodiversity levels should be a priority among European farmers. However, historically the Common Agriculture Policy (CAP) support - which represent almost 40% of the EU budget and on which many farmers are heavily reliant – benefits large production rates and spurs intensification of agricultural practices. During the last decade, however, reforms have started to move the CAP into a less environmentally harmful incentive system and introduced 'green' elements such as support for so-called agri-environmental schemes and cross-compliance mechanisms. Furthermore, the 2013 CAP reform provides a unique policy opportunity to strengthen the CAP's biodiversity agenda. The mission statement from the President to Commissioner Ciolos includes an explicit reference to the need to ensure greater CAP delivery on ecosystem services and further 'greening' the CAP is increasingly seen as a way to increase political acceptability of the CAP and of its share of the EU budget. For example, following a 2009 "Health check" of the CAP, several biodiversity elements were introduced.[26] It also included the rebalancing of the CAP budget, moving money from the first to the second Pillar of the CAP (via "modulation"), thus making additional funding available for biodiversity. Finally, the agricultural constituency's increasing concerns about the loss of non-urban areas (in most cases, agricultural areas) to urbanisation have created new convergences.

In many parts of Europe, Natura 2000 designated areas are an integral part of agricultural land. On average 10% of EU agriculture takes place in Natura 2000 areas and in some countries, such as Belgium and Slovenia, this number is over 20% (see Figure 4).

[26] http://ec.europa.eu/agriculture/healthcheck/index_en.htm

Figure 4 UAA under Natura 2000 (in %)[27]



Given the fact that a large part of UAA operates under Natura 2000, this creates potential synergies for both management and monitoring. It also shows, however, the overlap in authority between different directorates in the EC and in national governments.

The proposed biodiversity sub-target on agriculture has been discussed with DG AGRI to ensure the proper safeguarding of ecosystem services in agricultural land and forestry. With this objective in mind, different possibilities for a sub-target formulation include:

- a sub-target focused on lowering the pressure of intensive agriculture (e.g. nitrogen) and ensuring the sustained provision of a range of ecosystem services;
- a sub-target focused on a sufficient delivery of ecosystem services both in extensive and intensive agriculture areas; and
- a sub-target focused on maintaining and restoring extensive agriculture.

For the latter, there is a certain convergence of views on the attractiveness of 'High Nature Value' (HNV) farming/forestry to underpin the sub-target. The concept of HNV, although not fully harmonised and agreed yet, generally describes those types of farming activity and farmland that, because of their characteristics, can be expected to support high levels of biodiversity and their contribution to adaptation to climate change. These are not equally shared across Europe. The concept therefore makes it possible to reflect equity across Member States.

HNV farmlands refer to areas where farming systems are sustaining a high level of biodiversity. They are often characterised by extensive farming practices, associated with a relatively high species and habitat diversity or the presence of species of European conservation concern. HNV

[27] Source: personal communication with DG Environment and DG Agriculture

farmland currently represents approximately 1/3 of farmed land in Europe[28] [29], located mainly in the Mediterranean region and Eastern European countries. Grassland (meaning the sum of semi-natural grasslands and pastures) is by far the largest type of HNV area, totalling 1/3 of the farming area.

Table 2 HNV farming areas per Member State (HA) [30]

	(1)	(2)	(3)	(4)=(2)/(3)[31]	(5)=(1)/(2)
Country	**HNV farmland area, JRC/EEA study**	**Agricultural land (CLC agricultural classes + HNV areas)**	**Utilised agricultural area UAA (EUROSTAT)**	**Agriculture land CLC compared to UAA**	**Area share of HNV farmland**
Belgium	347 960	1 786 942	1 385 580	129%	19%
Bulgaria	2 509 989	6 734 217	2 729 390	247%	37%
CzechRepublic	1 043 973	4 950 869	3 557 770	139%	21%
Denmark	172 267	3 446 150	2 707 690	127%	5%
Germany	3 162 699	21 607 362	17 127 350	126%	15%
Estonia	380 879	1 695 820	828 930	205%	22%
Ireland	1 162 594	5 777 390	4 443 970	130%	20%
Greece	5 349 572	9 122 263	3 583 180	255%	59%
Spain	18 986 960	34 038 906	26 085 390	130%	56%
France	7 797 145	35 311 870	27 856 320	127%	22%
Italy	6 127 030	18 359 587	13 062 260	141%	33%
Cyprus	342 045	637 043	151 500	420%	54%
Latvia	568 400	2 853 680	1 432 680	199%	20%
Lithuania	627 202	4 159 700	2 792 040	149%	15%
Luxembourg	12 871	142 632	127 510	112%	9%
Hungary	1 906 124	6 822 877	4 555 110	150%	28%
Netherlands	368 788	2 621 717	1 958 050	134%	14%
Austria	2 447 292	3 578 621	3 266 250	110%	68%
Poland	4 813 243	20 231 887	14 754 880	137%	24%
Portugal	2 900 462	5 035 890	3 736 140	135%	58%
Romania	4 860 372	14 433 920	13 906 700	104%	34%
Slovenja	591 314	754 255	485 880	155%	78%
Slovakia	547 582	2 485 476	2 159 900	115%	22%
Finland	1 330 797	2 967 068	2 215 970	134%	45%
Sweden	1 136 030	4 759 869	3 192 440	149%	24%
United Kingdom	5 165 466	19 368 468	13 174 690	147%	27%
Total	**74 659 056**	**233 684 479**	**171 277 570**	**136%**	**32%**

[28] Paracchini M.L., J.-E.Petersen, Y.Hoogeveen, C.Bamps, I.Burfield, C.van Swaay (2008): High Nature Value Farmland in Europe - An estimate of the distribution patterns on the basis of land cover and biodiversity data, Report EUR23480 EN.87p

[29] Considering the constraints in mapping HNV areas, this number must be considered a conservative estimate.

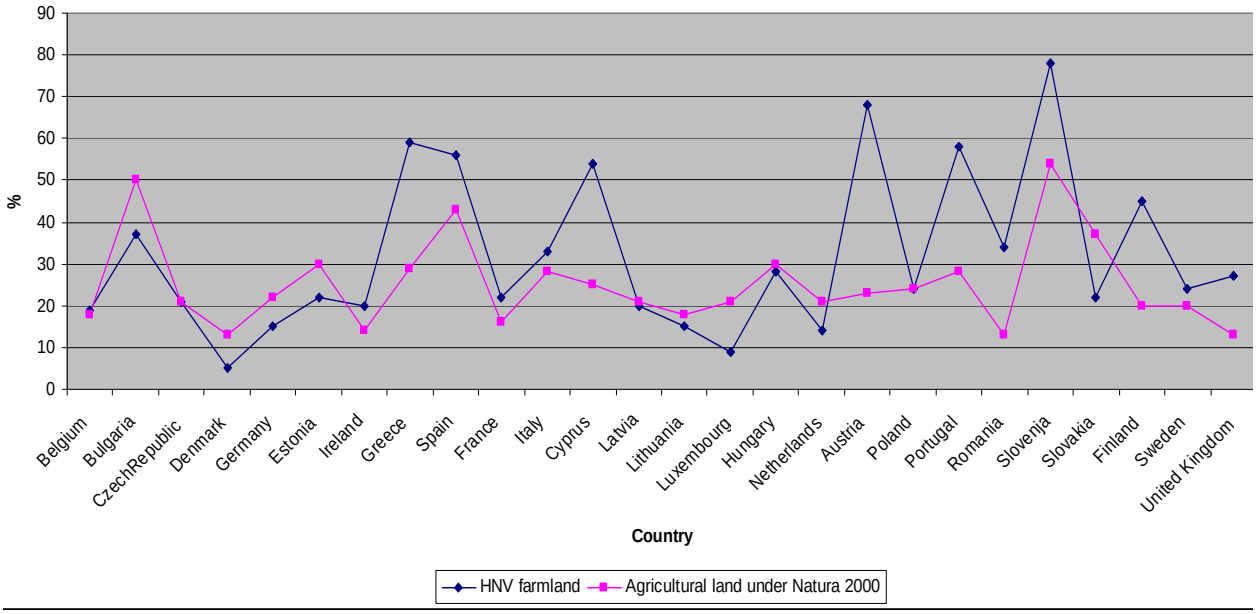
[30] Adapted from: Beaufoy, et al 2009. Distribution and targeting of the CAP budget from a biodiversity perspective. Technical report. European Environment Agency, Copenhagen. p. 20.

[31] This column indicates the relation between agricultural land as estimated by CLC and Member States reported UAA.

The above table is taken from Parrachini et al. and estimates the spread of HNV farmland based on several EU-wide datasets. Basic mapping information used the CORINE land cover data sets and biodiversity indicators were gathered from Natura 2000 data, bird and butterfly population data and national biodiversity datasets. In the end, data on HNV is based on estimations and information on management, policy impacts and socio-economic indicators are not added to the analysis.

Interestingly, the estimated spread of HNV farmland and agricultural land within Natura 2000 correlates rather well (see Figure 5) which might indicate that much of HNV farming takes place under Natura 2000 designated areas and could have implications for both monitoring and policy options.

Figure 5 Correlation between HNV farmland and Natura 2000 areas

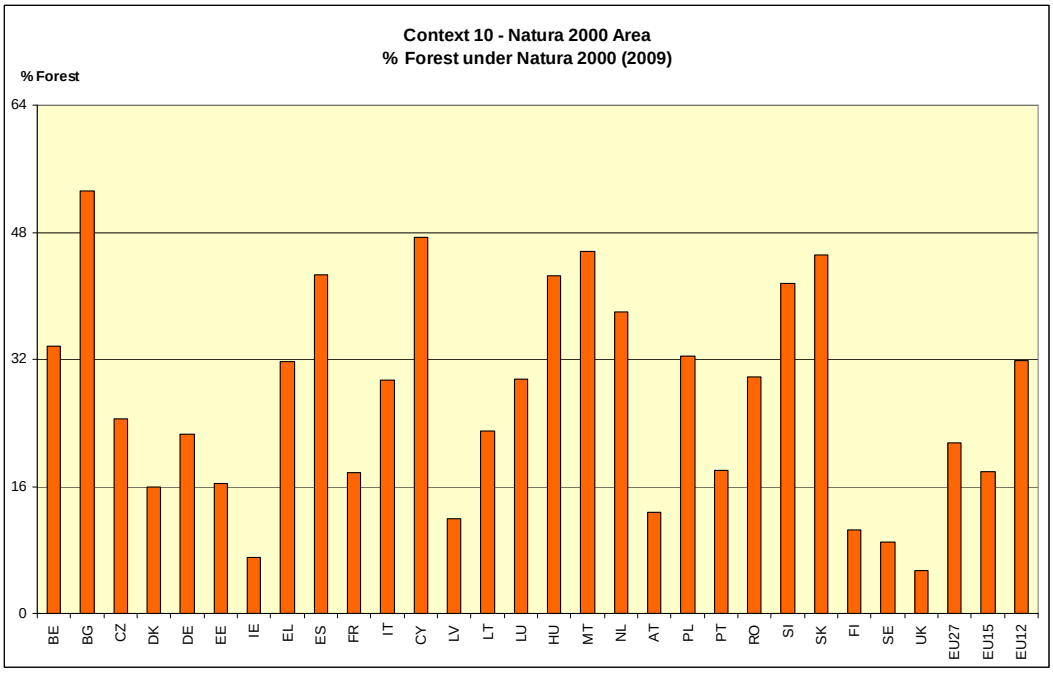


Forestry

Forests are among the most biodiverse terrestrial systems on Earth. A healthy forest ecosystem can provide jobs, raw material, renewable energy and income. It also sequesters carbon, regulate soils and freshwater supplies. Forests and wooded lands now cover approximately 40% of EU land area and Europe holds 5% of the world's total forests.[32] Also interesting to know is that about 60% of forest is privately-owned and 40% publicly-owned in Europe. Furthermore, large parts of forested land are situated in Natura 2000 designated areas. Compared to agriculture, the percentage is substantial and almost 20% of EU forests are located in Natura 2000 areas. For some countries, such as Belgium and Cyprus, some 50% of all forests are located in Natura 2000 areas (see Figure 6).

[32] EC 2010 Green Paper On Forest Protection and Information in the EU. SEC(2010)163 final

Figure 6 Forest under Natura 2000 areas (in %)[33]



Similar to agriculture, this creates great potentials for synergies in terms of management and monitoring.

The Council Resolution of 15 December 1998 on a Forestry Strategy for the European Union was the first effort to establish a framework for forest-related actions in support of sustainable forest management (SFM), based on the co-ordination of forest policies of the Member States and Community policies and initiatives relevant to forests and forestry. The Strategy emphasises the importance of the multifunctional role of forests and SFM for the development of society, and identifies a series of key elements, which form the basis for its implementation.

As an additional step, the EU Forest Action Plan was adopted on 15 June 2006[34]. It builds on the report on implementation of the EU Forestry Strategy and consequent conclusions by the Council. The importance of Sustainable Forest Management for the conservation and enhancement of biological diversity is identified under Article 2-g of the EU Forestry Strategy. Article 11 assigns an essential role to forest biodiversity in SFM and considers that appropriate measures should be integrated in the forest programmes or equivalent instruments of the Member States in line with the Pan-European "Work Programme on the Conservation and Enhancement of Biological and Landscape Diversity in Forest Ecosystems 1997–2000". Article 12 recognises the importance for biodiversity of protected forest areas, notably through the establishment of Natura 2000. The EU has taken a major step to preserve forest biodiversity through the creation of the Natura 2000 network (see Section 3.1). Almost 30 % of designated Natura 2000 sites comprise forest habitats and another 30 % partly contain woodland elements and associated species.

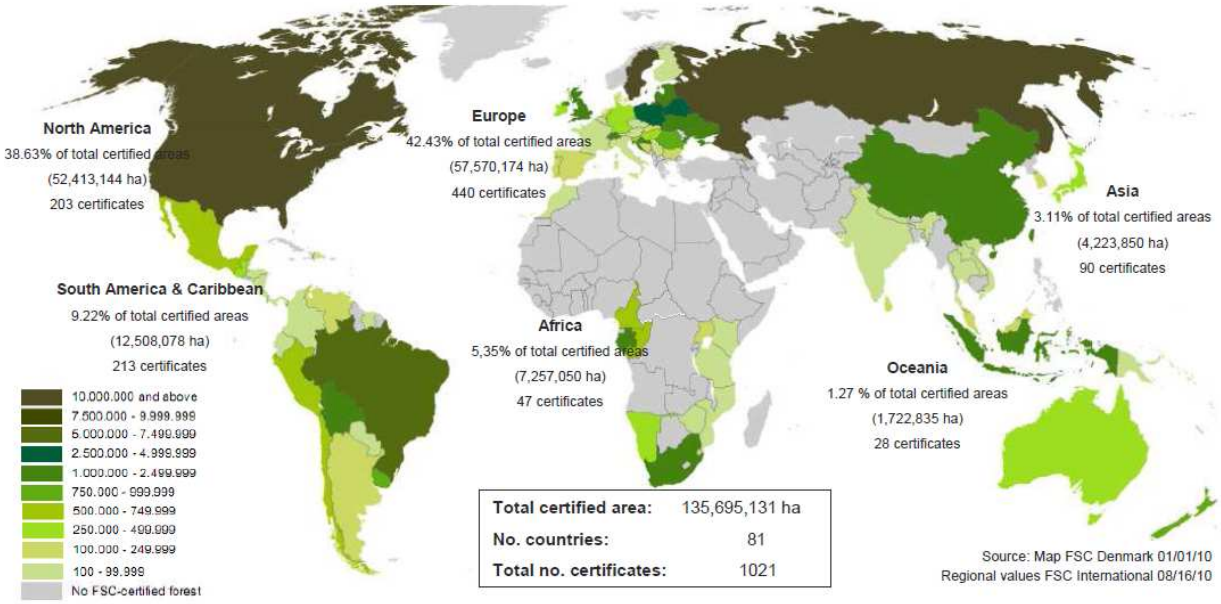
Through EU-wide legislation and other efforts, such as National Forestry Inventories (NFI) and the MCPFE process, forest ecosystems across Europe have traditionally been monitored rather well.

[33] Source: personal communication with DG Environment and DG Agriculture
[34] COM(2006) 302 EU Forest Action Plan

However, in a recent Green Paper on Forest Protection and Information in the EU[35], the European Commission asserts that: "*the need for more harmonized, reliable and comprehensive information on forests is increasingly recognized by the Commission, the MS and many economic operators*". Currently, information is held a many different levels and the NFIs suffer from incoherency which makes cross-national comparison difficult. In an attempt to consolidate forest information the Commission has set up the European Forest Data Centre (EFDAC).[36] It is a JRC run centre with the aim to become "*the focal point for policy relevant forest data and information*" as well as developing tools to improve accessibility.[37] Finally, indicators are not always directly linked to biodiversity and at the time of writing this report no agreement had been reached as to which direction to take a sub-target on forest biodiversity.

Forest certification schemes, such as **FSC** (Forest Stewardship Council) or **PEFC** (Programme for the Endorsement of Forest Certification), have become important tools for the implementation of sustainable forest management over the past years. The figure below shows, for example, that by August 2010, a total of 57,570,174 hectares of European forests have been certified via one of the existing forest certification schemes.[38] This amounts to approximately 6% of total European forest area.[39] It should be noted here that Europe includes countries such as Russia and the Ukraine with large amounts of forests. Some individual countries have a much higher percentage of their total forest area certified by FSC: for example, the UK has 55% of its forests under FSC certification, Estonia and Lithuania each close to 50%, and Sweden close to 40%.

Figure 7 Global FSC certified forest area: by region (as of August 2010) [40]



Similarly, about 226 million hectares of forest area (or 559 million acres) are managed in compliance with PEFC's internationally accepted Sustainability Benchmark. This is an area equivalent to the size of France, Germany, Italy and the UK combined. By the beginning of

[35] SEC(2010)163 final
[36] http://efdac.jrc.ec.europa.eu/
[37] http://efdac.jrc.ec.europa.eu/
[38] FSC. Global FSC certificates: type and distribution. September 2010.
[39] FAO. Global Forest Resource Assessment 2010.
[40] FSC. Global FSC certificates: type and distribution. September 2010.

September 2010, 7,299 companies and organizations have achieved PEFC Chain of Custody certification.

3.3.2 Towards a sub-target

The following sub-target formulations are currently under review:

- % of land under a contract to deliver HNV related farming and forestry within and outside HNV areas;
- % of CAP direct support directed to HNV (area/farming to be determined) to contribute to good conservation status.

3.3.3 Relevant existing indicators

Various indicators have been developed for both agriculture and forestry.

Agriculture

For agriculture, a significant amount of work has been carried out in relation to the identification of biodiversity indicators of relevance. A watershed in this process was provided by the OECD Expert Meeting on Agri-Biodiversity Indicators in 2000. This was recently followed up in a Workshop on Agri-Environmental Indicators in March 2010 in Leysin, Switzerland.[41] Other important published documents have considered agri-environmental indicators for sustainable agriculture in Europe, the European area frame survey LUCAS and indicators related to HNV farmland.

Additionally, the Common Monitoring and Evaluation Framework's (CMEF) includes seven Impact Indicators providing a tool against which to assess the economic, social and environmental impacts of the 2007 – 2013 rural development programmes (RDP). The HNV Impact Indicator is one of two indicators (the Farmland Birds Indicator is the second) which assess the impact of current programmes on biodiversity.[42]

Finally, the collection of HNV data in Member States today is scattered and inconsistent. The ones that collect information normally use land cover and species data mainly and not farming practices. This includes criteria such as semi-natural grassland, mosaic patterns and presence of species populations. In the end they are more focused on producing maps of potential HNV farmland areas, rather than on monitoring systems.[43]

In a nutshell, agri-biodiversity indicators can generally be divided into:

- Ecosystem: typically including indicators relating to change (conversion to and from agricultural land, afforestation, etc); presence or absence of agro ecosystem related habitats such as grasslands, farm woodlands, etc; pesticide and fertiliser input, organic food production.
- Species: number, abundance and distribution of selected species.
- Genetic: presence or absence of traditional breeds and races, wild crop relatives, etc.
- Other: ecosystem service related such as pollination/ presence or absence of pollinators; soil quality; use and application of agri-environment funding measures.

[41] http://www.oecd.org/document/9/0,3343,en_2649_33793_43662921_1_1_1_37401,00.html

[42] Evaluation Expert Network 2009 Guidance Document: The application of the high nature value impact indicator 2007-2013. The European Evaluation Network for Rural Development.

[43] Personal communication with Guy Beaufoy - EFNCP

For future research it might be interesting to compare traditional management-related indicators used by DG Agriculture and investigate correlations with state-of-environment related indicators used by, in particular, the EEA.

Forestry

Much of the work on forestry related indicators has focused on sustainable management. The forestry sector accounts for an important part of the economy in a number of European countries and is thus well represented by state institutes and ministries, which have set monitoring strategies as well as some biodiversity targets in their national and regional level strategies. The National Forestry Inventories, as well as the MCPFE reporting process, for example, are excellent monitoring avenues that can also deliver indicators for forest biodiversity monitoring.

The following existing indicators have been currently identified to be able to serve the purpose of monitoring at least parts of this sub-target:

Table 3 Existing indicators relevant for sub-target 1

Indicator	Description
SEBI 01	Abundance and distribution of selected species: a) birds, and b) butterflies
SEBI 02	Red List Index for European species
SEBI 04	Ecosystem coverage
SEBI 06	Livestock genetic diversity
SEBI 09	Critical load exceedance for nitrogen
SEBI 17	Forest: growing stock, increment and fellings
SEBI 18	Forest: deadwood
SEBI 20	Agriculture: area under management practices potentially supporting biodiversity
SEBI proposal	OECD statistics on subsidies
CMEF Impact 18	HNV farmland and forestry (measurement: Utilised Agricultural Area (UAA) of HNV)
IRENA 04	Area under nature protection
IRENA 07	Area under organic farming
IRENA 26	Area of High Nature Value (HNV), grassland, etc.
BAP	Indicators for AEM for Natura 2000
IUCN EU Red List	Percentage of EU species threatened by agricultural exploitation

Furthermore, biodiversity indicators used in current certification schemes could be of use for monitoring forest biodiversity in the future. For a variety of reasons, direct biodiversity indicators are rarely used in certification systems and as a result biodiversity is rarely determined directly during certification audits. Nevertheless, the focus on management process indicators, which attempt to ensure that inherent taxonomic, structural and landscape complexities characteristic of forest ecosystems are maintained and in so doing contribute to the conservation of biodiversity, is still an indirect means to gain further knowledge about forest biodiversity in certified areas. Most certification schemes use two types of biodiversity-related indicators:

- Those designed to reflect the type and status of management processes; and/or
- Those that provide actual measures of forest components to allow comparisons against desired outcomes and standards.

The following table provides a brief overview of certification standards that relate to biodiversity monitoring.

Table 4 Overview of indicators used in forest certification schemes that are relevant for biodiversity monitoring[44]

Stand-level, outcome-oriented metrics	Landscape-level, outcome oriented metrics
Age, size, and species diversity of trees	Ecological function, cycles and productivity
Dead wood	Ecological reserves or high conservation value forests
Excessive herbivory by deer	Examples of existing ecosystems
Disturbance by biotic and abiotic agents	Exotic species
Herbicide, pesticide, and/or biological control	Fire, prescribed burning
Mixed species stands	Fragmentation
Presence or distribution of hardwoods and broadleaved trees	Mature or old-growth stands
Road management and habitat inputs	Natural regeneration, deforestation, plantations
Rotation length	Rare or unique physical environments
Soils characteristics, function, nutrient capital	Restoration of forest types, refugia
Understory species diversity	Seed source, genetically modified organisms
Vertical and horizontal stand structure	Water course or wetlands

Synergy opportunities between agriculture and forestry indicators include the following:

- ecosystem related indicators looking at conversion of land and the presence or absence of habitats, fragmentation and ecological connectivity;
- the dead wood indicator;
- selected species;
- ecosystem service (including fire prevention) and sustainable management related; and
- funding via agri-environment schemes (the majority of forest and farm Woodland management schemes are classified under agri-environment).

3.3.4 Corresponding existing monitoring schemes

Several at least indirectly related monitoring schemes exist for agriculture and forest biodiversity monitoring.

HNV monitoring in Germany

A few studies have estimated the size of HNV farmland in Europe[45] however there are no existing EU-level monitoring schemes on spatial and temporal distribution. Hence, quantification of HNV farmland indicators is difficult in general considering differences in national applications of the concept, poor data, and non-existent monitoring schemes. On Member State level only Germany has a simple site-based (1000 sites of 1km^2) monitoring scheme in place. It cost about €200.000 per year and shows strong potential to upscale.

Current monitoring lacks a clear and tangible definition of the HNV farming concept. It makes studies using remote sensing suitable for rough estimations and not exact measurement. Large discrepancies between results emerging from different measuring methods are of particular concern. Nevertheless, the German simple site-based national scheme provides a good example on how a future cost-efficient monitoring system could function.

[44] Marijke van Kuijk, et al. Effects of forest certification on biodiversity. Tropenbos International, 2009

[45] See for example: EEA, 2004 *High nature value farmland: Characteristics, trends and policy challenges*. No: 1/2004; Paracchini M.L., J.-E.Petersen, Y.Hoogeveen, C.Bamps, I.Burfield, C.van Swaay (2008): High Nature Value Farmland in Europe - An estimate of the distribution patterns on the basis of land cover and biodiversity data, Report EUR 23480 EN. 87

Forest Focus

Forest Focus[46] was a successful programme running from 2003 to 2006, geared at establishing long-term, comparable, and comprehensive monitoring of European forest ecosystems. Forest Focus was co-financed by the Commission and had a budget of €65 million. The programme had a high potential as a comprehensive monitoring network because it utilized one common methodology across Europe, but at its end date it was not reviewed and improved, but rather stopped. The common methodology that had been set up with one accredited agency and annual programme reporting combined with a flexible financing mechanism. The 20 years of collected data and information can still be used for review of past forest status across Europe, but is now not updated anymore.

FutMon

FutMon[47] stands for 'Further Development and Implementation of an EU-Level Forest Monitoring System' and aims to create a European wide forest monitoring system with a focus on policy-relevant information. FutMon builds on Forest Focus, FutMon runs from 2009-2010 with a budget of €34.45 million (€15.14 million funded by LIFE+).

Monitoring services via Forest Certification Schemes

Forest certification schemes, such as FSC and PEFC, have implemented strict requirements on monitoring for the granting and renewal of certificates. While this type of monitoring mechanism is not per-se set up for biodiversity monitoring, it can certainly contribute valuable inputs on forest biodiversity status in these certified areas.

FSC's requirements for responsible management of biodiversity are partly contained within Principle 6 'Environmental impact'. In summary, the biodiversity requirements of Principle 6 require that forest management:

- Is protecting rare, threatened and endangered species (of birds, plants, reptiles etc.);
- Is protecting the areas in which these species live, feed, and breed (their habitats);
- Controls inappropriate hunting or collecting of animals and plants;
- Maintains the 'natural functions' of the forest. For example, ensuring that there is still a balance of trees of different ages, including seedlings, and that there is still a natural range of species and types of vegetation present;
- Takes into account the impacts of forestry on the forest; and
- Uses conservation zones and protection areas – where appropriate.

Other references to biodiversity management are found in FSC's Principle 9 –Maintenance of High Conservation Value Forests.

FSC expects forest managers carry out different types of monitoring, including assessing the condition of the forest, the yield of the products harvested, management activities and their social and environmental impacts. For responsible management of biodiversity and High Conservation Value Forests, monitoring should help with at least the following:

- Assessing how effective management has been in protecting the High Conservation Value Forests that has previously been identified;

[46] http://europa.eu/legislation_summaries/agriculture/environment/l28125_en.htm
[47] http://www.futmon.org/

- Being aware of whether the rare, threatened and endangered species and their habitats are being safeguarded.

The following table offers an example of what a monitoring plan for biodiversity and HCVF can look like under the FSC scheme.

Table 5 FSC example for a biodiversity and HCVF monitoring plan[48]

Actions to be taken	What to monitor	How will it be monitored? Who will be responsible? When will they do this?	How the responsible people will report on what they find.
Protect HCV forest structure (suitable habitat for HCV birds) by low impact logging	**A.** Check that low impact logging is actually taking place, according to the management plan.	The forest manager will inspect the harvest area at the end of each week of harvest to ensure that low impact logging has been used, and that damage to surrounding vegetation is minimal.	If low impact logging is not being practiced, the loggers will be warned that they are in breach of contract and asked to implement the practices. They will report on their findings and any action in the end of year reporting meeting. If necessary changes will be made to the management plan, and re-training may be offered.
Ensure key HCV bird species are not negatively affected by low impact logging	**B.** Check that the populations of these animals are being maintained or increased by the management measures taken	The forest manager will set up an annual monitoring program of 4 key species with the ecology department of the local university, for students to measure the population of these birds and animals in the forest over a 4 year period.	The forest manager will report to the forest owner annually with a summary of the results. They will be used to decide if the low-impact logging is helping to maintain species populations.

Recent studies have investigated whether FSC certification can help protect biodiversity and generate other socio-economic and environmental benefits. Commissioned by the WWF European Forest Program, Peter Hirschberger (2005) conducted a series of six studies based upon the publicly available information from audit reports prepared by independent assessors.

> "This analysis across six countries shows that FSC certification is delivering a number of benefits for a wide range of stakeholders in the forest industry, and provides hard evidence of tangible improvements that the voluntary mechanism of credible certification delivers for society, the environment and the economy. Certification has improved the social conditions for forest workers through the implementation of health and safety legislation and favoring employment of local people. In all six countries surveyed, FSC certification improved the conservation status and enhanced biodiversity levels in forests."[49]

[48] FSC step-by-step guide: Good practice guide to meeting FSC certification requirements for biodiversity and High Conservation Value Forests in Small and Low Intensity Managed Forests, FSC Technical Series No. 2009 - T002

[49] WWF European Forest Programme (2005): The Effects of FSC-certification in Estonia, Germany, Latvia, Russia, Sweden & the United Kingdom: An analysis of Corrective Action Requests (by Peter Hirschberger). Summary report. http://assets.panda.org/downloads/fscsummaryanalysisallcountries.pdf (as of July 2008)

Newsom and Hewitt [50] showed that monitoring systems of 86% of the certified operations had to be improved. Usually, operations were required to develop a monitoring protocol, or formalize their existing informal protocols. The topics that operations were specifically required to monitor ranged from regeneration success to recreational use to insect infestations to riparian buffer conditions. Often, operations were required to use post-harvest monitoring checklists; less often, they were required to monitor the social effects of forest management activities.

Similarly, PEFC's "act locally, think globally" approach offers substantial benefits and contributes positively to the maintenance and enhancement of global forest biodiversity. Developing standards nationally means that they can be tailored to the specific local biodiversity, environmental and ecological conditions in a country, and with consideration for local political, socio-economic, cultural and administrative conditions, thereby reflecting and responding to national and local concerns and priorities. Within PEFC-certified forests, managers must ensure that forest management activities maintain, conserve and enhance biodiversity. This includes that natural generation is preferred and that native species are favoured in reforestation and afforestation. Forest managers are required to ensure that special key biotopes are protected, harvest levels and forest productivity are balanced, and degraded forest ecosystems are rehabilitated.

Overview of existing monitoring schemes relevant for sub-target 1

The following table provides a summary overview of existing monitoring schemes relevant for sub-target 1.

Table 6 Summary typology of existing monitoring schemes addressing sub-target 1

Type	Name	Costs	Funded via	Coverage
HNV agriculture monitoring	Germany HNV farming monitoring scheme	€200,000	MS	Simple site-based. Socio-economic indicators lacking.
Forest monitoring	Forest Focus	€65 million	EC	Provided comprehensive status report for 20 years. Abruptly stopped.
Forest monitoring	FutMon	€34.45 million	Partly LIFE+	Builds on ForestFocus. Aims for broad coverage.
Forest monitoring	Forest Certification Schemes	Costs related to monitoring are unknown	Certificate holders	Covers certified areas only.

3.3.5 Gaps in current monitoring

Both agriculture and forestry show clear gaps in terms of the capacity and coverage of current monitoring schemes to sufficiently monitor progress towards the 2020 sub-target number 1.

Agriculture

Biodiversity in HNV farming suffers from a set of monitoring deficiencies. To start with, a common and operational definition is needed. Then spatial, temporal and socio-economic data could further

[50] Newsom, Deanna & Hewitt, Daphne (2005): The Global Impacts of SmartWood Certification. Final Report of the TREES Program for the Rainforest Alliance. http://www.rainforestalliance.rg/programs/forestry/perspectives/documents/sw_impacts.pdf (as of June 2008)

define the status and trends in HNV farming, as well as, indicate the likelihood or risk of intensification or abandonment. Third, the benefits of HNV farmland to biodiversity are still understudied and should be further explored. Thus, to monitor the spread of HNV farmland and the ecosystem services it produces, significant gaps remain.

There is a body of literature on biodiversity aspects of HNV grasslands (e.g. IEEP & Alterra, 2010) with the conclusion that relevance to biodiversity targets is hard to assess as there are many small areas with uncertain status and there is currently not a specific subsidy reporting monitoring regime, except for cases when it coincides with agri-environment schemes.

Forestry

For future forest biodiversity monitoring, it is highly unlikely that Member States would commit to a resurrection of a Forest Focus type system due to the termination of the system in 2006. The most feasible way forward for forest biodiversity monitoring is thus to build on existing frameworks – primarily the National Forestry Inventories and the MCPFE – as these are well functioning avenues for forest data collection. Data may have to be processed to make it directly relevant for chosen forestry biodiversity indicators, but the basic information required should be available via ongoing well-established processes.

Furthermore, forest certification schemes offer an existing network of well-monitored areas, which could be tapped into in the future on a more formalised basis in order to share biodiversity status as well as ecosystem service improvements via some of the biodiversity data integration portals.

3.4 Sub-target 2: Overexploitation

Fisheries are not the only example of overexploitation in Europe, soil and forests are other examples; however, fisheries are the most serious and by far the best documented. Currently, 88% of Community stocks are fished beyond the limits of Maximum Sustainable Yield (MSY)[51] and 30% of these stocks are outside safe biological limits, meaning they are not able to replenish[52]. This makes fisheries a formidable example of overexploitation in Europe.

The state of Europe's marine and freshwater fisheries, in particular the decline of fish stocks (including for some species near extinction) has for some time been of great concern to politicians and policymakers alike, not least because of their economic and social impacts. At the World Summit on Sustainable Development (WSSD 2002), the EU committed to restoring depleted fish stocks by 2015, however, despite several changes in the 2002 Common Fishery Policy (CFP), EU is not on track to fulfil its target. Finding the right policy mix is difficult. An excessive fleet-capacity where reductions in boats are off-set by increase in efficiency, and red numbers in fishermen's budgets are compensated with subsidies, is creating a complex web of stakeholders. This has been recognised in the 2009 Green Paper on CFP[53] reform which provides a unique opportunity to stop the overexploitation. The Green Paper identifies five structural reasons for why the CFP has failed to deliver the targets: (1) fleet overcapacity; (2) imprecise policy objectives; (3) a decision-making system that encourages a short-term focus; (4) a framework that does not give sufficient

[51] Which indicates that the fisheries could extract more efficiently if the stock was left untouched for only a few years.
[52] COM(2009)163 Green Paper 'Reform of the Common Fisheries Policy', p.7
[53] COM(2009)163 Green Paper 'Reform of the Common Fisheries Policy'.

responsibility to the industry; and (5) poor compliance and lack of political will to ensure compliance. Nevertheless, policy reforms have introduced a number of positive innovations, in particular ecosystem-based management. However, a long-term approach to the management of stocks needs to be based on scientific advice. Also, while reducing subsidies and properly manage the TAC/quota system, there needs to be support for fishing communities when adjusting to lower yields.

Moreover, the issue is closely linked to the objectives of the Marine Strategy Framework Directive, now considered the environmental pillar of the EU's Maritime Policy, and in process of being implemented. Several so called 'descriptors' of 'good environmental status' under the Directive are of particular relevance. The application of criteria for these descriptors is to be endorsed in comitology based on a Commission decision on criteria on good environmental status (currently in inter-service consultation).

On 13 September 2010 the European Commission (DG Maritime Affairs and Fisheries) presented the Marine Knowledge 2020 initiative which aims to improve knowledge of Europe's seas and oceans. This initiative therefore contains useful elements to develop a targeted strategy on improving the knowledge base for the marine environment. The creation of marine knowledge begins with the collection of marine data, which are afterwards assembled, and then analysed to create information and knowledge. The Marine Knowledge 2020 initiative responds to the stakeholders' need for a more coordinated approach to marine data collection and assembly, and describes an action plan to develop or improve existing EU policy measures in order to achieve this aim. Three main objectives are proposed:

1. Reducing operational costs and delays for those who use marine data;
2. Increasing competition and innovation amongst users and re-users of marine data by providing wider access to quality-checked, rapidly-available coherent marine data;
3. Reducing uncertainty in knowledge of the oceans and the seas and so providing a sounder basis for managing future changes.

3.4.1 Towards a sub-target

The following sub-target formulation is currently under discussion:

- Achieve Maximum Sustainable Yield (MSY) for 100% fish stocks by 2020 and eliminate destructive fishing practices.

The European Commission (DG MARE) is currently working on developing a new structure and gearing a shift of the Common Fisheries Policy to overcome the 5 structural failings of the current policy (fleet overcapacity, imprecise policy objectives, a decision-making system that encourages a short-term focus, a framework that does not give sufficient responsibility to the industry, poor compliance and lack of political will to ensure compliance). This revision and review process lends itself as an inlet to introduce the necessary changes particularly, but not only, in terms of combating the fleet overcapacity, that need to be introduced to reach the proposed sub-target on overexploitation.

3.4.2 Relevant existing indicators

The SEBI fisheries-related indicators - marine trophic index of European seas (12) and European commercial fish stocks (21) - have direct links to already measured parameters and the figures are derived from the fishery sector. Effluent water quality from fish farms (22) may be applied to both freshwater and saltwater aquaculture. Other indicators include the Eurostat indicator - size of the

fishing fleet[54] - which provides a proxy indicator of potential pressure on maritime fish stocks. Eurostat provides a range of statistics in relation to fisheries.[55] Further information on European marine biodiversity indicators may be found at the BIOMARE website[56] and its associated publications.[57]

There is clearly a strong link to both marine and freshwater ecosystem services related indicators. Habitats such as marine seagrass are indicative of management practice, linked to area and distribution of habitat; the presence or absence of species; etc.

Freshwater fisheries receive more attention via the implementation of the Water Framework Directive which is concerned with catchment management and the maintenance of ecological standards in relation to freshwater streams, rivers and water bodies.

The review of the CFP, the development of an integrated maritime policy by DG MARE and the current interest in Integrated Coastal Zone Management (ICZM) should be exploited for the development of existing and new biodiversity related marine indicators.

The following existing indicators have been identified to be able to serve the purpose of monitoring at least parts of this sub-target:

Table 7 Existing indicators relevant for sub-target 2

Indicator	Description
SEBI 12	Marine Trophic Index of European sea
SEBI 15	*Nutrients in transitional, coastal and marine waters*
SEBI 21	European commercial fish stock
SEBI 22	Aquaculture: effluent water quality from finfish farms
IUCN EU Red List	Percentage of EU species threatened by overfishing

Furthermore, DG MARE is in possession of very accurate data on the status of EU fish stocks which would allow fairly easily accessible information for monitoring progress towards the target.

3.4.3 Corresponding existing monitoring schemes

Significant efforts are devoted to comparing the performance of different monitoring systems and transport / dispersion models. Extensive monitoring guidelines have been developed for most water related issues (e.g. drinking water, ground water, urban waste water) as part of the Water Framework Directive implementation plan. However, significant shortcomings are typical in many national and local monitoring activities. In the area of water, including bathing water, what is being measured varies substantially, while measurement models are not always consistent with generating comparable data.

[54] See: epp.eurostat.ec.europa.eu/.../SIZE%20OF%20FISHING%20FLEET.PDF
[55] Eurostat statistics: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Fishery_statistics
[56] http://www.biomareweb.org/
[57] Féral,J-P., Fourt, M., Perez, T., Warwick, R.M., Emblow, C., Heip, C., van Avesaath, P., and Hummel, H. (2003) European Marine Biodiversity Indicators. Netherlands Institute of Ecology - Centre for Estuarine and Marine Ecology, Yerseke, The Netherlands, 2003

WISE

The WISE (Water Information System for Europe)[58] is the gateway to information on European water issues. It compiles a number of data and information collected at EU level by various institutions and bodies. The WISE viewer is a central location where geographically-mapped information on water-related issues can be found for the whole of Europe. This includes data on water quality and soon on water quantity, and information on implementation of EU water legislation. Bo Jacobsen (WISE) provided an estimate for set-up, operational, data access and coordination costs on EU as well as on Member State levels. These cost estimates amount to approximately €2.5 million per year in the period 2014-2020.[59]

GMES – marine core service (MyOceans project)

Little has been done so far to improve monitoring of marine life. The very recent EU Marine Knowledge 2020 Initiative aims to tackle current gaps in monitoring and baseline knowledge on marine species and habitats. The Commission's communication presenting the new initiative points out that GMES[60] (Global Monitoring for Environment and Security) is among existing EU instruments contributing to better understanding of Europe's seas and oceans. In this context, options for the marine core service of GMES are being tested through the MyOcean[61] project. MyOcean is the implementation project of the GMES Marine Core Service, aiming at deploying the first concerted and integrated pan-European capacity for Ocean Monitoring and Forecasting. Thus, if taking the costs of the GMES marine core service / MyOcean project as a very rough indicator for marine related monitoring, costs can amount to over €88 million per year (2014-2020) and are currently shared between the European Commission and various national research institutes. This cost estimate has been made for the in-situ components of the marine core service and is based on set-up, operational, data access and coordination costs.[62] It should be noted, however, that probably some of these costs would not be directly relevant for the biodiversity aspects to be monitored. Nevertheless, this estimate demonstrates the cost dimensions for marine monitoring efforts. These costs are shared between EU institutions and Member States.

Census of Marine Life (CoML)

The first Census of Marine Life (CoML)[63] hopes to act as a baseline of how human activity is affecting previously unexplored marine ecosystems. Its results were published on October 4, 2010. The international project involved more than 2,700 researchers from 80 nations, who spent a total of 9,000 days at sea during at least 540 expeditions. It has been described as the most comprehensive study of its kind.

The research programme, involving more that 670 institutions, set out in 2000 with the aim of answering three questions: what lived in the oceans? What does live in the oceans? What will live

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[58] http://water.europa.eu/en/welcome

[59] Estimate provided by Bo Jacobsen (WISE) for EU level costs. MS level costs based on upscaling Swedish and French cost estimates available from:

- Sweden: http://circa.europa.eu/Members/irc/env/wfd/library?l=/working_groups/new_wg_reporting/meetings/x16th_meeting_2010/2c-rbmp_reporting_1/_EN_1.0_&a=i (see slide 7)
- France: http://eea.eionet.europa.eu/Members/irc/eionet-circle/eionet-telematics/library?l=/technical_developments/wise_technical_group/meeting_07-08062010/france_wise_tgppt/_EN_1.0_&a=i (slide 3)

[60] http://www.gmes.info/

[61] http://www.myocean.eu.org/project.html

[62] ECORYS study 2010 for EEA: GMES in-situ cost assessment.

[63] http://www.coml.org/

in the oceans? However, the collection of millions of specimens has led to researchers identifying more than 6,000 potentially new species, of which 1,200 have been formally described. The findings also prompted scientists to increase the estimate of known marine species from about 230,000 to almost 250,000.

The monitoring effort confirmed that in all oceans overfishing, pollution and rising water temperatures pose the most severe threats to biodiversity. In the Mediterranean Ocean, for example, only 3% of all species are fish. Scientists agree that the newly gathered data provides a basis for monitoring changes in the oceans in the future.

Total costs of the research programme have amounted to €474 million, primarily funded via donations.

Overview of existing monitoring schemes relevant for sub-target 2

The following table provides a summary overview of existing monitoring schemes relevant for sub-target 2.

Table 8 Summary typology of existing monitoring schemes addressing sub-target 2

Type	Name	Costs	Funded via	Coverage
European water monitoring	WISE	€ 2.5 million annually (2014-2020)	EU and Member States	EU-wide coverage. Updated regularly. Linked to mandatory reporting requirements.
Marine monitoring	GMES – marine core service (MyOcean project)	€88 million annually (2014-2020)	FP7 co-funding; national research institutes	Worldwide collection of data; interlinked with other European research efforts.
Marine monitoring	Census of Marine Life	€474 million	Donations; national research institutes	Worldwide coverage. Can serve as status baseline. Needs continued funding to offer 2020 update.

3.4.4 Gaps in current monitoring

The review[64] of national Article 17 reporting revealed large voids in knowledge of marine habitats and species. The newly launched Marine Knowledge 2020 Initiative aims to address some of these shortcomings in the near future. It remains to be seen, however, how much of the new 2020 target can really be covered by the intensified efforts.

3.5 Sub-target 3: Fragmentation and Green Infrastructure

Considering that there has been more habitat and ecosystem fragmentation in Europe than on any other continent, a sub-target on fragmentation/ unsustainable land-use change both within and outside of Natura 2000 areas is the best entry point to include connectivity and ecosystem services into the new biodiversity policy and would allow tapping into the structural funds and cohesion

[64] COM(2009) 358 final

policy for the financing of improved biodiversity protection. All paths lead to Green Infrastructure, a concept introduced in the White Paper on Climate Adaptation[65], which addressed both the question of connectivity and the provision of ecosystem services (natural coastal protection through marshes/flood plain restoration vs. dikes; natural water cycling vs. waste water treatment plant; urban solutions such as tree planting vs. air conditioning etc).

Under the operational programmes for 2007-2013 co-financed by the Cohesion and Structural Funds, Member States have allocated €2,689 million to the “Promotion of biodiversity and nature protection”. A further €1,137 million has been allocated to the "protection of natural assets", which also includes biodiversity projects. A total of €1,406 million, earmarked for the "protection and development of natural heritage" in the framework of tourism also include some spending on biodiversity.

Altogether, this would indicate that approximately 1.5% of the total Cohesion and Structural Funds monies is contributing to biodiversity policy. However, the recent Strategic Report[66] reveals that the actual uptake of money allocated to environmental issues is below EU average, especially for biodiversity related projects. All but two Member States have allocated some funding for nature and biodiversity, although as a proportion of the overall allocations this varies between countries. Only seven Member States intend to use more than 2% of their allocated funds for biodiversity-related categories.

The development of and investment in ‘Green Infrastructure’ has been highlighted by the Commission and the Council. The Commission is supporting exchanges of best practice as a basis for developing an EU Strategy on Green Infrastructure in2011.

3.5.1 Towards a sub-target

A sub-target on green infrastructure is complex to develop, both in terms of definition of the concept and what it entails and in terms of considering the limited competences of the EU on land use and spatial planning, as well as subsidiarity involved. The sub-target should be, however, closely linked to the climate adaptation agenda. For this sub-target, there is a need to address the issue of the increase in and territorial distribution of built-up/urbanised areas in the EU.

Given the sensitivity of Member States/sub-national entities on issues pertaining to land use and spatial planning, this sub-target should not be associated with restrictions on land use which would trigger a negative reaction but rather should be based on a positive approach based on the constitution of green infrastructure networks in Europe (e.g. Dutch ecological networks, French *Trame verte et bleue* etc) and the extension of nature protection measures to EU overseas territories in line with the ongoing BEST initiative (scheme for biodiversity and ecosystem services in European overseas entities) launched during the French Presidency in 2008.

For the moment, the following potential formulations for a sub-target have been developed and are not mutually exclusive:

- Prioritisation of Green Infrastructure strategies incl. projects (e.g. such as of climate change mitigation/adaptation focus, and of strengthening ecosystem services) in particular under regional policy (e.g. through earmarked funding);

[65] COM(2009) 147 final
[66] COM(2010) 110 and SEC(2010) 360 final

- Maintenance and restoration of key ecosystem services at a sufficient level;
- (connectivity and adaptation) Putting in place a Trans-European network of Green Infrastructure through dedicated funding;
- (natural capital investments) - % EU funding devoted to Green Infrastructure projects (e.g. starting with climate change mitigation/adaptation focus); and
- (fragmentation / land-use change) - no net loss of natural areas and good functioning soil including compensation obligation which could be based on the maintenance of key ecosystem services / or sealing capping.

3.5.2 Relevant existing indicators

Much of the work in relation to spatial planning and biodiversity has considered issues such as the possibility for including mitigation and compensation measures for biodiversity within schemes for built development. Specific research into privacy related indicators were spatial planning is limited. However, as with agriculture, it is possible to divide spatial planning/energy/transport biodiversity indicators as follows:

- Ecosystem: including indicators relating to land conversion into urban, industrial and related infrastructure development; the maintenance, creation, translocation or restoration of habitats (linked to compensation, using area), the creation of eco-ducts, the implementation of habitat management related to development planning.
- Species: relocation, protection and/or creation of growing, nesting and hibernation areas within development schemes, of selected species.
- Genetic: the preservation of locally occurring varieties (e.g. top fruit) within development schemes.
- Other: ecosystem service related such as creation of habitat and features for pollination/ pollinators; creation of habitat such as reed beds for sewage treatment, flood alleviation, etc; soil restoration; the development of visitor centres, volunteering schemes to bring people closer to nature.

The following existing indicators have been identified to be able to serve the purpose of monitoring at least parts of this sub-target:

Table 9 Existing indicators relevant for sub-target 3

Indicator	Description
SEBI 04	Ecosystem coverage
SEBI 05	Habitats of European interest
SEBI 13	Fragmentation of natural and semi-natural areas
SEBI 14	Fragmentation of river systems
SEBI 16	Freshwater quality
SEBI proposal	Trends in ecosystems restored
IUCN EU Red List	Percentage of species threatened by loss of habitat
EEA, ETC/LUSI	Landscape ecological potential, species specialisation index, land accounts

3.5.3 Corresponding existing monitoring schemes

Some Member States (such as the UK) are further than others in integrating green infrastructure in spatial planning on local, regional and national level and a European strategy is still lacking. Consequently, there are few existing monitoring schemes on fragmentation and green infrastructure from a biodiversity perspective. However, since large quantities of spatial data are collected on both Member State and European level (e.g. CORINE), large potential exists to cost-efficiently adapt and

analyse biodiversity indicators via these schemes. Beyond existing schemes (such as LUCAS), a recent FP7 funded project, SCALES, intends to zoom in on problems relating to differences on both spatial and temporal scales.

SCALES

SCALES stands for 'Securing the Conservation of biodiversity across Administrative Levels and spatial, temporal, and Ecological Scales'. It is a FP7 project which aims to capacitate decision-making on biodiversity conservation across scales which is essential when addressing connectivity problems. SCALES has a budget of €9,986,715 of which FP7 contributes €6,995,640. The project runs from 2009 to 2014.

LUCAS

LUCAS is a statistical tool which collects data on land cover/land use and landscape diversity in all Member States. Currently the possibilities on including specific biodiversity components and gather data from approximately 260,000 points are discussed pending funding and technical possibilities. Two possibilities stand out:

1. Grassland species/habitat/ecosystems monitoring. Currently no mapping/monitoring of grassland species/habitats/ecosystems or their services is available at European level. Including a survey on this category needs, if relevant, to be in line with and contributing to Member States' monitoring exercises for their obligations according to Art.17 Habitats Directive (and if they wish to use such a module), and for underpinning target monitoring of EU post-2010 biodiversity strategy. Once a list of indicators (species, habitats or ecosystems and their services) will be identified, the LUCAS network would easily offer the possibility of a long term monitoring with a limited budget (since the core survey is already in place).

2. Biodiversity and ecosystem services monitoring (more specifically insect, mollusc or bat recording and pollination service mapping). High information value could be gathered with a repeated point visit (next day, in some months). On the example of pollination services mapping, the aim of the exercise should be to monitor the pollinator presence and variety in the sampled areas via the location of trap nesting in the surveyed points.

Adding to the second point, the EU Red List data for dragonflies, butterflies and saproxylic beetles have been published since 2008 and could prove valuable in tracking presence and quantity. There plans to extend this monitoring to pollinators, medicinal plants and habitats. In the long-term, this type of data could be integrated and related to scales to track movement and spread possibly due to efforts to reach the 2020 sub-target 3.

Overview of existing monitoring schemes relevant for sub-target 3

The following table provides a summary overview of existing monitoring schemes relevant for sub-target 3.

Table 10 Summary typology of existing monitoring schemes addressing sub-target 2

Type	Name	Costs	Funded via	Coverage
Green infrastructure monitoring	SCALES	€ 6,995,640	FP7	Facilitates European-wide progress on green infrastructure related cooperation across scales
Green infrastructure monitoring	LUCAS	€ 700,000[67]	EUROSTAT	Europe-wide, well-established statistical tool that can fulfil part of the monitoring needs; however it is not focussed on green infrastructure directly

3.5.4 Gaps in current monitoring

Little is known about green infrastructure or at least knowledge is not consolidated. There is some convergence on the reasons for why and how fragmentation occurs but in terms of policy impact or effectiveness, spread or decrease, and/or existing monitoring approaches knowledge is scarce.

3.6 Sub-target 4: Nature conservation

The Commission has flagged that there are major implementation gaps in the establishment of the Natura 2000 network and there have been delays and problems with implementation, including insufficient resources allocated to this effort. At the same time, targeted measures under the EU nature conservation legislation have proved capable of reversing the decline in threatened species and habitats.

The achievement of all other sub-targets will have a significant positive impact on the nature conservation objectives. Nevertheless, the Birds and Habitats Directives are key instruments dedicated to habitat and species conservation at EU level (together with the Water and Marine Strategy Framework Directives) and therefore play a crucial role in achieving EU biodiversity objectives, it is therefore essential to use the new biodiversity strategy to boost their implementation via a dedicated sub-target.

3.6.1 Towards a sub-target

Ideas considered at this stage for a possible sub-target are both effort-based (e.g. completion of establishment of Natura 2000; full funding of the network) and status-based (e.g. % of species/habitats protected under 'favourable conservation status', as defined in the Habitats Directive):

- 20-30% of conservation status assessments (EU – biogeographical level) for species and 30-40% for habitats are favourable or show evidence of improvement;
- Less than x% of species/habitats protected under EU legislation are classified as unknown;
- -Sufficiency index for designated Natura 2000 sites;
- x% of funding needs for the management of the Natura 2000 network (€6 billion) met;
- % of Natura 2000 sites which have an appropriate management plan or equivalent instrument.

The conservation status of habitats and species protected under the Habitats Directive is undertaken every six years according to Article 17 of the Habitats Directive. The first report was

[67] According to the Tender doc's (2006) the LUCAS Project Budget was €700.000 (source: http://www.eurogi.org/POOLED/DOCUMENTS/a216104/contract%20notice%202006_S%20173%20_183876.pdf)

published last year. It revealed that only 17% of the assessments of the conservation status of habitats and species are favourable. This provides a very clear baseline against which future progress can be measured.

Efforts are being stepped up to improve the implementation on Nature legislation as well as improving the funding mechanisms to finance the Natura 2000 network (the funding needs of the network are about €6 billion. The Communication on Financing Natura 2000 scheduled for adoption in 2011 will be a good opportunity to make better use of existing funding as well as exploring other ways of improving funding in the future).

3.6.2 Relevant existing indicators

Across Europe work has been under way to identify and evaluate indicators which, together, allow an assessment of progress towards the 2010 target. The European Community's 2006 Biodiversity Communication[68] provided a detailed strategic response to accelerate progress towards the 2010 targets at Community and Member State level.

The following existing indicators have been identified to be able to serve the purpose of monitoring at least parts of this sub-target:

Table 11 Existing indicators relevant for sub-target 4

Indicator	Description
SEBI 01	Abundance and distribution of selected species: a) birds (all, farmland, forest), and b) butterflies (grassland)
SEBI 02	Red List Index for European species
SEBI 03	Species of European interest
SEBI 05	Habitats of European interest
SEBI 07	Nationally designated protected areas
SEBI 08	Sites designated under the EU Habitats and Birds Directives
SEBI 11	Impact of climactic change on bird populations
SEBI 25	Financing biodiversity management
BAP	Funding for Natura 2000 (for EU, per MS)
BAP	Sites with management plan or equivalent
IUCN EU Red List	Percentage of EU species, including mammals, amphibians, reptiles, birds and butterflies, which face risk of extinction

3.6.3 Corresponding existing monitoring schemes

The EU Natura 2000 policy is very ambitious and the first time in history that different countries have made a political commitment to protect nature at the international level. At the moment, the European Commission (EC) uses several mechanisms to monitor the implementation of Natura 2000 within Member States.[69]

Natura 2000 Barometer

[68] EC (2006) COM/2006/0216 final: Communication from the Commission - Halting the loss of biodiversity by 2010 - and beyond - Sustaining ecosystem services for human well-being.

[69] This section is based largely on: Smit, I (2009) Safeguarding Europe's biodiversity? A tool to assess the implementation process of the EU Natura 2000 policy. ECNC, Tilburg/ Master's Thesis, University of Utrecht.

The Natura 2000 Barometer gives an evaluation on the progress made in establishing the Natura 2000 network, under both the Birds and the Habitats Directives, and is in this sense not directly a monitoring scheme but rather indicating status *vis-à-vis* the biodiversity target. It is based on information on number of sites and areas covered, as indicated by Member States. In the implementation process of Natura 2000, two stages can be distinguished:

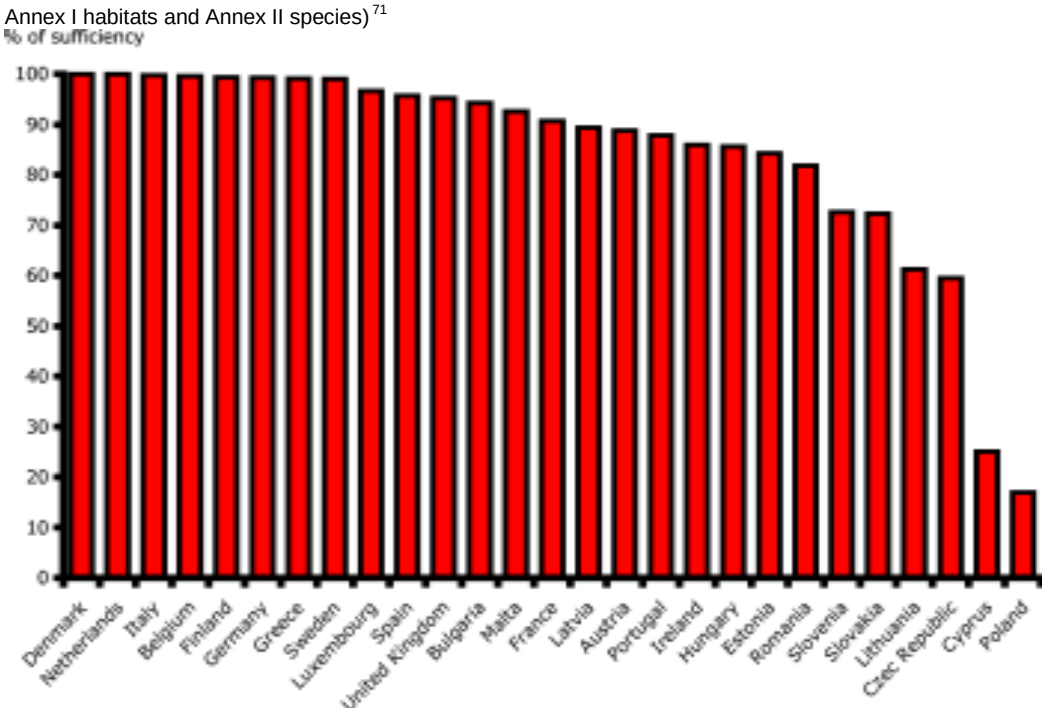
1. the site designation process (first pSCI, now SACs); and
2. the management of the sites.

The Natura 2000 Barometer gives an overview of the progress of Member States concerning this first phase of site designation and gives an indication about the development of the Natura 2000 network. It does not say anything about site management, the second phase of the implementation.

Sufficiency Index

In addition to the Barometer, the EC uses the Sufficiency Index (SI) presented in the figure below. The SI gives an overview of the state of progress by Member States in reaching sufficiency for the Habitat Directives Annex I habitats and Annex II species. In this way, the SI is similar to the Natura 2000 Barometer as it is not directly a monitoring scheme. It is based on the indicators 'number and total area' of designated sites and 'presence of management plans', which are both indicators with a quantitative nature.[70]

Figure 8 Sufficiency Index (state of progress by Member States in reaching sufficiency for the Habitat Directive Annex I habitats and Annex II species) [71]



Unlike the barometer, this indicator does not cover the sites designated under the Birds Directive only. The bars show the degree to which Member States have proposed sites that are considered sufficient to protect the habitats and species mentioned in Habitats Directive Annex I and II

[70] EEA (2007b), Europe's environment - The fourth assessment. Luxembourg: Office for Official Publications of the European Communities, 2007.

[71] EEA, 2007b.

(situation January 2007; marine species and habitats are not considered). This is measured against a threshold that is considered sufficient to achieve a 'Favourable Conservation Status' for those species and habitats of concern. Comparison between countries is complicated by the heterogeneous distribution and abundance of species and habitats, and as a result some countries have a heavier burden than others in implementing the Directives[72].

Although most EU countries have made much progress in designating sites to protect species and habitats listed in the Habitats Directive, these relatively recent designations do not measure the achievement of the overall Favourable Conservation Status of the habitats and species concerned. In addition, the SI does not take the Birds Directive into account.

Article 17 reporting

A third means used by the Commission for monitoring Natura 2000 implementation is through the obligation of Member States to report about the condition of species and habitats of community importance (Article 17) every six years to the EC. Article 17 section 1 of the Habitats Directive states:

> "Every six years from the date of expiry of the period laid down in Article 23, Member States shall draw up a report on the implementation of the measures taken under this Directive. This report shall include in particular information concerning the conservation measures referred to in Article 6 (1) as well as evaluation of the impact of those measures on the conservation status of the natural habitat types of Annex I and the species in Annex II and the main results of the surveillance referred to in Article 11. The report, in accordance with the format established by the committee, shall be forwarded to the Commission and made accessible to the public."

The Directive asks for six-yearly reports and requires that the European Commission then produces a consolidated EU report based on the national reports. The reporting format aims to standardise the reports to allow the aggregation of national data to produce the EU report. The format adopted requires an assessment of the conservation status of each Annex I habitat and each species listed on Annexes II, IV and V across the entire territory of the Member States where they occur. Conservation Status can be reported using three classes: Favourable; Unfavourable – Inadequate; Unfavourable – Bad plus an 'unknown' category for species or habitats where insufficient information exists to allow a proper assessment. This report is constructed by the European Topic Centre on Biodiversity in Paris and is based on the reports from the individual Member States. The reporting format by the EC is as follows:

- First report – 2000: Transposition of legislation and the current status of the site designation process.
- Second report – 2006, due to delay - 2007/2008: First assessment of the conservation status of all species and habitats of Community Interest listed in the Habitats Directive based on best available information.
- Third report -2012, due to delay 2013/2014: Renewed assessment of conservation status, based on the established monitoring system. By 2013/2014, in the third report, the effectiveness of the measures taken under the Directive will be assessed.

[72] EEA (2008), Indicator management service. Available at the on-line: http://ims.eionet.europa.eu/IMS/ISpecs/ISpecification20041007131611/IAssessment-1216803252161/view_content.

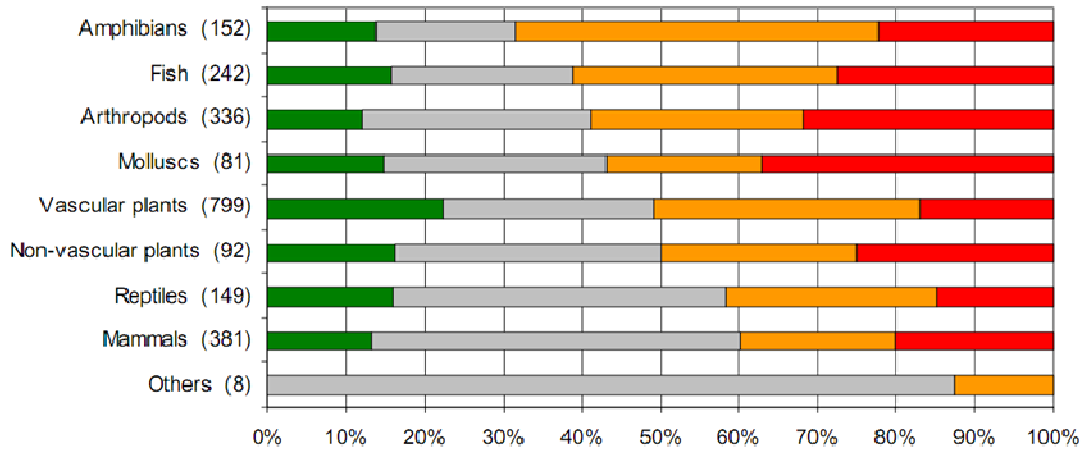
Reports about the conservation status were prepared by Member States in 2007 and in 2009; the first results are now ready. The European Topic Centre on Biodiversity prepared a European overview report on basis of all the national reports. According to a Natura 2000 official from the EC the report is, despite the various monitoring methodologies and national reports, very rich in information. Delay in the report is not seen as a huge problem because this first monitoring report is seen as an exercise for the Member States and the second report expected in 2013 is likely to be much easier to develop.

The EC has now started to collect information about the way in which Member States manage their sites in order to get an overview of what is going on in the Member States with the final purpose of getting information about the effectiveness of Natura 2000. At the moment, according to a Natura 2000 expert from the European Commission, not much progress has been made in relation to this topic and there is an urgent need for information about the performance of the implementation within single Member States. The following charts give examples in summary form; fuller information can be obtained in relation to Article 17 in the reference given below[73]:

Table 12 Habitats, species and sites from Nature Directives

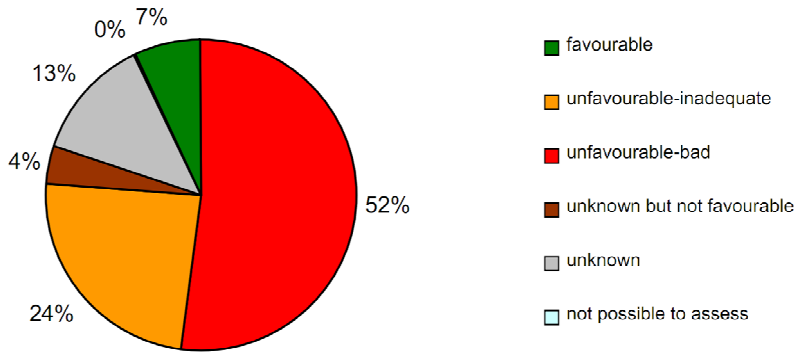
Conservation status	Favourable	Unfavourable	Unknown
Habitat types	17%	65%	18%
Species	17%	52%	31%

Figure 9 Detailed conservation status in relation to species



[73] ETC/BD (2009) http://eea.eionet.europa.eu/Public/irc/eionet-circle/habitats-art17report/library?l=/papers_technical/overview_conservation_1/_EN_1.0_&a=d pages 6 and 8 and EC (2009) Article 17 composite report http://ec.europa.eu/environment/nature/knowledge/rep_habitats/docs/com_2009_358_en.pdf pages 7 and 9

Figure 10 Detailed conservation status of (e.g.) habitats dependent on agriculture



EU Red List

The European Red List is run by IUCN and reviews the conservation status of ca. 6,000 European species (mammals, reptiles, amphibians, freshwater fishes, butterflies, dragonflies, and selected groups of beetles, mollusks, and vascular plants) according to IUCN regional Red Listing guidelines. It identifies those species that are threatened with extinction at the European level – so that appropriate conservation action can be taken to improve their status. To date, the IUCN's European Red List is the most comprehensive list of species status and used extensively by decision-makers, NGOs, academics and even general public. It is supported by EC.

Vigie-Nature (France)

The French initiative Vigie-Nature is not directly related to Natura 2000 but gives a good indication on how an expert/voluntary scheme can be used to cost-efficiently to monitor several species and habitats.

Vigie-Nature has been established by the French Muséum national d'Histoire naturelle as a citizen science programme for monitoring ordinary biodiversity in France through greater use of novice volunteers. Involving more than 10,000 volunteers, the programme bring together monitoring data on different species groups (common birds, butterflies, pollinators, plants, bats, and amphibians). The reliance on novice volunteers allows for more data being collected and at the same time helps to create awareness amongst the general public.

All monitoring is coordinated by the same research unit at the Muséum and therefore relies on a single and complementary method, which means that protocols and sampling plans are designed to obtain structured datasets which allow comparisons over time and space. Each programme (on different species groups) leans on a close cooperation with an NGO partner.

The team for running the programme consists of 30 full-time equivalents at the Muséum, plus the NGO partners for each programme, plus regional coordinators. The cost currently amounts to € 1 million per year. But to further improve coordination of the databases, a bigger budget is needed. The current budget is shared between research organisations, government (national coordination) and local authorities (regional coordination). If this approach was to be replicated in other Member States, the strong centralised coordination centre has been highlighted as one of the crucial factors for success. This centre needs to have a strong scientific basis and be able to establish working partnerships with specialised NGOs. Furthermore, Vigie-Nature is currently exploring how to integrate data into LUCAS.

Countryside Survey

Countryside Survey is, like Vigie-Nature, a national monitoring scheme of state of the countryside in terms of habitats and species. It has been done in intervals since 1978 and the latest study coming out in 2009. The latest survey used almost 600 1x1 squares across the UK and was carried out by a team of 80 trained specialists. For this UK wide survey DEFRA and the Natural Environment Research Council (NERC) paid €11.7 million (£10 million).

Overview of existing monitoring schemes relevant for sub-target 4

The following table provides a summary overview of existing monitoring schemes relevant for sub-target 4.

Table 13 Summary typology of existing monitoring schemes addressing sub-target 4

Type	Name	Costs	Funded via	Coverage
Species and habitats	Natura 2000 Barometer	Unknown		EU-27
Species and habitats	Sufficiency Index	Unknown		EU-27
Species and habitats compulsory	Article 17	See chapter 5 ST4	MS	EU-27
Species and habitats	EU Red List	€ 6 million (for update)	EC co-funded	EU-27
Species and habitats voluntary	Vigie-Nature	€1-2 million	MS	France
Species and habitats voluntary	Countryside Survey	€11.7 million	MS	UK

3.6.4 Gaps in current monitoring

Whilst the majority of Member States are reporting on the number and area of sites designated as Natura 2000, there is a lack of information about the actual implementation process within Member States; presently this relates specifically to site management towards maintaining or achieving favourable condition, however, this can also be applied to the use of methods to assess for example development plans, scientific knowledge and research, monitoring, public involvement and effectiveness of the policy itself.

A recent evaluation of Natura 2000 reporting[74] suggested that the following indicators could be useful and representative for a framework for collecting data to assess the effectiveness of Natura 2000 implementation of EU Member states towards a baseline and against each other. A very few will be seen to covered already in Article 17 and Article 6 reporting and many could be monitored remotely/centrally thus reducing costs (see

[74] Smit, 2009

Table 14).

Table 14 Feasible indicators for monitoring progress of Natura 2000 implementation

Topic	Indicators
Legislation	• Transposition of Articles into national legislation • Integration within other policies and sectors • Enforcement • Responsible institution present • Working group on Article 10
Site selection	• Scientific study at basis of selection process • Representativeness of sites • (Cross-border) connectivity between sites • Marine sites included • Number + total area of SCIs • Number + total area of SPAs
Protection	• Legal protection of sites • (Incidental) Catching and killing of BD Annex IV and V species + control system
Management	• Incorporation of proposed sites into system of protected areas • Implementation of procedure for assessing projects and plans • Compensation measures where necessary + number of cases • Elaboration of management plans • Implementation of management plans • Number of sites where management plans have been adopted and where management • plans are in preparation • Number of sites without management plans but with relevant territorial planning or • management instruments for achieving nature conservation goals • Staff members exclusively employed for N2000 • Goal setting per species and habitat at national and site level
Monitoring	• Identified responsibilities for national monitoring report • Measures undertaken to establish system to monitor conservation status of habitats • and species (Art.2)
Favourable conservation status	• Presence of typical / characteristic species • Communication • Presence of communication / awareness-raising strategy for N2000 • Social acceptance • Awareness of officials • Public participation and consultation • Financing • Presence of national budget line for N2000 • Total annual national budget and costs for N2000 and managing of N2000 sites
Legislation	• Transposition of Articles into national legislation • Integration within other policies and sectors • Enforcement • Responsible institution present • Working group on Article 10

3.6.5 Conclusions

Natura 2000 monitoring and the indicators applied represent state-of-the-art in terms of their application and reporting across the member states. It is clear that the monitoring is carried out

because it is a requirement of the Directives. However, it can also be seen that there are shortfalls in terms of the detail of all species and habitat monitoring which are revealed on closer examination of the figures.

The list of potential areas for monitoring linked to Natura 2000 specifically rather than biodiversity in general, represent a rich area for consideration; many of them are highly cost-effective and could be applied in a comparison across Member States.

3.7 Sub-target 5: Invasive alien species (IAS)

Invasive Alien Species (IAS) are amongst the most potent threats to biodiversity. Famously documented in the movie 'Darwin's Nightmare' (2004), IAS can alter entire eco-systems, change biodiversity, disrupt cultural landscapes and destroy socio-economic values.[75] Whereas alien species (IS) are defined as "subspecies or lower taxon, introduced outside its natural past or present distribution…that might survive and subsequently reproduce", an *invasive* alien species is "an alien species which becomes established in natural or semi-natural ecosystems or habitat, is an agent of change, and threatens native biological diversity".[76] Europe hosts more than 10,000 (known) IS from which 10-15% are expected to have negative ecological and/or economic impact, especially in marine eco-systems and isolated species-rich islands.[77] Increase in trade, tourism, and transport of goods, as well as, climate change is expected to exacerbate the problem of IAS.[78]

Compared to other OECD countries[79], the EU is poorly equipped to address IAS and lacks a coherent IAS policy. However, following a Communication in 2008, 'Towards an EU Strategy on Invasive Species'[80], the Environment Council invited the European Commission to prepare an EU strategy on IAS, including a possible legislative component. The Council highlighted the need for identification and regulation of pathways, a clear definition of responsibilities, and comprehensive assessment of the risks and impacts of existing and future IAS.

Given the generality and lack of consistency of legislation addressing invasive IAS at Community and Member State level - including provisions within international agreements and other international instruments - there is a need for strategic and comprehensive approaches. This is currently being developed as part of an EU Strategy on Invasive Species.

3.7.1 Towards a sub-target

Early identification and measures to contain IASs are pivotal to address the problem effectively and cost-efficiently. Consequently, investing in monitoring and reporting of existing, new and potential IASs could avert many future biodiversity problems. This should be reflected in a sub-target for IASs. Such a sub-target could mirror an existing sub-target under the CBD:

- Pathways for the introduction and establishment of invasive species have been controlled and established invasive species are identified, prioritised and controlled or eradicated.

[75] The DAISIE Project
[76] Decision VI/23* of the Conference of the Parties to the CBD, Annex, footnote to the Introduction
[77] SEC(2008) 2887 and SEC(2008) 2886 'Towards an EU Strategy on Invasive Species
[78] EEA (2010) EU 2010 Biodiversity Baseline, p 8.
[79] e.g. U.S., Canada, Australia and New Zealand
[80] COM (2008) 789

While building on existing legislation, particularly the European Commission's (DG SANCO) legislation on Plant Health (currently being reviewed), the IAS strategy scheduled for adoption in 2011 would focus on: a) the prevention of IAS entry into EU territory; b) early detection and rapid response; c) control and management to contain spread and eradicate new IS; d) horizontal/cross-cutting activities (monitoring, research in particular).

3.7.2 Relevant existing indicators

The following existing indicators have been identified to be able to serve the purpose of monitoring at least parts of this sub-target:

Table 15 Existing indicators relevant for sub-target 5

Indicator	Description
SEBI 10	Invasive alien species in Europe
IUCN EU Red List	Percentage of EU species threatened by invasive species

3.7.3 Corresponding existing monitoring schemes

Monitoring of alien species is considered well established with good European coverage. Due to negative economic impact of invasive alien species (IAS) proliferation (estimated to exceed €12.5 billion per year[81]), monitoring is expected to continue.

The central indicator for IAS, SEBI 10, comprises two elements: (a) cumulative number of alien species in Europe since 1900; and (b) worst invasive alien species threatening biodiversity in Europe.'[82] To monitor SEBI 10 thus entails both an inventory of alien species in Europe and a classification of the most threatening alien species to ecological services.

DAISIE

The project Delivering Alien Invasive Species In Europe (DAISIE), funded by the European Commission under FP6, maps out 10,962 alien species in up to 63 countries/regions and 39 marine and coastal areas regions in wider Europe.[83] DAISIE includes over 248 datasets and more than 45,000 records on individual alien species in Europe and is by this the largest database on alien species in the world. It also contains and expert based list of the 100 worst IAS which directly corresponds to the second part of the SEBI 10 indicator.

Overview of existing monitoring schemes relevant for sub-target 5

The following table provides a summary overview of existing monitoring schemes relevant for sub-target 5.

Table 16 Summary typology of existing monitoring schemes addressing sub-target 5

Type	Name	Costs	Funded via	Coverage
IAS monitoring	DAISIE	€3.45 million	Partly FP6	EU-27

[81] Kettunen, M., Genovesi, P., Gollasch, S., Pagad, S., Starfinger, U. ten Brink, P. and Shine, C. (2008). Technical support to EU strategy on invasive species (IAS) -Assessment of the impacts of IAS in Europe and the EU (final module report for the European Commission). Institute for European Environmental Policy (IEEP), Brussels, Belgium. 44 pp. + Annexes.

[82] EEA (2007). Halting the loss of biodiversity by 2010: proposal for a first set of indicators to monitor progress in Europe. EEA Technical report No. 11/2007. European Environment Agency, Copenhagen, Denmark.

[83] http://www.europe-aliens.org/aboutDAISIE.do, accessed 2010-06-25

3.7.4 *Gaps in current monitoring*

Monitoring of certain alien species' presence and spread occurs in many European countries driven, in part by their economic, human and animal health impacts; however, the knowledge on impact on ecosystem services is less developed. From over 10,000 alien species registered in DAISIE, the economic impact of only 1347 (13% of total) and the ecological impact of 1094 (11% of total) alien species have been determined.[84] This gap needs to be filled in order for proper monitoring and cost-benefit analyses for policy action to take place.

A recent study[85] estimated the economic impact of IASs to almost €6 billion per year. It also concluded that this is probably a conservative number because of gaps in data. The following data gap is mentioned in the study:

- "impacts of only about 10 per cent of invasive species in Europe are known to ecologists and economists;
- monetary estimates for the cost of species extinctions and loss of biodiversity are not commonly available;
- far more IAS have socio-economic impacts (by affecting ecosystem services) than are documented in monetary terms;
- data are inadequate for certain regions (east and south-east Europe) and for some large taxonomic groups (plants, invertebrates and marine taxa);
- economic impact data are only available for a third of the species studied and for a limited range of taxonomic groups (terrestrial plants and vertebrates in the EU); and
- such data are inadequate/non-existent for key sectors known to be affected by IAS, such as forestry, fisheries, tourism and infrastructure/utilities."

3.8 Sub-target 6: Contribution to global biodiversity

The new EU vision and headline target recognise that it is in the EU's interest to contribute to the protection of global biodiversity (Europe has impoverished biodiversity by global standards and therefore depends on biodiversity protection beyond its borders) and the responsibility of the EU in the global loss of biodiversity (the foot print dimension). It calls for stepping up the EU's contribution to averting global biodiversity loss. While the EU is the most important global donor for biodiversity protection efforts, average annual EU external assistance for biodiversity has remained largely unchanged at least since the adoption of the BAP in 2006, whereas the problem has continued to grow.

Preliminary discussions DG ENV carried out with RELEX, AIDCO and DEV on ways to improve the integration of biodiversity aspects into EU external policies revealed that although there are many uncertainties linked to the new developments brought about by the Lisbon Treaty, there is a will to better gear the development aid to cover investments linked to ecosystem and ecosystem services (cf. Global Alliance for Climate Change). This could involve, for instance, reviewing the rules

[84] Montserrat Vilà, Corina Basnou, Petr Pyšek, Melanie Josefsson, Piero Genovesi, Stephan Gollasch, Wolfgang Nentwig, Sergej Olenin, Alain Roques, David Roy, Philip E Hulme (2010) How well do we understand the impacts of alien species on ecosystem services? A pan-European, cross-taxa assessment. Frontiers in Ecology and the Environment: Vol. 8, No. 3, pp. 135-144.

[85] Shine, C., Kettunen, M., ten Brink, P., Genovesi, P. and Gollasch, S. (2009). Technical support to EU strategy on invasive species (IAS) – Recommendations on policy options to control the negative impacts of IAS on biodiversity in Europe and the EU. Final report for the European Commission. Institute for European Environmental Policy (IEEP), Brussels, Belgium. 35 pp.

governing the way development aid is spent in order to allow for more flexibility needed for biodiversity-related investments (longer time frame for programmes/projects, possibility to invest in Trust Funds, less emphasis on 'long-term financial viability'…).

Within the framework of broader Commission discussions on the future Financial Perspectives, strong linkages should be made to relevant negotiations/processes at global level. Climate has been given prominence and funding is likely to be earmarked for it as part on the budgetary envelope allocated to external policies. Moreover, the EU has already pledged €73 billion per year by 2020 as part of the Copenhagen Accord. As nature is both the most effective climate regulator and the largest carbon sink, biodiversity loss jeopardises climate objectives. Strong and resilient ecosystems are our life insurance against climate change, providing a 'natural fix' for mitigating and adapting to its consequences. This underpinning should be capitalised upon to direct climate funding allocations to the conservation and sustainable use of biodiversity and ecosystem services also in EU outermost regions and overseas territories.

On the other hand, another aspect to be addressed is the EU's ecological footprint which amounts to 4.7 hectares per person, or double the EU's biological capacity, according to the EU footprint indicator. The Resource Efficiency Initiative that was announced in the context of EU2020 is the right vehicle to address the issue and build a strong methodological approach to allow monitoring progress on this front.

3.8.1 Towards a sub-target

Beyond traditional development cooperation assistance, a significant source of funding could be ETS auctioning revenues and the fast track financing for adaptation. At this point in time, the following sub-target formulations have been brought forward:

- % reduction of the biodiversity-related impacts of the EU footprint, to be achieved through the Resource Efficiency Initiative;
- % EU external budget earmarked for payments for biodiversity and ecosystem services;
- % EU climate change budget devoted to ecosystem-based adaptation and mitigation measures ("REDD+" model, with potential expansion to peatland and wetlands); and
- % of Marine Protected Areas in areas beyond national jurisdiction.

3.8.2 Relevant existing indicators

The following existing indicators have been identified to be able to serve the purpose of monitoring at least parts of this sub-target:

Table 17 Existing indicators relevant for sub-target 6

Indicator	Description
SEBI 08	Sites designated under the EU Habitats and Birds Directives
SEBI 09	Critical load exceedance for nitrogen
SEBI 11	Impact of climatic change on bird populations
SEBI 15	Nutrients in transitional, coastal and marine waters
SEBI 16	Freshwater quality
SEBI 23	Ecological footprints of European countries
SEBI 24	Patent applications on genetic resources
SEBI 25	Financing biodiversity management
SEBI 26	Public awareness
SEBI proposal	Indicator based on number of enterprises reporting to GRI

3.8.3 Corresponding existing monitoring schemes

Currently, none of the existing monitoring schemes directly monitor the EU's footprint on global biodiversity. Nevertheless, well documented and abundant sectoral data on trade patterns in natural resources, including fisheries, agricultural produce, timber and other marine and terrestrial products can be used and adapted as indicators for the EU's impact on global biodiversity. But the need to enhance this understanding of the impact of EU consumption of food and non-food commodities such as soy beans, palm oil and metal ore, and of how it contributes to global biodiversity loss remains a challenge[86] because the biodiversity link - and more systematic monitoring - of these trade interactions has not been studied in detail.

There are some ongoing research efforts that can be linked to global biodiversity monitoring, namely GEOSS, Digital Observatory for Protected Areas (DOPA) including e-Habitat modelling services.

DOPA[87]

DOPA stands for Digital Observatory for Protected Areas and aims to create an open and operational system providing methods and tools to assess, monitor, and forecast biodiversity in areas of ecological interest at the global scale. It is developed by the European Commission's JRC in collaboration with international organisations such as GBIF, UNEP-WCMC, Birdlife International and RSPB. DOPA includes the so-called e-Habitat which is a web processing service for modelling habitats.

The DOPA is based on a set of web services which makes it difficult to assess the total costs given that there are a few very big partners involved. From a technological point of view, Gregoire Duboire (JRC) estimates the cost of setting up the services (assessment, monitoring and forecasting) they intend to have operating one day (operational version expected for 2013-2014) to around €3 million (development only of an operational system, the later maintenance would be extremely cheap), but the preparation of the data by the data providers and the data collection costs tens and tens of millions of Euros (just think about the effort of defining range maps for all birds, mammals, amphibians, from in situ observations to digital maps derived from models). Obviously, a lot of work has already been done, but still much needs to be done (just think about the remaining efforts to collect information in marine environments).

At the moment, a part of the costs is covered through competitive projects (EuroGEOSS by DG RTD, UncertWEB by DG INFSO).

More accurate figures can be provided in the future by Christine Heumesser (Boku, Vienna) who is assessing the costs and benefits of DOPA, but she has only started recently.

Overview of existing monitoring schemes relevant for sub-target 6

The following table provides a summary overview of existing monitoring schemes relevant for sub-target 6.

[86] Press release from Brussels on 16 December 2008 reporting on the 4 main policy areas being pursued by the EU.
[87] http://bioval.jrc.ec.europa.eu/PA/DOPA/

Table 18 Summary typology of existing monitoring schemes addressing sub-target 6

Type	Name	Costs	Funded via	Coverage
Global biodiversity	DOPA	€3 million (only set-up of the DOPA operating system). Significant extra costs for data input providers.	EC – JRC together with GBIF, UNEP-WCMC, Birdlife International and RSPB	Worldwide

3.8.4 Gaps in current monitoring

Current monitoring of the EU's footprint on global biodiversity is not yet formalised in any monitoring scheme. While indicators exist in various sectoral datasets, such as trade patterns of natural resource imports into Europe, these sectoral datasets are not geared towards monitoring biodiversity. Thus, additional efforts would be required to make the data useful for biodiversity monitoring under sub-target 6.

3.9 Summary: Identifying gaps in the SEBI set and drawing lessons from the current monitoring landscape

3.9.1 Gaps and lessons learned from the SEBI set

In 2009, a SEBI Working Group (WG1) on interlinkages between indicators mapped out to what extent Europe's major ecosystems were covered by the SEBI set.[88] It resulted in the following table:

Table 19 SEBI set coverage per ecosystem

Indicator	agric	forest	built-up	inland water	grassland, heath & tundra	polar	bare	marine
01 Birds	1	1						
01 Butterflies	1							
02 RLI	1	1		1	1	1	1	1
03 Species FFH	1	1		1	1	1	1	1
04 Ecosystems	1	1	1	1	1	1	1	1
05 Habitat FFH	1	1		1	1	1	1	1
06 Livestock genetic	1							
07 National sites		1		1	1	1	1	1
08 SCIs & SPAs	1	1		1	1	1	1	1
09 Critical load	1	1			1	1	1	
10 IAS	1	1		1	1	1	1	1
11 Temperature sensitive species	1	1		1	1	1	1	1
12 Marine Trophic Index								1
13 Frag Natural & semi,	1	1			1	1	1	
14 Frag Rivers				1				
15 Nutrients coastal								1

[88] Working Group 1: Interlinkages (2009) *Interlinkages between SEBI 2010-indicators - Improving the information power: An exploration*. Intermediate report to the SEBI coordination team.

& marine waters								
16 Freshwater				1				
17 Forest		1						
18 Deadwood		1						
19 Nitrogen	1			1				
20 Agri Managt	1							
21 Fisheries								1
22 Aquaculture								1
23 Footprint	1	1						1
24 Patents								
25 Financing								
26 Public awareness								

The following is a brief review of the coverage and usefulness of the full SEBI set based on the various EEA reports already referred to and other information available on the EEA website.[89]

The SEBI set is one step closer to a harmonized and complete picture of European biodiversity status. Nevertheless, there are remaining gap in certain areas from which valuable lessons could be learned.

Whilst the majority of Member States are reporting on the number and area of sites designated as Natura 2000, there is a lack of information about the actual implementation process within Member States. This could suggest that additional indicators on actual implementation would greatly benefit monitoring. It would provide Member States with a baseline for themselves and to compare with other countries. In current situation a significant proportion of habitats and species are simply not reported on (indicators 3 and 5) because the information is unavailable and the resources required to carry out detailed monitoring (in particular for certain species) are simply beyond the majority of countries. This even with the incentive of the Natura 2000 directives and the requirements associated with them. Realistically, a number of the indicators listed below are unlikely ever to be implemented at national level unless: a) they are provided with some form of instrumental requirement; or b) external funding is provided. Moreover, certain management related indicators such as deadwood (18), or cultural and landscape associated such as fragmentation (13) cannot be applied with consistency between bio-geographic regions. The uncertainty that this generates will hinder their implementation; on the basis that countries which do not currently use the indicators are unlikely to introduce them where they cannot clearly see the value.

Many of the indicators show incomplete coverage across Member States. This suggests that (1) monitoring and data collection efforts should be stepped up, and (2) that some indicators might be better monitored on bio-geographical level in terms of cost-effectiveness and coverage. Regarding point one, a highly motivated NGO/group of NGOs linked to a popular species and group can deliver extremely cost-effective monitoring effort, however, the question is whether or not a similar level of quality and coverage (as in birds and butterflies) can be achieved for other, more obvious, taxa such as: dragonflies and damselflies, moths, bees (in particular bumblebees), amphibian and reptiles, large mammals and flowering plants. Common birds monitoring, the climate change linked

[89] For example: biodiversity-chm.eea.europa.eu

bird indicator and the Butterfly indicator based on volunteer effort coordinated by influential and highly motivated NGOs; the former supported by a relatively modest financial contribution by the European Commission. In the end, there is a question of how to ensure (financial) sustainability of these schemes in the long-term. Member States need to support these on a contractual basis otherwise these schemes may not be sustained in the long-term. Regarding point two, in relation to certain groups it may be that a bio-geographic approach would be more sensible and cost-effective; in particular if this were related to certain issues. Thus, it might make sense to target alpine vascular plants linked to the issue of climate change (as he is already the case, successfully, in the Gloria project).

There is huge potential in using indicators and data collected from other sectors. For example, the agriculture sector, spatial planning, industry, tourism and transport, all have and could benefit from more biodiversity related data. The majority of agri-environment, the rural regeneration and related schemes were not set up as indicators of policy commitment in relation to biodiversity management.

When developing new indicators it is clear that centrally coordinated and funded indicators should be given a level of priority. This applies particularly to indicators such as public awareness (26) and ecosystem coverage (4). Such indicators can be coordinated and financed by, for example, the European Commission who can also publicise and promote the results. We also see that an indicator that is linked to economic impacts is likely to have wide coverage and active monitoring, as evidenced by, for example, the invasive alien species indicator (10). It should be noted that many invasive alien species also impact on native fauna and flora, some of which have recreational (hunting) or cultural (medicinal herbs, etc) value; this factor also drives the likelihood of their being monitored.

4 Developing scenarios for post-2010 biodiversity monitoring

This chapter presents three scenarios for monitoring the post-2010 EU biodiversity target. The scenarios range from Business as Usual, i.e. full implementation of existing monitoring obligations and schemes (BAU), via Improved monitoring (Scenario 1) to Optimal monitoring (Scenario 2) which would allow the EU to cost-effectively monitor progress towards the 2020 target in sufficient detail for every sub-target. In Chapter 5 the costs and benefits, effectiveness, etc. of these scenarios or a combination of schemes are discussed in order to feed into the impact assessment process.

4.1 Business as Usual scenario

The Business as Usual (BAU) scenario has in the previous chapter already been outlined for each sub-target. The overall picture shows a patchy monitoring landscape with significant discrepancies in coverage across sub-targets. This BAU scenario assumes however that current reporting obligations, research schemes and EU initiatives are going to be fully implemented, meaning a considerable enhancement of the current situation, however, not introducing new regulatory measures or major research initiatives. Moreover, funding levels to research schemes or voluntary/community action are assumed to remain constant.

Full implementation of this scenario in the next few years would mean closing the current monitoring gap of 13% regional habitat assessments and 27% regional species assessments with 'status unknown'. For some regions, such as southern Europe, and some biomes, such as marine environments, this gap is larger. In terms of coverage the BAU scenario would lead to significant improvement of the coverage of species and habitats.

In all sub-targets, large quantities of data exists but are unaccounted for due to coordination problems. For example, general farmland coverage, commercial fish stocks and land-use cover are well documented, however not translated into biodiversity indicators. Remote sensing (e.g. GMES, CLC) could be of greater benefit to understanding *habitat loss and degradation but also to conversion of HNV land to other land uses*, if there was a refinement in the classification system, and if data was made available on a more regular basis. Additionally continued research into sensor selection and methods and algorithms of habitat/land cover classification and translation of spectral data will all aid monitoring and mitigation of habitat loss and degradation. [90]

Headline target and current spending in Member States

The BAU scenario does imply a serious effort of both the Member States and the European Commission if the headline target is to be reached. The EEA[91] lists a whole set of data, information and knowledge gaps identified in attempting to produce the 2010 Biodiversity Status report. In concludes that:

[90] EEA (2010) Baseline Knowledge Gaps, Chapter 14

[91] EEA (2010) Baseline Knowledge Gaps, Chapter 14

- European data on status and trends of biodiversity is not comprehensive and there are fundamental gaps, even for the small number of species and habitat types targeted by the nature directives. Efforts are needed to improve European data on the: diversity (genetic diversity, species, habitats), distribution (inventories, atlas, mapping), abundance(monitoring population sizes and habitats surface area, trends) and quality (structure and function of habitats/ecosystems).

- Little is known, for example, about many aquatic systems (i.e. floodplains and deltas), genetic diversity beyond the agricultural sector, soil biodiversity and for many taxa at the species level.

- Generally, data for marine species and habitats are much scarcer than for terrestrial ecosystems, and across marine and coastal ecosystems.

- The European Red List revealed that there was not enough scientific information to evaluate the risk of extinction of some species and they were classified as Data Deficient (DD).

- The analysis of the data provided by the Member States on the conservation status of the species listed on the annexes of the EU Habitats Directive, indicated an important lack of quantitative/qualitative data from the Member States.[92]

- Considerable work is required to assess the status of plants, invertebrates and fungi, and to assess species of the marine biome, as this represents an important gap in European species assessments.

- For some species groups, like beetles, it would appear that few European countries - if any - have an organised and systematic monitoring programme and in most countries of the EU even basic data on species distribution and population status are limited.[93]

Sub-target 1: integration and sustainable use of resources

HNV farming and forestry are not currently well covered in a BAU. It is expected that some progress is to made in terms of on-going processes, but until clear guidelines, reporting mechanisms and monitoring schemes are defined, sub-target 1 remains inadequately monitored under a BAU.

Sub-target 2: overexploitation

In a BAU, the monitoring of fisheries remains under-developed making it difficult to determine progress towards the 2020 target. Some on-going schemes are trying to improve the situation but the general picture is unsatisfactory and in a BAU – like with sub-target 1 – fisheries would be difficult to monitor in terms of biodiversity status.

Sub-target 3: fragmentation and green infrastructure

Sub-target 3 might be, together with ecosystems, among the least developed sub-targets in terms of monitoring. A clearer definition of the concept and strong monitoring language in a future

[92] Reporting from EC Member States under Article 17 of the Habitats Directive to the European Commission. Compiled by ETC-BD, 2008,

[93] Nieto, A. and Alexander, K.N.A. 2010. European Red List of Saproxylic Beetles. Luxembourg: Publications Office of the European Union

European Strategy for green infrastructure, would certainly improve the situation. However, without concrete measures, a BAU scenario foresees no great improvement in the monitoring of this sub-target.

Sub-target 4: nature conservation

Best monitored already at this point in time are the situations referred to in sub-target 4, where Article 17 reporting, Natura 2000 monitoring, research projects and voluntary schemes generate an overall, be it incomplete, picture of European habitat and species status. Nevertheless, the 2009 Article 17 review together with other reviews of voluntary species and habitat monitoring show that considerable work remains, especially in marine environment and certain species.

Sub-target 5: invasive alien species

For IASs, the DAISIE (Delivering Alien Invasive Species Inventories for Europe, www.europe-aliens.org) project provided a good start in mapping spread and impact on European biodiversity. This research project is now completed and there is a risk that the database will not be kept up-to-date. However, there is still significant work to be carried out, in particular for determining costs of IASs as a consequence of detrimental effects on ecosystem services.

Sub-target 6: contribution to global biodiversity

The BAU scenario ensues improving compliance and streamlining opportunities in reporting obligations to international treaties and conventions. CBD, Bern Convention, RAMSAR, GEO5/UNEP reporting, CITES, HELCOM, OSPAR, and the Bonn Convention all require reporting, in various intervals. Again it is difficult to estimate national spending on reporting requirements, however as an example, Denmark currently spends €67.000 on international, non-EU reporting.

Costs incurred on Member States under BAU

Under the BAU scenario, it expected that Europe can benefit from earlier investments in monitoring in some Member States. Significant efforts have been made to improve the data availability on the status of certain species groups. For instance, the European Red List has comprehensively assessed the status of all mammals, amphibians, reptiles, butterflies, dragonflies and a selection of saproxylic beetles at the EU level – and early in 2011 all freshwater fish and a selection of plants and molluscs will be assessed, covering a total of about 6,000 species. Also for other groups, such as mammals, national mammal population monitoring schemes have been initiated in some EU Member States, for example in the UK the Tracking Mammals Partnership has set up a surveillance and monitoring network that aims to deliver distribution and population trend information.[94]

In terms of costs, uncertainties in Member States' expenditures on monitoring and differences in monitoring strategies with associated budgets across the member states hamper reliable estimations. In some countries good information exists, however (see Annex C). For example, Denmark's annual spending on monitoring species and terrestrial habitat types is estimated to €4.173 million and Natura 2000 related Article 17 reporting to €750.000.[95]

The Dutch NEM (Network Ecological Monitoring) is a successful cooperative effort which tailors individual efforts into a common framework, where biodiversity is measured once, but used many

[94] Temple H.J. and A. Terry, 2007. The status and distribution of European mammals. Luxembourg: Office for Official Publications of the European Communities.

[95] Note: Article 17 reporting is only required every 6th year.

times for local, national and international decision-making. The use of highly motivated volunteers combined with strict quality control, creates an efficient and cost-effective system. The total annual cost of the biodiversity monitoring system in the Netherlands is estimated to be about €4.5 million, roughly in the same ballpark as Denmark.

Sweden's €18.5 million (2008) environmental monitoring program is subdivided into ten program areas, each of which is monitored by different institutions. About 50% of the program is dedicated to biodiversity monitoring, although there is not always a clear distinction between environmental and biodiversity efforts.

The UK monitoring community is large and fragmented, involving many organizations, funding bodies and monitoring activities. A clear strategy and structure is missing. Accordingly, coordination and consistency are the main issues of the monitoring program. Major concern for the various reporting organizations is a lack of funding. In addition, approximately one fifth of data collection is carried out by volunteers, endangering the continuity and quality of recording. The cost of monitoring could be up to £500m. Only 32% of funds (approximately £28 m) are spent on non-statutory monitoring per year. The remaining 68% are bound up in statutory monitoring, which is perceived as a constraint: "In seeking short-term efficiencies (e.g, through focused monitoring), the wider application of the results from statutory/compliance is often constrained."

4.2 Scenario 1: Approaches for improved monitoring

This scenario assumes the implementation of additional measures for further improving monitoring towards the 2020 target on top of the BAU implementation. Essentially, any improvement beyond the BAU scenario would therefore be defined under Scenario 1. Eventually, Scenario 1 evolves into Scenario 2, if the vast majority or all of the approaches were to be implemented.

In this section the various components are briefly outlined. The various elements and opportunities for combining improvement approaches which are part of Scenario 1 are discussed in detail in the next chapter.

Headline target

For improved monitoring of the headline target, advances in data collection and integration (such as SEIS, EBONE, LifeWatch and BISE) as well as more adequate funding (particularly via LIFE) for any monitoring scheme could help. Additionally, measures for more targeted ecosystem services monitoring are currently close to non-existent and any improvement would therefore count as an improvement in monitoring toward this headline target component. In summary, the following monitoring scheme improvements are analysed for the headline target:

- SEIS, EBONE, LifeWatch, and BISE for improvements in data collection and integration;
- The introduction of a biogeographical monitoring scheme for data quality and relevance improvements;
- Improved funding via adjustments of current LIFE mechanisms; and
- Mapping of ecosystem services across Europe as a means to advance ecosystem services monitoring.

Sub-target 1: integration and sustainable use of resources

As this sub-target primarily refers to agriculture and forestry, suggestions for improved monitoring approaches have also focussed on these two categories. Namely, for agriculture, improvements in HNV monitoring, such as for example up-scaling Germany's approach for monitoring HNV farming, could contribute to improved monitoring for sub-target 1. For forestry, lessons could be learned from FutMon as well as from improved links with forest certification schemes.

Sub-target 2: overexploitation

Since large gaps exist between the BAU scenario and required knowledge for monitoring progress towards sub-target 2, substantial gains can be achieved via any type of monitoring approach that improves the current status quo. More specifically, the sound implementation of the recently launched Marine Knowledge 2020 Initiative as well as follow-up work to the Census of Marine Life offer interesting starting points.

Sub-target 3: fragmentation and green infrastructure

Fragmentation and green infrastructure remains one of the least defined sub-targets at the time of writing this report. But even without concrete target definitions it is clear that the current monitoring approaches under the BAU scenario are insufficient for monitoring of progress towards the 2020 target and improvements are urgently needed. The largest stepping stone for progress in sound monitoring for sub-target 3 can most likely be achieved by ensuring the that EU Strategy on Green Infrastructure – to be launched in 2011 – will include concrete measures and financing for monitoring measures specifically geared towards measuring connectivity and the biodiversity impacts of green infrastructure.

Sub-target 4: nature conservation

Even though this is currently the best covered sub-target in terms of existing monitoring schemes, gaps remain in adequately measuring progress towards the new 2020 target. For example, national monitoring systems for species and habitats differ significantly both in terms of their scope as well as their funding provisions. In addition to potentially improving the national monitoring standards and scope of national schemes, EU co-funded schemes, such as the European Barometer of Life or the establishment of a European vegetation data initiative, could be upgraded to better serve the purpose of monitoring the new biodiversity strategy sub-target 4. In the same way, existing NGO-driven species and habitat monitoring approaches, such as the bird and butterfly monitoring, could be up-scaled to increase coverage or to expand to new species.

Sub-target 5: invasive alien species

Bridging the knowledge gap on IASs and their impact on biodiversity levels is of utmost importance if future progress is to be assessed. Previously LIFE and FP projects have invested some efforts into better monitoring and establishing baseline knowledge on IASs. Particularly, ensuring that the DAISIE project will continue its efforts and that the information on the two IAS related SEBI indicators are updated regularly would provide strong improvements in current monitoring for this sub-target. Furthermore, the inclusion of concrete monitoring approaches and associated funding in a future EU Strategy on IAS would certainly create the necessary support structure to enable significantly improved monitoring for this sub-target.

Moreover, discussions on the possible establishment of an EU Early-warning systems (EWS) are ongoing within the context of the EU strategy on invasive species. Studies[96] rarely give answers to the questions of how much will it cost (according to degree of ambition) and who will support these costs?

The European Commission proposes a number of possible options:

1. The Commission is proposing *the immediate setting up of a Europe-wide early warning and information system to report new and emerging species*. This is in line with an internationally agreed three-stage approach to tackle invasive species which is based on prevention, early detection and eradication, and control and containment measures.

2. The last option is to develop a new legal framework for tackling invasive species with independent procedures for assessment and intervention. A dedicated agency could also be set up to deal with technical aspects. *Mandatory monitoring and reporting procedures and rapid response mechanisms could also be established.*

Sub-target 6: contribution to global biodiversity

For this sub-target, the creation of a Global Barometer of Life would reach the upper end of a Scenario 1 type improvement in monitoring, almost comparable to a Scenario 2 type optimal monitoring as it is assumed to greatly improve monitoring on a global scale.

4.3 Scenario 2: Optimal monitoring

Scenario 2 assumes all of the separate approaches to improve the BAU result, plus additional financial resources and political commitment improve monitoring towards the post-2010 headline and sub-targets.

An optimal scenario would include four general elements:

1. substantial increase in funding (at EU and / or Member State level to existing volunteers-based and professionals-based schemes in order for them to expand);
2. increase of funding for scientific research into better monitoring methods, statistical analysis and protocols.
3. full inclusion of ecosystem service indicators; and
4. full integration of socio-economic indicators and their relevance to biodiversity.

Then, the ideal monitoring strategy for assessment of progress towards the headline target (and its 4 elements) would:

1. Cover the species and habitats in the Bird- and Habitat Directives in terms of the relevant indicators
2. Cover the ecosystems services as mapped and decided relevant per region in Europe (mapping and confirmation of priorities need to be completed first)
3. Cover the progress in restoration projects defined between EC and MS, in terms of habitat indicators

[96] Kettunen et al., 2008; Shine et al., 20087; Shine et al., 2009.

4. Cover contribution of the EU (EC+ MS) to reduce ecological footprint in terms of biodiversity indicators and ecosystem service indicators abroad (i.e. countries which supply goods and services to the EU, or suffer impacts of EU economic etc activities).

Sub-target 1: integration and sustainable use of resources

In an optimal scenario land use / land cover data, agricultural and forestry statistics, and geo-referenced data, would all be consolidated into a European system. The system would allow for cross-referencing and keeping track of multiple indicators which could complete the picture around sub-target 1. For HNV farmland for example, there is particular use of socio-economic indicators to better assess risks for abandonment or intensification. The system would have to incorporate Member State level data and make it open for external input from registered organisations and other entities to make use of scale.

Another possibility would be to make reporting compulsory in agri-environmental programmes under the CAP. This could be done by providing simple web-based scoring cards, which farmers have to complete in the support process.

Sub-target 2: overexploitation

To reach an ideal situation in terms of monitoring of fisheries would require much work. However, the current Marine Knowledge 2020 Initiative could potentially provide such an opportunity and if adequately implemented, benefit greatly to the monitoring of sub-target 2.

Sub-target 3: fragmentation and green infrastructure

The use of remote sensing based land use changes combined with use statistics could be a highly effective mean to monitor fragmentation and green infrastructure. Some countries, such as the Netherlands, keep this information up to date on a national level, but a European level programme is lacking. There are various maps of green and blue elements in the rural landscape; combination of data on habitats of key species with knowledge on their migration and short distance mobility can produce green infrastructure potential maps. A statistically sound sampling scheme can provide insight in progress towards the achievement of the sub-target.

Sub-target 4: nature conservation

The general elements in the beginning of this section outlines a good picture of what we would be an optimal scenario for sub-target 4. It must cover the species and habitats in the Bird- and Habitat Directives in terms of the relevant indicators, to the least and maybe most importantly, additional funding to expand the EU Red Lists to include more species and habitats, in particular marine species and habitats.

Sub-target 5: invasive alien species

An optimal scenario for IAS is practically a continuation or full implementation of monitoring provisions in an upcoming European Strategy. The DAISIE programme which has been mentioned several times in this study does show the potential to at least map out existing IASs and quantify their costs. Suggestions under scenario 1 - an early warning system and a dedicated agency - would surely are also likely to create an optimal situation if implemented correctly.

Sub-target 6: contribution to global biodiversity

In an optimal scenario, the EU would both provide input to the CBD via regional data and support other signatories to the convention to do the same.

5 Analysis of options in terms of costs, benefits and coverage

This chapter will pull together data collected in previous chapters and provide an analysis on the monitoring situation under each sub-target and elaborate on costs, potential benefits, and instruments for improvements.

This section compares the scenarios outlined in Chapter 4 for the headline target and per sub-target.

5.1 Headline target

The headline target should be monitored by schemes covering all biodiversity and ecosystem services. As described in Chapter 4, there are several scenarios possible and successful monitoring of the headline target depends – to a large extent - on successful monitoring of the sub-targets. However, data collection is of little use if it is not made accessible for stakeholders and policy makers, hence, data integration and harmonisation of biodiversity data across Member States is essential.

For funding, the Research Framework Programmes (FP) and LIFE are central to increase the knowledge base and integrate data. Regional Development Programmes (RDPs) and Member State funding are additional relevant resource bases on national data collection and policy implementation.

This section analyses the range of options to improve monitoring of the headline target. It deals with data collection, data integration, funding, indicators, ecosystem services, and an improved BAP monitoring system post-2010.

Data collection and integration

Monitoring and data integration initiatives, such as LifeWatch, EBONE, BISE and SEIS, have kick-started the EU's attempts to make environmental and biodiversity data more accessible. Nevertheless, although they look good on paper, these initiatives have to prove functional to make a real difference in the future.

There is a difference between environmental data collection and making that data relevant for biodiversity. SEIS, for example, targets environmental data in general whereas BISE is created specifically for biodiversity.

In a similar vein, indicators and data from other sectors should be included. Thus, to better address monitoring for some of the sub-targets, an improved integration/mainstreaming of biodiversity indicators in already existing monitoring and data collection schemes of other sectors could be sought. For example, more directly usable biodiversity indicators could be included on marine species, alien species, forestry and agriculture. Such inclusion of directly usable indicators in other sectoral monitoring regulations or guidelines would improve data transfer and usability for biodiversity monitoring.

The measure should incur minimal cost for the EU involving primarily the adjustment of some sectoral guidelines during natural revision cycles. Potentially some additional costs for business / national ministries are incurred to collect or report the data.

Finally, suggestions have been made to adapt biodiversity monitoring to nature itself and not national borders, which would improve monitoring of ecosystem services in particular. A concrete proposal is to use biogeographic regions as a basis. The approach of collecting data on a biogeographic regions basis rather than an EU-wide level stems from the argumentation that such an approach makes more sense from a data interpretation and data comparability point of view. Thus, the baseline becomes easier to define and progress towards targets can be judged more clearly.
Cost estimates range around €5 million per reporting year for EU-15 for an updating frequency of every 5-10 years. This is assuming that the first data collection is carried out locally, and follow-up checks are carried out via remote sensing. Costs essentially cover collection of data, coordination, analysis, etc. for those indicators that do not already exist in other systems (e.g. MCPFE, NFI). LIFE funding could be used to pay for this type of initiative. The biogeographical seminar could be utilised to further develop this idea for improved biodiversity monitoring. A cost estimation of €5 million has been made assuming a frequency of updating ever 5-10 years.

Funding

Adequate funding is vital for any initiative to improve monitoring. One suggestion is to make improvements under the LIFE programme. For example, the policy relevance of LIFE data and results could be increased. A flexible monitoring mechanism could be set up with LIFE data compatibility ("species dots") as inputs for BISE. These "dots" would be fed in via a standardised reporting format on biodiversity monitoring to be filled in by all LIFE projects (sheet would need to be developed by DG Environment's Unit B.2 and could be made mandatory from the 2012 LIFE call onwards). Additionally, LIFE requirements could be adapted to make an exception in the next call (2012) to reduce the 25% "concrete action" requirement in order to stimulate applications for projects focussed on monitoring.

Secondly, LIFE requirements could also be adapted to ask for detailed overviews in the proposal stage of how the project will contribute to ecosystem services.
More specifically for sub-target 3, a LIFE theme on connectivity for the 2012 round of projects could lead to a project for estimating connectivity of Natura 2000 sites across Europe today. Furthermore, including biodiversity benefits for area/region monitoring in already existing annual LIFE ex-post evaluations could help gather data on green infrastructure and fragmentation.

Targeted LIFE funding for biodiversity monitoring is not expected to lead to significant additional costs for the EU but could, however, lead to incremental costs for implementing bodies.

Ecosystem services

One area with a substantial gap in monitoring is ecosystem services. This is not surprising as ecosystem services were not explicitly part of the 2010 target, but are now included in the new 2020 headline target. Although a formal programme for monitoring ecosystem services has not yet been initiated, a good basis of relevant data has already been collected and processed under different headings, which could give this monitoring issue a jump-start. For example, a project is

currently conducted led by JRC[97] to develop pilot ecosystem service maps (with quantification of biophysical potential service levels) for the EU in relation to Member State maps and even site level maps. This then should lead to the reference database for future monitoring of changes in ecosystem services.

Spatially explicit information about ecosystem services is generally derived from classical land-use maps, where the dominant ecosystem service (e.g. crops, timber, recreational natural system) is shown, but the many ecosystem services simultaneously delivered at the same site are ignored. There is therefore an urgent need to upgrade the knowledge base of land-use information and mapping to reflect the existing knowledge about ecosystem services and their social and economic values to better inform policy design and decision making processes. In addition, the increased availability of other spatial datasets allows a more direct quantification of some ecosystem services.

With the Millennium Ecosystem Assessment (MA, 2005) and the European Biodiversity Communication (EC, 2006) the potential of the ecosystem services concept as a policy tool was recognised. The Economics of Ecosystems and Biodiversity (TEEB) Interim report (TEEB, 2008) identified the spatial explicit mapping of ecosystem services as a key instrument for decision making at various scales. The “Message from Athens” from the April 2009 High Level Conference on Biodiversity Protection-Beyond 2010 (Priorities and Options for Future EU Policy) solicits European institutions and Member States to ensure that the real value of ecosystem services is taken into consideration when designing relevant EU policies.

The credibility of policy strategies to deliver plans incorporating biodiversity conservation and multiple services provisioning is dependent on the availability of spatial targeting methodologies for ecosystem services. Decisions should be based on reliable estimates of current and expected trends in economic values of a specific landscape considering heterogeneities in the spatial distribution of resources providing ecosystem services. It is essential to take into account the entire service providing capacity as well as the value of the services in each area. By accounting all benefits in an area and, where possible, placing value on these benefits, net changes in the services can be estimated.

Different methodological approaches are possible for mapping, at a given scale, ecosystem services, depending on the type of service (provisioning, regulating, cultural)[98] considered, the spatial characteristics of the ecosystem service, the spatial and temporal contexts in which the services are delivered (e.g. the relationships between service production and where the benefits are realized) and the resolution at which indicator data are available. Mapping ecosystem services is the first round, creating a reference database, which can then function in a monitoring strategy, with updates at regional and country level, depending on land use dynamics.

A methodology for monitoring in marine systems has not been developed yet, but should very much rely on fisheries catch data and marine system quality data to deduce changes in potential ecosystem services.

[97] Bidoglio, G. and L. Braat (2010) PRESS (PEER Research on Ecosystems Services) Research proposal for mapping ecosystem services. JRC-Ispra /Alterra -Wageningen.

[98] Milllenium Ecosystems Assessment 2005.

An essential question is which indicators can be used to capture spatial complexities and variability across scales. The extent to which we need to be spatially explicit depends on the purpose of the ecosystem service assessment. For example, data availability, disaggregation of spatial data and multi-model combinations are still limitations to full-scale mapping of ecosystem services. Rather than argue for a single unified methodology that can apply to all possible circumstances (i.e. across all scales), several parallel approaches and ways of modeling are needed based on solid research.. A continuous feedback between the different scales of applications will take place during the project. The end products will be a set of validated methodologies, and a series of maps of ecosystems services for selected regions in Member States and Europe.

A crucial element in constituting ecosystem service maps is the transformation of available data into suitable indicators. Some ecosystem services may be mapped without prior data transformation. Statistics of crop production or carbon storage may already be available in a desired format or require only minor spatial operation before they can be made available in maps. However, many non-provisioning ecosystem service indicators require transformation of the source data or the models that are used to infer a service indicator before they can be mapped. The characteristics of data will determine / control their usability for expression of ecosystem services indicators.

Monitoring: Once the digital maps of the various ecosystem services have been developed, a regular update is required to function as a monitoring system in the context of the new post 2010 EU Biodiversity strategy. Updates are possible along several ways:

1. At the EU level, based on Remote Sensing data updates, for appropriate scale land use / land cover changes, with the associated ecosystem services; this may be synchronized with the CORINE system, so no extra cost need to be involved for this step. The additional work to update the quantity and economic value of the changes in ecosystem services (and assess the position with respect to the Targets) would require initial investment in ecological-economic models and processing of Member State and EU sectoral statistical data. A role for EUROSTAT is logical in this case.

2. At the Member State level, under the assumption that monitoring of ecosystem services becomes part of the (adopted) new Post 2010 EU Biodiversity strategy , the approach would mimic the European level, with remote sensing, sectoral statistics and economic-ecological models. Member states may choose to involve regional governments in providing basic data.

3. At the site level, e.g. Natura 2000 sites, the monitoring of biodiversity data can be synchronized with collecting data on a selected set of non-biodiversity indicators to represent the dynamics of the relevant ecosystem services (outdoor recreation, agricultural production, water quality, etc).

Improved BAP monitoring system post-2010

The recently (October 6, 2010) published Final Report (Year 3) on European Commission Biodiversity Knowledge Base (Service contract nr. 09/543261/B2) offers lessons learned from the past Biodiversity Action Plan reporting phase and proposes guidelines for an improved BAP monitoring system in the post-2010 period.

The collection of information for the monitoring of the Biodiversity Action Plan implementation across all EU Member States has been and will always be a complex process. In the reporting period up to 2010, “the process has been extremely manually intensive and the resulting outputs

are not as readily available as they could be, they are not easy to interrogate, and in their present form require substantial effort to update".

According to the report, one of the key problems was related to the applied BAP data storage system. In order to improve BAP related monitoring and the practical implementation thereof in the post-2010 period, the report suggest to not using the embedded schema in a Word document as the basis of the monitoring system any longer. Instead, "it is essential that adequate resources are committed not only to the sourcing of information but also to the underlying IT tool used to collect, collate, process, store and analyse the data". The report further clearly states that a future monitoring system should have the following four objectives:

1. structure and centralize existing and future data required for BAP evaluations;
2. enable those data to be entered into the system and maintained easily;
3. enable the information to link to and be available to other systems (such as BISE); and
4. enable data stored on the system to be consulted and analysed efficiently, and generate reports.

Furthermore, an improved BAP monitoring system should allow for the incorporation of newly identified BAP information from currently unknown sources. Similarly, all information should be enabled to be updated directly by Member States. The user interface should therefore be online, browser-based and use open web standards in order to facilitate all interactions.

In order to reduce the current level of administrative burden and associated cost levels, the data verification process would benefit from a central database. This could reduce the currently required several rounds of verification by allowing Member States to edit information directly. Similarly, if the IT tool is developed well and incorporates direct quality control of the data entry into its design, then much time and resources can be saved. At the same time, however, the improved database should remain traceable, i.e. it should have transaction logging capabilities so that changes to the information can be tracked and if necessary rolled back.

It is currently unknown how much such an improved BAP monitoring system would cost, or how much money could actually be saved via the efficiency gains. However, it is clear that costs as well as benefits would primarily be born by Member States.

Conclusions

The following table is a summary of the proposals, suggested and on-going, dealing specifically with the headline target.

Table 20 Summary typology of potential monitoring schemes to better cover monitoring of the headline

Type	Name	Costs	Funded via	Coverage
(Environmental) data integration	SEIS	Unknown	EU	EU-wide reach. Broader than just biodiversity data.
(Biodiversity) data integration - assessment	EBONE	€3.4 million	FP7	Potentially helpful for the provision of additional indicators relevant for monitoring the headline target.
(Biodiversity) data integration - infrastructure	LifeWatch	€6.37 million	FP7	Helps set up EU-wide infrastructure for biodiversity research.
(Biodiversity) data integration - access	BISE	Unknown	EU	Has the potential to become a comprehensive platform for sharing all knowledge on biodiversity EU-wide.
Data improvement	Biogeographical monitoring	€5 million (EU-15)	Various possibilities	Would allow for improved monitoring across national borders.
Funding	LIFE adjustments	Limited	EU; implementing agencies	EU-wide improvements by providing better access to funding.
Ecosystem services monitoring	Mapping of ecosystem services across Europe	Total unknown	DG ENV and six PEER institutes	Has the potential for monitoring part of the ecosystem services component of the headline target.
Ecosystem services monitoring	FSC (other) certification schemes involving PES	variable	Certificate holders	Has the potential for monitoring part of the ecosystem services component of the headline target.

It is clear that the accuracy and quality of monitoring the headline target hinges on the success of on-going data integration projects and the introduction of new initiatives. It is clear that while already a full implementation of the BAU scenario would improve the current monitoring situation, the introduction of at least a few of the additional improved or new monitoring schemes would help improve the capacity of monitoring progress towards the 2020 headline target. Under ideal circumstances (e.g. no budgetary or political feasibility restrictions) all listed avenues for monitoring improvement could be introduced and therefore a situation close to the one described in scenario 2 would likely reached.

5.2 Sub-target 1: Integration and sustainable use of resources

Agriculture

Europe lacks a rigid picture of HNV status in Europe. However, a better picture is emerging from MS reporting on HNV farmland cover using indicators developed in 2007.[99] This could help in generating a baseline; however, without a coherent monitoring framework progress is difficult to measure.

One option would be to up-scale on-going national programmes such as the German monitoring system. This is a unique site-based (1000 sites of 1km^2) monitoring scheme which shows great potential for up-scaling, especially for countries with a similar agricultural structure as Germany.

The decline in HNV farming in Europe is mainly due to financial disadvantages in the CAP structure, compared to intensive farming. Hence, in an optimal monitoring scenario socio-economic indicators should be included to produce timely information on the likelihood of abandonment or intensification. These types of schemes are, however, currently not in place.

Forestry

Through two finished projects, BioSoil and Forest Focus, a biodiversity baseline has been established at EU level with harmonised and comparable information on tree species richness, stand structure, forest types, deadwood, and ground vegetation.[100] It creates a golden opportunity for real measurement of the progress towards a 2020 target. The recently published Green Paper on Forest Protection and Information in the EU, recognise that further harmonisation of National forest inventories (NFIs) should take place and that several on-going initiatives could help in this, for example, the European Forest Data Center (EFDAC). As mentioned in Chapter 3, the FutMon project aimed to continue where Forest Focus left off and is supported under LIFE+.

Furthermore, forest certification schemes offer an existing network of well-monitored areas, which could be tapped into in the future on a more formalised basis in order to share biodiversity status of forests as well as ecosystem service improvements via some of the biodiversity data integration portals.

Conclusions

The following table is a summary of the proposals, suggested and on-going, dealing specifically with sub-target 1.

[99] Cooper, T. et al. 2007. *Final report for the study on HNV indicators for evaluation*. Report prepared by the Institute for European Environmental Policy for DG Agriculture. Contract notice 2006–G4-04.

[100] EC 2010 Green Paper On Forest Protection and Information in the EU. SEC(2010)163 final

Table 21 Summary typology of potential monitoring schemes to better cover monitoring of sub-target 1

Type	Name	Costs	Funded via	Coverage
HNV agriculture monitoring	Germany HNV farming monitoring scheme	€200,000	MS	Simple site-based. Socio-economic indicators lacking.
Forest monitoring	FutMon	€34.45 million (€15.14 million funded by LIFE+)	Partly LIFE+	Builds on ForestFocus. Aims for broad coverage.
Forest monitoring	Forest Certification Schemes	Costs related to monitoring are unknown	Certificate holders	Covers certified areas only.

When reviewing the options for improved monitoring of sub-target 1 it becomes clear that not that many tangible options exist. However, it should be mentioned that some of the options analysed under the headline target would certainly also help improve monitoring of sub-target 1. Furthermore, the BAU scenario should already provide a relatively decent level of monitoring for sub-target 1; any improvement might therefore not be a priority – especially when compared to the more urgent needs for improved monitoring of some of the other sub-targets. Finally, it should be mentioned that any intended improvements in monitoring could be channelled through the upcoming CAP reform, which presents an ideal point of entry for upgraded monitoring on agriculture and forestry in Europe.

5.3 Sub-target 2: Overexploitation

The historical setting for monitoring of fisheries dates back to 1988. The monitoring and inspection policy in fisheries aimed to ensure compliance with the legislation on fisheries. The basic Regulation 3483/88 established the main principle that each Member State is primarily responsible for monitoring compliance with Community rules on fisheries on its territory and in its maritime waters, but the Commission has the power to carry out checks, at sea and in fishing ports, on the national authorities' enforcement of these rules.

The Member States and the Commission also took the necessary steps to ensure compliance with the conservation rules imposed under agreements with non-member States and international agreements. The Commission's inspectors carry out regular missions in Community fishing ports and on board the Member States' surveillance vessels, in both EU and international waters.

As part of its efforts to safeguard sustainable fisheries, the EU has reinforced its monitoring system with a regulation (EC 2846/98), which came into force on 1 July 1999. The system aimed to monitor fisheries more effectively, giving priority to three objectives:

- greater transparency on the basis of increased cooperation among the Member States, and between them and the Commission;
- increased monitoring of commercial activities so that the authorities can collect data; and
- a more effective level of monitoring vessels from non-member States.

The Community authorities are responsible for adopting measures to conserve stocks and monitor fishing activities, but each Member State is responsible for applying the measures and penalising any infringements which are discovered in their maritime waters or on their territory

Very little has been published about independent monitoring of fish catch and marine biodiversity monitoring. A very recent presentation was *Satellite Technologies for Fisheries Monitoring, Control and Surveillance (MCS)* by (Juan Cicuendez, Marlene Alvarez; JRC Info Day Madrid, 2 June 2010).

Information about costs of monitoring is then also logically very limited at this point in time.

Conclusions

This sub-target remains one of the most challenging goals of the new 2020 target to monitor in a way that will allow the assessment of progress. The monitoring schemes under the BAU scenario are likely insufficient to capture the range of progress that needs to be monitored. However, some recent initiatives, such as the Census of Marine Life and the European Marine Knowledge 2020 Initiative, if supported with appropriate funding and other resources, could deliver the needed baseline knowledge and tools for monitoring progress in the near future. Similarly to sub-target 1, potential improvements in monitoring should be strongly linked to the revision of the CFP, which itself has already highlighted the needs for better monitoring in the future.

The following table is a summary of the proposals, suggested and on-going, dealing specifically with sub-target 2.

Table 22 Summary typology of potential monitoring schemes to better cover monitoring of sub-target 2

Type	Name	Costs	Funded via	Coverage
European water monitoring	WISE	€ 2.5 million annually (2014-2020)	EU and Member States	EU-wide coverage. Updated regularly. Linked to mandatory reporting requirements.
Marine monitoring	GMES – marine core service (MyOcean project)	€88 million annually (2014-2020)	FP7 co-funding; national research institutes	Worldwide collection of data; interlinked with other European research efforts.
Marine monitoring	Census of Marine Life	€474 million	Donations; national research institutes	Worldwide coverage. Can serve as status baseline. Needs continued funding to offer 2020 update.

5.4 Sub-target 3: Fragmentation and green infrastructure

Green infrastructure has received much attention lately, in particular due to an EU strategy expected to come out in 2011. Despite this, community-wide initiatives are scarce and knowledge on Member State initiatives to promote, evaluate, and monitor fragmentation is either non-existent or scattered. There are several good examples of Member States working towards creating green infrastructure[101] and on a regional level.[102]

[101] See for example "EEB 2008 *Building green infrastructure for Europe* EEB special report publication number 1008/017

An on-going related initiative is that EUROSTAT is preparing a new LUCAS campaign (Land Use/Cover Statistical Area Frame Survey), possibly in 2012, covering EU-27. It will collect data in the ground on land cover/land use and landscape diversity on approximately 260,000 points. The cost for the core survey will be financed by ESTAT. This exercise could offer the possibility for gathering harmonised additional, selected data, such as on biodiversity and ecosystems and their services, through an in-situ effort on a subset of the total points. It could represent the baseline for trend monitoring on European scale over the next decades - if complementary to Member State and European monitoring exercises already planned or undertaken.

Secondly, the SCALES project, mentioned in Chapter 3 is intended to address the issue and produce policy relevant information, tools and dialogue for further action.

Conclusions

The following table is a summary of the proposals, suggested and on-going, dealing specifically with sub-target 3.

Table 23 Summary typology of potential monitoring schemes to better cover monitoring for sub-target 3

Type	Name	Costs	Funded via	Coverage
Green infrastructure monitoring	SCALES	€9.986.715 (FP7 6.995.640)	FP	First mapping

The problem of fragmentation and its potential solution - creating Green Infrastructure - is poorly understood and quantified, at least on an EU-level. It is currently premature to evaluate the cost and benefits of these options as no concrete definitions and goals have been developed. The focus of EU policy should instead be to ensure that concrete monitoring measures are incorporated in the upcoming Strategy on Green Infrastructure, expected in 2011.

5.5 Sub-target 4: Nature conservation

Monitoring nature conservation, i.e. species and habitats, might be the best covered sub-target in terms of schemes and funding. Nevertheless, a considerable monitoring gap of 13% regional habitat assessments and 27% regional species assessments with 'status unknown' remains.

Costs of monitoring are mainly borne by Member States and EC co-funded monitoring schemes such as the IUCN Red List. Additionally, there is a large voluntary and NGO conservation movement which reports on selected species and habitats in a highly cost-efficient way.

Costs incurred by Member States

Costs incurred by Member States to monitor habitats and species diverge vastly across Europe. For example, Hungary estimates their minimum costs for monitoring habitats and species to be €250,000 (excluding additional costs for e.g. preparing the report) whereas Denmark estimated an annual cost of €4,173,000 to monitor the same indicators. Costs for the Netherlands' monitoring programme, Netwerk Ecologische Monitoring (NeM), are similar to Denmark's and amount to

[102] www.europeangreenbelt.org

€4,500,000. Additionally, Denmark also indicates the additional cost (excluded by Hungary) to be approximately €8,000 for every reporting period.

Table 24 Monitoring cost estimations for selected Member States

Country	Article 17	CBD	Total	Country
Denmark[103]	€4,173,000 (Species and habitats)	€12.086 (per reporting period)		Denmark[104]
Hungary	€250.000/year (excluding report preparation)	€10.000 (per reporting period)		Hungary
Netherlands			€4.500.000	Netherlands
Sweden	€2,700,000 (estimated cost to fulfill reporting requirements)		€544,464 – 1.1 million[105]	Sweden

It should be noted that costs for MS' monitoring are based on estimates and often disaggregated from the total costs of environmental monitoring. For example, the total cost for the environmental monitoring programme in Sweden was €20,400,000 in 2008 and Denmark, in their DEVANO[106] and NOVANA[107] programmes, allocated €7,828,667; furthermore the estimations are often based on expert opinions on how relevant an indicator is for biodiversity monitoring.

Upgrading national systems is also important, however, aggregated data on costs and instruments are scarce. One example is a Swedish pre-study estimating the costs of upgrading the national monitoring system to at least cover the reporting requirements under Article 17 at approximately €2,500,000.

Cost of upgrading EC co-funded schemes

Upgrading species and monitoring systems on a European level requires additional funding and human resources. A key suggestion is to improve the current IUCN Red List and create a **European Barometer of Life** (EBL) to include representation of plants and invertebrates, as well as to have taxonomic groups representative of the various biomes in Europe (freshwater, marine and terrestrial). Specific groups linked to important ecosystem functions (such as pollinators) should be monitored too.

The expected cost of creating an EBL is €6 million.[108] This is a considerable sum in relation to individual Member State spending on monitoring; however, when taken into a broader perspective the concept becomes attractive. A European Barometer of Life, i.e. an expanded Red List could help to[109]:

- present an overview of the status of European biodiversity and of the various biomes represented in Europe (freshwater, marine and terrestrial), and to establish a baseline from which to monitor their changes over time;

[103] 2007 figures. See Annex F for more numbers an details on Danish biodiversity monitoring costs.
[104] 2007 figures. See Annex F for more numbers an details on Danish biodiversity monitoring costs.
[105] 2005 figures. Based on estimates from: Kunskap för biologisk mångfald – inventera mera eller återvinn kunskapen? SOU 2005:94
[106] http://www.blst.dk/NATUREN/Overvaagning_af_vand_og_natur/DEVANO/
[107] http://www.blst.dk/NATUREN/Overvaagning_af_vand_og_natur/NOVANA/
[108] Personal communication with IUCN.
[109] Based on personal communication with IUCN.

- identify the species that are most in need of conservation attention and the measures needed to save them;
- define the main threats to European biodiversity, as well as the areas where biodiversity is being lost most rapidly;
- measure the effectiveness and impact of conservation measures;
- provide a context for setting conservation and funding priorities (e.g. LIFE programme, etc.);
- at the national and regional level: to develop new legislation, biodiversity strategies or actions plans;
- at the international level: to implement targets for multi-lateral agreements (such as the Global Strategy for Plant Conservation or the Red List Index indicator, both adopted by the CBD) or to revise the Annexes for these agreements;
- monitor species important to ecosystem function and services (such as pollinators, or medicinal plants), that have an impact on the economy and livelihood of people;
- guide management and planning at the site and regional level and provide key input into Environmental Impact Assessment process;
- support analysis at a large-scale or site-scale, such as Important Birds Areas, Alliance for Zero Extinction sites or Evolutionary Distinct and Globally Endangered (EDGE) species;
- strengthen networks of experts and capacity to generate and use these data to support conservation;
- communicate efficiently to raise awareness among the public; and
- inform academic work and guide scientific research on emerging threats or through data.

Furthermore, an EBL would considerably expand and improve monitoring of species in Europe. Through first consultations, a tentative list of priority taxonomic groups that should be considered for inclusion providing insights in the various biomes (marine, freshwater and terrestrial), as well as in ecosystem services, has been drafted: all vertebrates (mammals, birds, amphibians, reptiles, freshwater and marine fish), as well as invertebrates (butterflies, dragonflies, bees, diptera, saproxilic beetles, freshwater molluscs, crabs and crayfish or marine lobsters) and plants (orchid, conifers, crop-wild relatives, medicinal plants, aquatic plants, national endemics and seagrasses).

Finally, an EBL would consolidate species monitoring efforts into the simple framework of the European Red List and simultaneously feed in to global monitoring schemes via the CBD or, potentially, a Global Barometer of Life. It shows great potential to significantly improve monitoring of the headline target and sub-target 1, 2, 4 and 5 directly, and 3 and 6 indirectly

A second more incremental improvement of monitoring sub-target 4 would be to use **vegetation data as a tool for improved species and habitat monitoring**. Monitoring biodiversity often focus on species level (flora/fauna), however, vegetation is becoming increasingly standardized as a usable and valuable monitoring parameter. Especially considering that vegetation is the driving force behind a suitable habitat for species, and moreover, we can influence biodiversity strongly by vegetation (i.e. nature management).

Vegetation science describes the vegetation by using the techniques of relevés. A relevé is a description of all plant species and their coverage within a homogeneous plot of varying size. These relevés (in big quantities) can be ordered and therefore form the framework of a (national)

vegetation classification. Currently, this classification is operable mainly on national levels, but the first steps towards a European framework were set in 2002[110].

During the last decade electronic databases of vegetation plots, mainly phytosociological releves, has been established in different European countries. An inventory in Europe in 2009[111] provided estimates of the number of plots in Europe and their electronic storage.

There are > 4,300,000 vegetation-plot records in Europe, of which > 1,800,000 are already stored electronically. Of the electronic plots, 60% are stored in TURBOVEG databases. Most plot records probably exist in Germany, the Netherlands, France, Poland, Spain, Czech Republic, Italy, UK, Switzerland and Austria. The largest numbers of plots per unit area are in the Netherlands, Belgium, Denmark and countries of central Europe. The most computerized plots per country exist in the Netherlands (600,000), followed by France, the Czech Republic and the UK. Due to its strong phytosociological tradition, Europe has many more vegetation plots than any other part of the world. This wealth of unique ecological information is a challenge for future biodiversity studies. With the alarming loss in biodiversity and environmental problems like global warming and ongoing changes in land use, there is an urgent need for wide-scale scientific and applied vegetation research. Developments of information systems such as SynBioSys Europe and facilitation of data flow between the national and regional databases should make it easier to use these vegetation-plot data.

The International Association for Vegetation Science (IAVS) is a worldwide union of scientists and others interested in theoretical and practical studies of vegetation. It has about 1500 members, belonging to 96 countries worldwide. 26 of the 27 EU countries are represented with (in total) over 700 EU members. Currently, there are several regional sections and six working groups, of which especially the European Vegetation Survey (EVS) and the European Dry Grassland Group (EDGG) are important networks for EU vegetation data. There is one international IAVS symposium a year, but the separate working groups organize their own meetings. The EVS was established in 1992 and this active working group of the IAVS organizes a meeting every year.

EVS-initiatives:

1. The diversity of European Vegetation. An overview of phytosociological alliances and their relationships to EUNIS habitats; and
2. SynBioSys Europe.

The field data are being collected basically at no additional costs. Most of the work is part of University research programmes funded by Member states.

To make the data readily available in the context of reporting for EU policy making, some facilitation process has to be funded, e.g. some kind of Vegetation NGO at the European level, with a small (part time) staff (ca 3-4 full time equivalents). The management could be driven by an independent NGO or be embedded in an existing organisation such as EEA/ETC or IUCN. The concrete actions of such coordination unit are to include data on an EU level while consolidating existing data. The

[110] Rodwell, J.S., Schaminée, J.H.J., Mucina, L., Pignatti, S., Dring, J. & Moss, D. (2002) The diversity of European vegetation. An overview of phytosociological alliances and their relationship to EUNIS habitats. EC-LNV, Report ECLNV 2002/054, Wageningen, 168 pp

[111] Schaminée J. H. J., Hennekens S. M., Chytrý M. & Rodwell J. S. (2009): Vegetation-plot data and databases in Europe: an overview. – Preslia 81: 173–185

coordination unit would probably need to develop a new stratified network (geographic regions, environmental conditions and habitat types) and a large scale network of permanent plots, which are recorded every 4-6 years. The estimated cost for such an endeavour would be €500.000 on a yearly basis.

A third alternative is to **upscale current NGO driven butterfly and bird monitoring approaches**. NGO initiatives that monitor specific species, such as birds and butterflies, have been highly successful in delivering good data at a low-cost. Examples of NGO run monitoring schemes and groups are the Pan-European Common Bird Monitoring Scheme, Birdlife International and Butterfly Conservation Europe. The birds monitoring schemes aim to use common birds as indicators of the general state of nature using scientific data on changes in breeding populations across Europe. The butterfly scheme involves over 10,000 volunteer recorders. The data gathered in databases is used by governments to indicate the health of the environment at national, UK and European levels. All three schemes are run by NGOs composed of several organisations with a wide European coverage.

Furthermore, for some species groups it will be extremely difficult to collect data on a European scale. We think that this will be the case for plant species and perhaps also for reptiles and amphibians. Trends in these species groups may still be detected, but only if these trend are strong and partly based on expert judgment. This does not allow the making of statistical valid species abundance indicators, but the information gathered may still be included in the Red List indicator for any given species group. If a considerable amount of the species of a species group need to be monitored already for reporting under the habitat directive.

Conclusions

The following table is a summary of the proposals, suggested and on-going, dealing specifically with sub-target 4.

Table 25 Summary typology of potential monitoring schemes to better cover monitoring of sub-target 4

Type	Name	Costs	Funded via	Coverage
Species and habitat assessment	European Barometer of Life	€6 million	EU co-funded	Ideally coverage would be determined by species and habitats not yet covered by Article 17 reporting / or currently poorly reported under Article 17.
Habitat assessment	Use vegetation data	€500.000	MS	EU-wide vegetation-based monitoring approach.
Voluntary monitoring	Up-scaling voluntary species monitoring	limited	EU co-funded	Depending on expert/voluntary ratio and number of volunteers

Overall, sub-target 4 is clearly the sub-target that already under the BAU scenario has the highest degree of existing mandatory and voluntary monitoring schemes associated with it. In addition, the adaptations of existing mechanisms and new ideas for monitoring discussed above would have the potential to further improve the level of monitoring for sub-target 4 related goals. If the political will and necessary funding can be obtained, monitoring improvements for this sub-target would

probably have the highest chance - compared to all other sub-targets - to reach a situation close to the ideal situation under scenario 2.

5.6 Sub-target 5: Invasive alien species (IAS)

Bridging the knowledge gap on IASs and their impact is of utmost importance if a future EU strategy on the issue is to succeed. The majority of this work so far has been carried out through two instruments: LIFE and FPs. Concerning costs, in 1992-2006 the EU spent €10 million a year on such programmes, increasing to €15 million in 2004-2006.[112] It all totals to almost 300 projects and a total budget of €132 million.[113] It also shows a positive trend in spending, in particular towards the EU Strategy on IAS.

Early investment could prove highly cost-efficient considering the adverse economic impact of unchecked spread of IAS. For example, if €12.5 billion is lost yearly due to IAS impact, then the budget for DAISIE, which totalled €3.45 million, are well spent money.[114] Furthermore, an appraisal to keep the two elements of the SEBI indicator updated, estimated that, in 2010, €160,000 is needed to monitor the trends in IAS and an additional €15,000 to keep the list of 'worst IAS threatening biodiversity in Europe' up-to-date.[115]

Conclusions

The following table is a summary of the proposals, suggested and on-going, dealing specifically with sub-target 5.

Table 26 Summary typology of potential monitoring schemes to better cover monitoring of sub-target 5

Type	Name	Costs	Funded via	Coverage
Invasive species monitoring	DAISIE update	€160.000 + €15.000	FP	Depending on investment levels

The improved monitoring needs for sub-target 5 as well as the associated costs are relatively clearly defined and thus could be addressed without much additional prior research or preparation efforts. In addition, the parallel development of the EU strategy on IAS could offer the needed point of entry for a quick improvement in monitoring for this sub-target.

5.7 Sub-target 6: Contribution to global biodiversity

In an optimal scenario the creation of a **Global Barometer of Life** would greatly improve monitoring on a global level, especially towards reaching - yet to be adopted - post-2010 CBD targets and Strategy. The idea for such a Global Barometer of Life was recently brought forward in

[112] Scalera, R. 2008 EU funding for management and research of invasive alien species in Europe (Prepared for a pilot project on 'Streamlining European 2010 Biodiversity Indicators *(SEBI2010)'*, Contract no. 3603/B2007.EEA.53070)
[113] Scalera R. 2010 How much is Europe spending on invasive alien species? Biological Invasions (2010) 12:173-177
[114] DAISIE cost €3.45 million of which FP6 allocated €2.4 million (http://cordis.europa.eu/home_en.html)
[115] EEA 2007. Halting the loss of biodiversity by 2010: proposal for a first set of indicators to monitor progress in Europe. EEA Technical report No. 11/2007. European Environment Agency, Copenhagen, Denmark.

an article published in *Science*.[116] To date only 1.9 million species have been identified globally, though the estimated number of species is thought to be somewhere between 10 and 20 million. While the IUCN's Red List contains assessments of all species of mammals, birds, amphibians, reef-building corals, freshwater crabs, cycads and conifers, the vast majority of the world's species are poorly represented, including many plants, invertebrates, reptiles, fishes and fungi.[117]

Creating a Global Barometer of Life would involve an update of the IUCN Red List of Threatened Species from current 48,000 species (costing about $4 million/year) to 160,000 species.

Table 27 Species and projected costs for a Barometer of Life

			FOR THE BAROMETER	
Major taxonomic grouping	Described species*	Species assessed on IUCN Red List by 2009†	Provisional target number of species	Estimated cost to complete (US$)
Chordates	64,788	27,882	61,635	16,000,000
Invertebrates	1,359,365	7,615	45,344	20,000,000
Plants	310,129	12,151	38,521	17,000,000
Fungi and others	165,305	18	14,500	7,000,000
	1,899,587	**47,676**	**160,000**	**60,000,000**

*Data on the number of described species taken from (1). †Data on the number of assessed species from http://iucnredlist.org.

There are evidently significant synergetic opportunities if the EU decides to create an EBL; however, creating a GBL is a costly project. As can be seen from the table above, researchers estimate that creating a complete GBL with a target of assessing 160,000 species.

Conclusions

The following table is a summary of the proposals, suggested and on-going, dealing specifically with sub-target 6.

Table 28 Summary typology of potential monitoring schemes to better cover monitoring of sub-target 6

Type	Name	Costs	Funded via	Coverage
Global biodiversity monitoring	Global barometer of life	€45 million	EU co-funded	Depending on investment levels and global participants

Monitoring efforts related to sub-target 6 are one of the most complex and are not yet well defined. The ambitious EU target to include the global dimension now requires associated monitoring in order to be able to judge any progress made on this dimension until 2020. Most existing tools under the BAU scenario are not yet directly geared towards biodiversity monitoring and therefore require improved implementation. New or improved versions of existing monitoring schemes are currently scarce and further investment and research needs to be invested, if serious progress towards improved monitoring for sub-target 6 is to be achieved. An ideal monitoring situation as described under scenario 2 therefore still seems far from being reached for sub-target 6.

[116] Stuart, S.N, Wilson, E. O., McNeely, J. A., Mittermeier R. A., Rodríguez J. P. (2010) The Barometer of Life. Science. April 2010. Vol. 328, no. 5975, p. 177.

[117] IUCN (2010, April 13). Conservation scientists call for 'biodiversity barometer'. ScienceDaily. Retrieved July 29, 2010, from http://www.sciencedaily.com- /releases/2010/04/100408160903.htm

5.8 Consolidated overview of existing and potential future monitoring schemes: a typology

Table 29 Consolidated table of monitoring schemes, costs and coverage

(Sub)-target	Type	Name	Costs	Funded via	Coverage	Status
Headline target	(Environmental) data integration	SEIS	Unknown	EU	EU-wide reach. Broader than just biodiversity data.	On-going
Headline target	(Biodiversity) data integration	EBONE	€3.4 million	FP7	Potentially helpful for the provision of additional indicators relevant for monitoring the headline target.	On-going
Headline target	(Biodiversity) data integration	LifeWatch	€6.37 million	FP7	Helps set up EU-wide infrastructure for biodiversity research.	On-going
Headline target	(Biodiversity) data integration	BISE	Unknown	EU	Has the potential to become a comprehensive platform for sharing all knowledge on biodiversity EU-wide.	On-going
Headline target	Data improvement	Biogeographical monitoring	€5 million (EU-15)	Various possibilities	Would allow for improved monitoring across national borders.	Suggested
Headline target	Funding	LIFE adjustments	Limited	EU and implementing agencies	EU-wide improvements by providing better access to funding.	Suggested
Headline target	Monitoring schemes mapping	EuMon	€2.22 million	FP6	EU	Finished
Headline target	Ecosystems monitoring	RUBICODE	€2.16 million	FP6	EU; no actual monitoring	Finished
Headline target	Ecosystems monitoring	Mapping of ecosystem services across Europe	Total is unknown	DG ENV and six PEER institutes	Has the potential for monitoring part of the ecosystem services	On-going

					component of the headline target.	
1	HNV monitoring	Germany HNV farming monitoring scheme	€200,000	MS	Simple site-based. Socio-economic indicators lacking.	On-going, potential for up-scale
1	Forest monitoring	FutMon	€34.45 million (€15.14 by LIFE+)	Partly by LIFE+	Highly functional monitoring and reporting system; but abruptly stopped.	On-going
1	Forest monitoring	Forest Focus	€65 million	EC	Has the potential to recapture some of the successes of FutMon.	Finished
1	Forest monitoring	Forest Certification Schemes	Costs related to monitoring are unknown	Certificate holders	Has the potential for monitoring part of the ecosystem services component of the headline target as well as forestry biodiversity for sub-target 1 (limited to certified areas however).	On-going
2	European water monitoring	WISE	€ 2.5 million annually (2014-2020)	EU and Member States	EU Member States	On-going
2	Marine monitoring	GMES – marine core service (MyOcean project)	€88 million annually (2014-2020)	FP7 co-funding; national research institutes	worldwide	On-going
2	Marine monitoring	Census of Marine Life	€474 million	Donations; national research institutes	worldwide	On-going
3	Green infrastructure monitoring	SCALES	€9.986.715 (FP7 6.995.640)	FP	First mapping	On-going
3	Green infrastructure monitoring	LUCAS	€700,000	EUROSTAT	Europe-wide, well-established statistical tool	On-going

					that can fulfil part of the monitoring needs; however it is not focussed on green infrastructure directly	
4	Species and habitats	Natura 2000 Barometer	Unknown		EU	On-going
4	Species and habitats	Sufficiency Index	Unknown		EU	On-going
4	Species and habitats compulsory	Article 17	See chapter 5 ST4	MS	EU	On-going
4	Species and habitats	EU Red List	€ 6 million (for update)	EC co-funded	EU	On-going
4	Species and habitats voluntary	Vigie-Nature	€1-2 million	MS	France	On-going
4	Species and habitats voluntary	Countryside Survey	€11.7 million	MS	UK	On-going
4	Species and habitat assessment	European Barometer of Life	€6 million	EU co-funded	Best possible	Suggested
4	Habitat assessment	Use vegetation data	€500.000 (3-4 fte/year)	MS	EU /Pan Europe	Suggested
4	Voluntary monitoring	Up-scaling voluntary monitoring	limited	EU co-funded	Depending on expert/voluntary ratio	On-going, potential for up-scale
5	Invasive species monitoring	DAISIE	€3.45 million	Partly FP6	Successful in monitoring IAS that it covers.	Finished
5	Invasive species monitoring	DAISIE update	€160.000 + €15.000	FP	Depending on investment levels	Suggested
6	Global biodiversity monitoring	DOPA	€ 3 million (only set-up of the DOPA operating system). Significant extra costs for data input providers.	EC – JRC together with GBIF, UNEP-WCMC, Birdlife International and RSPB	Promising tool for improved biodiversity monitoring on a global scale.	On-going
6	Global biodiversity monitoring	Global barometer of life	€45 million	EU co-funded	Depending on investment levels	Suggested

5.9 Lessons learned

The overview table shows that many of the proposed measures are existing schemes or upgrades of existing schemes. Also, some of the sub-targets have a better starting position than others to be adequately monitored, i.e. the BAU scenario already offers more monitoring possibilities. For example, sub-target 1 on sustainable use and sub-target 4 on habitats and species, are already widely monitored via mandatory and voluntary schemes, but need upgrades in terms of resources and coverage to further improve monitoring with the aim of moving from the BAU to at least scenario 1 or ideally scenario 2. Sub-target 3 on fragmentation and green infrastructure and sub-target 5 on invasive species, on the other hand, both still lack revised sectoral strategies, and therefore associated monitoring even under the BAU scenario is not yet well defined / covered. Finally, the headline target and sub-target 6 on global biodiversity monitoring both cover large and partially undefined monitoring goals and therefore would require significantly more costly, time-consuming and politically challenging efforts to really improve associated monitoring by 2020.

6 Recommendations for improved monitoring towards the 2020 biodiversity target

Based on chapter 5, this part will provide recommendations and give options how monitoring can be improved providing different cost and coverage alternatives.

6.1 Conclusions per (sub)-target

For many of the sub-targets, there are monitoring schemes in place which need to be up-scaled and extended, with secured long-term funding. Given the short timeframe and limited additional budgets and political will available for these types of improvements, this is more important than launching new programmes and initiatives at this stage. The scattered and incomparable nature of much of the data supports this conclusion and advocates consolidation instead of expansion.

6.1.1 Headline target

The analysis in this report has shown that the accuracy and quality of monitoring the headline target hinges on the success of on-going data integration projects and the introduction of new initiatives. It is clear that while already a full implementation of the BAU scenario would improve the current monitoring situation, the introduction of at least a few of the additional improved or new monitoring schemes would help improve the capacity of monitoring progress towards the 2020 headline target. Under ideal circumstances (e.g. no budgetary or political feasibility restrictions) all listed avenues for monitoring improvement could be introduced and therefore a situation close to the one described in scenario 2 would likely be reached.

6.1.2 Sub-target 1

When reviewing the options for improved monitoring of sub-target 1 (both for agriculture as well as forestry) it becomes clear that not that many tangible options for improvement exist. However, it should be mentioned that some of the options analysed under the headline target would certainly also help improve monitoring of sub-target 1. Furthermore, the BAU scenario should already provide a relatively decent level of monitoring for sub-target 1; any improvement might therefore not be a priority – especially when compared to the more urgent needs for improved monitoring of some of the other sub-targets. Finally, it should be mentioned that any intended improvements in monitoring could be channelled through the upcoming CAP reform, which presents an ideal point of entry for upgraded monitoring on agriculture and forestry in Europe.

6.1.3 Sub-target 2

This sub-target remains one of the most challenging goals of the new 2020 target to monitor in a way that will allow the assessment of progress. The monitoring schemes under the BAU scenario are likely insufficient to capture the range of progress that needs to be monitored. However, some of recent initiatives, such as the Census of Marine Life and the European Marine Knowledge 2020 Initiative, if supported with appropriate funding and other resources, could deliver the needed baseline knowledge and tools for monitoring progress in the near future. Similarly to sub-target 1,

potential improvements in monitoring should be strongly linked to the revision of the CFP, which itself has already highlighted the needs for better monitoring in the future.

6.1.4 Sub-target 3

The analysis in this report showed that the problem of fragmentation and its potential solution - creating Green Infrastructure - is still poorly understood and quantified, at least on an EU-level. It is currently premature to evaluate the cost and benefits of any potential monitoring options as no concrete target definitions and goals have yet been developed. The focus of EU policy should instead be to ensure that concrete monitoring measures are incorporated in the upcoming Strategy on Green Infrastructure, expected in 2011.

6.1.5 Sub-target 4

Overall, sub-target 4 is clearly the sub-target that already under the BAU scenario is associated with the highest degree of existing mandatory and voluntary monitoring schemes. In addition, the adaptations of existing mechanisms and new ideas for monitoring discussed in this report (such as the creation of a European Barometer of Life, greater coherency across national monitoring systems, the creation of a vegetation database, or the up-scaling of successful NGO-driven butterfly and bird monitoring schemes to cover other species and habitats) would have the potential to further improve the level of monitoring for sub-target 4 related goals. If the political will and necessary funding can be obtained, monitoring improvements for this sub-target would probably have the highest chance - compared to all other sub-targets - to reach a situation close to the ideal situation (i.e. scenario 2).

6.1.6 Sub-target 5

As the analysis in Chapter 5 has shown, the improved monitoring needs for sub-target 5 as well as the associated costs have already been relatively clearly defined and thus could be addressed without much additional prior research or preparation efforts. In addition, the parallel development of the EU Strategy on IAS could offer the needed point of entry for a quick improvement in monitoring for this sub-target.

6.1.7 Sub-target 6

Monitoring efforts related to sub-target 6 are some of the most complex and are not yet well defined. The ambitious EU target to include the global dimension now requires associated monitoring in order to be able to judge any progress made on this dimension until 2020. Most existing tools under the BAU scenario are not yet directly geared towards biodiversity monitoring and therefore require improved implementation and/or slight adjustments. New or improved versions of existing monitoring schemes are currently scarce and further efforts need to be invested in research, if serious progress towards improved monitoring for sub-target 6 is to be achieved.

6.2 Recommendations

In addition to the overarching conclusions on the current situation and future potential for monitoring of all (sub) targets of the new Biodiversity Strategy, the analysis carried out in this report allows for some broader recommendations to be drawn.

6.2.1 *Improvements in data collection, integration, quality and access*

The collection and integration of data that is collected on all different levels (local, regional, global…) is essential to improve future monitoring. EBONE, BISE, and SEIS are excellent examples of a first attempt to collect, integrate, assess and facilitate spread of data. These projects are already in place with funding secured but past experience shows that they must be considered in a more long-term perspective than is the situation in many FP schemes. For example, Forest Focus was highly successful and appreciated but terminated when the mandate expired and moreover, review and improvement was not conducted. FutMon is supposed to take on where Forest Focus left off, however, it is also restricted with a time limit for 2010. This ad hoc nature of many monitoring schemes is harmful for the creation of long-term, reliable and comprehensive data-sets. Continuous funding opportunities and support from both Commission and associated institutions and organisations is essential to ensure success in the large-scale data gathering needed to cover the headline and sub-targets.

This report also shows that considerable gains could be made if sectoral data-sets - such as fishery and forestry - are made biodiversity relevant. Indicators related to economic activity – such as invasive species – are expected to be widely covered as effects from biodiversity loss are relevant for private interests. These synergies should be utilised in a transparent manner in order to avoid bias and utilise readily available data.

Finally, improvements in the current BAP reporting system would likely improve not only the quantity and quality of data collected (i.e. submitted by Member States), but also aid the data integration and data access efforts. If recommendations provided by the recent Final Report on the European Commission Biodiversity Knowledge Base are taken up and implemented as soon as possible, this could certainly improve overall biodiversity monitoring across the EU and thus help in the assessment of progress towards the new 2020 targets.

6.2.2 *Building on the potential power of voluntary/community monitoring*

Voluntary and community run monitoring schemes have repeatedly featured throughout the report as a cost-efficient and effective method. In particular sub-target 1 and 4 are suitable for up-scaling and extending these schemes. There are certainly trade-offs in costs and accuracy, however, as many projects such as Vigie-Nature have shown, there is considerable potential benefits to be explored. Vigie-Nature, with a budget of around €1 million, shows how simple, effective and cost-efficient a national monitoring scheme can be set up. The accuracy is clearly dependent on expert/volunteer ratio and the sheer number of people and organisations involved, however, many of these problems can be mitigated using simple scoring cards and methods. A downside of using (semi)-voluntary approaches is that only some taxonomy groups, such as birds and butterflies, are chosen based on volunteer and NGO preferences and not scientific advice or policy needs.

To improve future voluntary monitoring, additional resources are needed. Despite the term voluntary, these schemes demand resources for coordination and hiring of experts. Furthermore, many of the schemes feed directly into larger databases and surveys such as the IUCN Red List, hence, the voluntary approach demands some EU-level coordination to be useful for measuring the headline and sub-targets. Again Vigie-Nature is a good example of attempts to incorporate data collected on a voluntary basis into larger data-bases such as LUCAS.

The challenges of voluntary schemes are to receive data on species and habitats that are not susceptible for amateur monitoring, and to secure resources to include more species and habitats.

It is also unclear to what extent and how the promotion of voluntary schemes can be promoted on a European level.

6.2.3 Developing appropriate monitoring for ecosystem services

One area with a substantial gap in monitoring is ecosystem services. This is not surprising as ecosystem services were not explicitly part of the 2010 Target. Although a formal programme for monitoring ecosystem services has not yet been initiated, a good basis of relevant data have already been collected and processed under different headings, which could give this monitoring issue a jump-start. A project is currently conducted led by JRC to develop pilot ecosystem service maps (wit quantification of biophysical potential service levels) for the EU in relation to Member State maps and even sit level maps. This then should lead to the reference database for future monitoring of changes in ecosystem services

An essential question remains which indicators can be used to capture spatial complexities and variability across scales. For example, data availability, disaggregation of spatial data and multi-model combinations are still limitations to full-scale mapping of ecosystem services. Rather than argue for a single unified methodology that can apply to all possible circumstances (i.e. across all scales), several parallel approaches and ways of modelling are needed based on solid research.

6.2.4 Who pays matters

The analysis in this report showed that it is essential that the provider of funding must be ready to allocate continuous funding opportunities. While funding on a time-constrained project basis can be useful for generating a first new attempt at monitoring, overall success of a new or improved monitoring scheme hinges on the provision of continuous funding over a much longer timeframe. Funding sources for existing and potentially new or improved monitoring approaches can generally be divided into: EU schemes, national schemes and co-funded schemes.

National funds for monitoring contribute substantially to biodiversity monitoring; however, allocation of money diverges greatly among Member States. For example, Denmark provides approximately 16 times more funds to Article 17 reporting than Hungary. However, budgets for national biodiversity monitoring are hard to quantify since is often is part of larger environmental monitoring schemes. For Member State reporting it is also clear that compulsory reporting resulting from EU directives and regulation yields a much better response in data collection than other initiatives. This is relevant since the allocation of scarce monitoring funds appears to be geared towards the necessities and not voluntary commitments.

EU funded schemes, often via LIFE or FPs, are better equipped to bridge some of the current monitoring gaps for the EU 2020 biodiversity target, especially in terms of integrating data, generating a broader European picture of the status on species and habitats, etc. These types of EU-funded schemes are, however, currently suffering from time-constraints and an ad hoc nature.

6.3 Indicators

In addition to the focus on how best to improve / enhance monitoring schemes for assessing progress towards the 2020 targets, several essential conclusions can be drawn regarding the importance and use of indicators.

A key problem with indicators in the EU is the large diversity and spread. Hence centrally coordinated and funded indicators should be prioritised, where the Commission can publish and promote the results. This would mitigate problems with national indicators which could hinder comparability. However, some SEBI indicators can not be applied in all MS because of differences in bio-geographic regions. The uncertainty that this generates will hinder their implementation; on the basis that countries which do not currently use the indicators are unlikely to introduce them where they cannot clearly see the value.

When looking at coverage of the SEBI set it becomes clear that indicators linked to economic impact are likely to have wide coverage and active monitoring, for example, invasive species and forests. This is also reflected in that sectoral data-collection in, for example, fisheries is extensive but has not been integrated in biodiversity monitoring. Coverage is also related to resources in which non-Natura 2000 related monitoring is under-funded. Realistically, a number of indicators are unlikely ever to be implemented at national level unless: a) they are provided with some form of instrumental requirement; or b) external funding is provided.

Moreover, biodiversity indicators do not necessarily have to be defined bottom up, nor is it necessary to monitor all species in all locations of particular habitats. This means that it would be *ideal* to develop sets of "representative" species, which are acceptable indicators for the progress towards the headline targets. If the Mean Species Abundance (MSA) of a selected set of representative species is monitored and combined with the knowledge from ecological studies on these species about their response to various environmental pressures and economic uses that should be sufficient for many of the sub-targets. An alternative can be the so-called Community Specialisation Index which expresses the relative composition between specialist species with a narrow ecological niche and generalist species which are less requiring, and therefore reflects the ecosystem integrity (ETC/BD, 2009).

In addition, it is considered more relevant to monitor the fate of the habitat of endangered species than to count the remaining few specimens. Again, a combination of Remote Sensing technique based monitoring with statistically sound field checks can be cost effective.

Habitat monitoring is relatively easy to do based on the extremely well established vegetation databases in Europe. There are well established links with fauna and abiotic conditions so much can be reported based on well organised vegetation monitoring. The basis is available, an NGO-like organisation is not yet established.

Finally, there is some momentum in improving biodiversity indicators as they relate strongly to ecosystem services and climate change mitigation and adaptation. For example, SEBI 2010 already contains a new indicator to measure the impact of climate change on bird populations.

6.4 Vast differences and unknowns remain with regard to potential costs and coverage of improved monitoring approaches

This report has demonstrated that the knowledge on biodiversity monitoring across Europe and how to best improve it remains patchy and only few experts can help contribute towards a more coherent picture and clear steps for improvement.

Similarly, while cost and benefit indications have been collected to the extent possible for existing as well as new monitoring approaches, their accuracy varies widely and unfortunately no overall cost range for improved monitoring can be generated based on this patchy quantitative information.

Coverage implications have also been discussed to the extent possible throughout the report. What has become clear is that some existing approaches have the potential to be easily up-scaled to either cover a wider geographic scope, or additional species and habitats. For other potential improved schemes it remains questionable whether the improved coverage can justify the cost implications.

Nevertheless, what can be said is that future improvements should focus on those items that score high on the feasibility for securing the needed funding, that can be implemented relatively quickly (given the short timeframe until 2020) and that ideally cover as many sub-targets, additional species or habitats, and geographic scope as possible.

References

Reports and academic papers

Anton, C., Young, J., Harrison, P.A., Musche, M., Bela, G., Feld, C.K., Harrington, R., Haslett, J.R., Pataki, G., Rounsevell, M.D.A., Skourtos, M., Sousa, J.P., Sykes, M.T., Tinch, R., Vandewalle, M., Watt, A. and Settele, J. (2010) Research needs for incorporating the ecosystem service approach into EU biodiversity conservation policy. Biodiversity Conservation, 19(10): 2979-2994

Bibby, C.J. (1999) Making the most of birds as environmental indicators. Ostrich 70: 81-88

Bidoglio, G. and L. Braat (2010) PRESS (PEER Research on Ecosystems Services) Research proposal for mapping ecosystem services. JRC-Ispra /ALterra -Wageningen

Beaufoy, et al (2009) Distribution and targeting of the CAP budget from a biodiversity perspective. Technical report. European Environment Agency, Copenhagen. p. 20.

Cooper, T. et al. (2007) Final report for the study on HNV indicators for evaluation. Report prepared by the Institute for European Environmental Policy for DG Agriculture. Contract notice 2006–G4-04.

ECNC (2003) Are we halting the loss of biodiversity in Europe? ECNC-European Centre for Nature Conservation, Tilburg

ECORYS study 2010 for EEA: GMES in-situ cost assessment

EEA (2004) High nature value farmland: Characteristics, trends and policy challenges. No: 1/2004; Paracchini M.L., J.-E.Petersen, Y.Hoogeveen, C.Bamps, I.Burfield, C.van Swaay (2008): High Nature Value Farmland in Europe - An estimate of the distribution patterns on the basis of land cover and biodiversity data, Report EUR 23480 EN. 87

EEA (2007a) Halting the loss of biodiversity by 2010: proposal for a first set of indicators to monitor progress in Europe. Luxembourg: Office for Official Publications of the European Communities, 2007

EEA (2007b), Europe's environment - The fourth assessment. Luxembourg: Office for Official Publications of the European Communities, 2007

EEA (2008) Indicator management service. Available at the on-line: http://ims.eionet.europa.eu/IMS/ISpecs/ISpecification20041007131611/IAssessment

EEA (2009) Progress towards the European 2010 biodiversity target. Report No 4/2009

EEB (2008) Building green infrastructure for Europe EEB special report publication number 1008/017

ETC/BD (2009) http://eea.eionet.europa.eu/Public/irc/eionet-circle/habitats-art17report/library?l=/papers_technical/overview_conservation_1/_EN_1.0_&a=d pages 6 and 8 and

Evaluation Expert Network (2009) Guidance Document: The application of the high nature value impact indicator 2007-2013. The European Evaluation Network for Rural Development.

FAO. Global Forest Resource Assessment 2010.

Féral,J-P., Fourt, M., Perez, T., Warwick, R.M., Emblow, C., Heip, C., van Avesaath, P., and Hummel, H. (2003) European Marine Biodiversity Indicators. Netherlands Institute of Ecology - Centre for Estuarine and Marine Ecology, Yerseke, The Netherlands, 2003

FSC. Global FSC certificates: type and distribution. September 2010

Herkenrath, P., N. Fournier, S. Gantolier, S. Good, C. Mees (2010) European Commission Biodiversity Knowledge Base. Service contract nr 09/543261/B2. Final report, 6 October 2010.

IUCN (2010, April 13). Conservation scientists call for 'biodiversity barometer'. ScienceDaily. Retrieved July 29, 2010, from http://www.sciencedaily.com-/releases/2010/04/100408160903.htm

Kettunen, M., Genovesi, P., Gollasch, S., Pagad, S., Starfinger, U. ten Brink, P. & Shine, C. (2008) Technical support to EU strategy on invasive species (IAS) - Assessment of the impacts of IAS in Europe and the EU (final module report for the European Commission). Institute for European Environmental Policy (IEEP), Brussels, Belgium. 44 pp. + Annexes.

Millenium Ecosystems Assessment (2005)

Montserrat Vilà, Corina Basnou, Petr Pyšek, Melanie Josefsson, Piero Genovesi, Stephan Gollasch, Wolfgang Nentwig, Sergej Olenin, Alain Roques, David Roy, Philip E Hulme (2010) How well do we understand the impacts of alien species on ecosystem services? A pan-European, cross-taxa assessment. Frontiers in Ecology and the Environment: Vol. 8, No. 3, pp. 135-144

Newsom, Deanna & Hewitt, Daphne (2005): The Global Impacts of SmartWood Certification. Final Report of the TREES Program for the Rainforest Alliance. http://www.rainforestalliance.rg/programs/forestry/perspectives/documents/sw_impacts.pdf (as of June 2008)

Nieto, A. and Alexander, K.N.A. (2010) European Red List of Saproxylic Beetles. Luxembourg: Publications Office of the European Union

Norden (2009) State of biodiversity in the Nordic countries. An assessment of progress towards achieving the target of halting biodiversity loss by 2010. TemaNord 2009:509.

Paracchini M.L., J.-E.Petersen, Y.Hoogeveen, C.Bamps, I.Burfield, C.van Swaay (2008): High Nature Value Farmland in Europe - An estimate of the distribution patterns on the basis of land cover and biodiversity data, Report EUR 23480 EN. 87 p

Rodwell, J.S., Schaminée, J.H.J., Mucina, L., Pignatti, S., Dring, J. and Moss, D. (2002) The diversity of European vegetation. An overview of phytosociological alliances and their relationship to EUNIS habitats. EC-LNV, Report ECLNV 2002/054, Wageningen, 168 pp

Scalera, R. (2008) EU funding for management and research of invasive alien species in Europe (Prepared for a pilot project on 'Streamlining European 2010 Biodiversity Indicators (SEBI2010)', Contract no. 3603/B2007.EEA.53070)

Scalera R. (2010) How much is Europe spending on invasive alien species? Biological Invasions (2010) 12:173-177

Stuart, S.N, Wilson, E. O., McNeely, J. A., Mittermeier R. A., Rodríguez J. P. (2010) The Barometer of Life. Science. April 2010. Vol. 328, no. 5975, p. 177

Shine, C., Kettunen, M., Genovesi, P., Gollasch, S., Pagad, S. & Starfinger, U. (2008) Technical support to EU strategy on invasive species (IAS) – Policy options to control the negative impacts of IAS on biodiversity in Europe and the EU (Final module report for the European Commission). Institute for European Environmental Policy (IEEP), Brussels, Belgium. 104 pp. + Annexes.

Shine, C., Kettunen, M., Mapendembe, A., Herkenrath, P. Silvestri, S. & ten Brink, P. (2009) Technical support to EU strategy on invasive species (IAS) – Analysis of the impacts of policy options/measures to address IAS (Final module report for the European Commission). UNEP-WCMC/Institute for European Environmental Policy (IEEP), Brussels, Belgium. 101 pp. + Annexes.

Shine, C., Kettunen, M., ten Brink, P., Genovesi, P. & Gollasch, S. (2009) Technical support to EU strategy on invasive species (IAS) – Recommendations on policy options to control the negative impacts of IAS on biodiversity in Europe and the EU. Final report for the European Commission. Institute for European Environmental Policy (IEEP), Brussels, Belgium. 35 pp.

Schmeller D. S., et al (2007) Advantages of Volunteer-Based Biodiversity Monitoring in Europe. Conservation Biology Volume 23, No. 2, 307–316

Schmeller (2008) European species and habitats monitoring: Where are we now? Biodiversity Conservation (2008) 17: 3321-3326

Smit, I (2009) Safeguarding Europe's biodiversity? A tool to assess the implementation process of the EU Natura 2000 policy. ECNC, Tilburg/ Master's Thesis, University of Utrecht

Temple H.J. and A. Terry, 2007. The status and distribution of European mammals. Luxembourg: Office for Official Publications of the European Communities

TEEB – The Economics of Ecosystems and Biodiversity for National and International Policy Makers (2009). (http://teebweb.net/)

WWF European Forest Programme (2005): The Effects of FSC-certification in Estonia, Germany, Latvia, Russia, Sweden & the United Kingdom: An analysis of Corrective Action Requests (by

Peter Hirschberger). Summary report. http://assets.panda.org/downloads/fscsummaryanalysisallcountries.pdf (as of July 2008

Working Group 1: Interlinkages (2009) Interlinkages between SEBI 2010-indicators - Improving the information power: An exploration. Intermediate report to the SEBI coordination team.

EU and CBD Documents

COM (1998) 42 final

COM (2001) 162 final

EC (2006) COM/2006/0216 final: Communication from the Commission - Halting the loss of biodiversity by 2010 - and beyond - Sustaining ecosystem services for human well-being

COM(2006) 302 EU Forest Action Plan

SEC(2008) 2887

SEC(2008) 2886 Towards an EU Strategy on Invasive Species

COM (2008) 789

COM(2009)163 Green Paper 'Reform of the Common Fisheries Policy'

COM(2009) 358 final

COM(2009) 147 final 'White Paper on Climate Adaptation'

EC (2009) Article 17 composite report http://ec.europa.eu/environment/nature/knowledge/rep_habitats/docs/com_2009_358_en.pdf,pages 7 and 9

COM(2010) 4 final, 19.01.2010

COM(2010) 110

SEC(2010) 360 final

EC 2010 Green Paper On Forest Protection and Information in the EU. SEC(2010)163 final

Decision VI/23* of the Conference of the Parties to the CBD, Annex, footnote to the Introduction

Press release from Brussels on 16 December 2008 reporting on the 4 main policy areas being pursued by the EU

Internet pages

http://ec.europa.eu/environment/nature/biodiversity/comm2006/bap_2008.htm

http://EUMON.ckff.si/

http://www.rubicode.net/

http://biodiversity.europa.eu/

http://ec.europa.eu/agriculture/healthcheck/index_en.htm

http://efdac.jrc.ec.europa.eu/

http://europa.eu/legislation_summaries/agriculture/environment/l28125_en.htm

http://www.futmon.org/

http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Fishery_statistics

http://www.biomareweb.org/

http://bioval.jrc.ec.europa.eu/PA/DOPA/

biodiversity-chm.eea.europa.eu

www.europeangreenbelt.org

http://www.blst.dk/NATUREN/Overvaagning_af_vand_og_natur/DEVANO/

http://www.blst.dk/NATUREN/Overvaagning_af_vand_og_natur/NOVANA/

http://www.edinburgh.ceh.ac.uk/biota/default.htm

http://www.oecd.org/document/9/0,3343,en_2649_33793_43662921_1_1_1_37401,00.html\

Eurostat statistics: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Fishery_statistics

http://www.gmes.info

http://www.myocean.eu.org/project.html

http://www.coml.org/

Annex A: SEBI indicators[118]

Table 1.1 SEBI 2010 indicators within CBD focal areas and headline indicators

CBD focal area	Headline indicator	SEBI 2010 specific indicator
Status and trends of the components of biological diversity	Trends in the abundance and distribution of selected species	1. Abundance and distribution of selected species a. Birds b. Butterflies
	Change in status of threatened and/or protected species	2. Red List Index for European species
		3. Species of European interest
	Trends in extent of selected biomes, ecosystems and habitats	4. Ecosystem coverage
		5. Habitats of European interest
	Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socioeconomic importance	6. Livestock genetic diversity
	Coverage of protected areas	7. Nationally designated protected areas
		8. Sites designated under the EU Habitats and Birds Directives
Threats to biodiversity	Nitrogen deposition	9. Critical load exceedance for nitrogen
	Trends in invasive alien species (numbers and costs of invasive alien species)	10. Invasive alien species in Europe
	Impact of climate change on biodiversity	11. Impact of climatic change on bird populations
Ecosystem integrity and ecosystem goods and services	Marine Trophic Index	12. Marine Trophic Index of European seas
	Connectivity/ fragmentation of ecosystems	13. Fragmentation of natural and semi-natural areas
		14. Fragmentation of river systems
	Water quality in aquatic ecosystems	15. Nutrients in transitional, coastal and marine waters
		16. Freshwater quality
Sustainable use	Area of forest, agricultural, fishery and aquaculture ecosystems under sustainable management	17. Forest: growing stock, increment and fellings
		18. Forest: deadwood
		19. Agriculture: nitrogen balance
		20. Agriculture: area under management practices potentially supporting biodiversity
		21. Fisheries: European commercial fish stocks
		22. Aquaculture: effluent water quality from finfish farms
	Ecological Footprint of European countries	23. Ecological Footprint of European countries
Status of access and benefits sharing	Percentage of European patent applications for inventions based on genetic resources	24. Patent applications based on genetic resources
Status of resource transfers	Funding to biodiversity	25. Financing biodiversity management
Public opinion (additional EU focal area)	Public awareness and participation	26. Public awareness

[118] Adapted from EEA Report No. 4/2009 Progress towards the European 2010 biodiversity target.

Overview of monitoring situation per indicator

Indicator	Current status of monitoring	Lessons/Gaps	Sectoral links	Issue-based links
1. Abundance and distribution of selected species a. Birds b. Butterflies	**Birds**: Continues as an extremely active and effective recording scheme, managed and run by Birdlife International and supported financially by the European commission. **Butterflies**: Grassland butterflies are actively recorded in a large number of countries and the scheme has the potential to be extended.	Both taxa illustrate how voluntary effort can provide an enormous amount of extremely valuable data and information. However, it is clear that such efforts have to be focused on popular groups if they are to be successful. Additional groups with well established national recording schemes such as dragonflies and damselflies, certain beetle taxa and flowering plants could all provide extremely cost-effective data and information.	Currently SEBI records farmland and forest birds. There is clearly potential to link these two agriculture and forestry-based indicators for biodiversity.	Both birds and butterflies can be linked to agri-environment funding. In addition, the issue of land abandonment has relevance in relation to the maintenance of semi-natural grassland (which is typical of traditionally farmed landscapes, is often botanically species rich). Grassland butterflies could therefore provide a link into this issue.
2. Red list index for European species	RLIs will soon be available for a suite of taxonomic groups, and methods are being developed to aggregate these indices into a single RLI for biodiversity. A sampled approach is being implemented for poorly known groups with many species, in order to increase the taxonomic breadth and representativeness.	The Red List is used to guide conservation planning, reviews the state of the world's species, and has various chapters focussing on freshwater biodiversity, marine species, the Sampled Red List Index initiative, the impacts of climate change and a regional case-study showing what is happening in the Mediterranean.	The red list index includes a number of species that can be associated with sectors that manage and use land. There is clearly potential for certain species therefore to be identified as sectoral "flagships". There is clearly overlap with three species of European interest.	The regional case studies and evaluations of the impacts of climate change on red list species have a value for issue-based links.
3. Species of European interest	With the exception of birds and certain large carnivores The Majority of Species of European	There is no monitoring carried out for a significant number of Species of	A number of Species of European Interest are affected, negatively or	The abundance and distribution of many species is governed by factors

Indicator	Current status of monitoring	Lessons/Gaps	Sectoral links	Issue-based links
	Interest are monitored as part of the Natura 2000/ Article 17 reporting efforts.	European Interest. This is largely due to a lack of availability of relevant taxonomic expertise, human and financial resources.	positively, by hunting. The potential for using hunters to monitor selected Article 17 species is recognized that has yet to be fully realized; (for instance, the majority of controlled or a licensed content involves the collection of 'bag numbers' - that is the number of animals killed during the hunting period. Furthermore there is likely to be a link with land management, via the agricultural practice, land use, energy, transport, etc.	such as climate, thus they are potential indicators of/ are likely to be affected by climate change.
4. Ecosystem coverage	This indicator is based on Corine land cover. It is therefore subject to regular update and (in theory) should have near Pan European coverage.	Because it can be collected and presented centrally, Corine land cover represents an effective and cost effective means for monitoring land use change. However, it is not completely responsive to change on the ground (for example, there may be a lack of recognition of land which has become abandoned and reverted to scrub or forest).	Particularly useful for measuring the impact of, for example, urban sprawl and built developments, other changes in land use and management associated with agriculture and/or land abandonment. Therefore strong links with land use and management sectors (e.g. planning, transport, energy, agriculture).	More sector driven than issue driven; although likely to be useful for identifying desertification and other climate change related factors.
5. Habitats of European interest	The Majority of Habitats of European Interest are monitored as part of	There is no monitoring carried out for a significant	50% of the European Union territory is devoted to	As well as management, the abundance and

Indicator	Current status of monitoring	Lessons/Gaps	Sectoral links	Issue-based links
	the Natura 2000/ Article 17 reporting efforts.	proportion of Habitats of European Interest. This is largely due to a lack of availability of relevant taxonomic expertise, human and financial resources.	agricultural production of some form. Those habitats associated with agricultural ecosystems therefore rely on certain forms of often traditional agricultural management which are usually maintained by agri-environment type payments. This is particularly the case with seminatural wet and dry grasslands.	distribution of many habitats is governed by factors such as temperature and humidity and prevailing climate, thus they are potential indicators of/ are likely to be affected by climate change.
6. Livestock genetic diversity	Reported on by a relatively small number of countries (mainly Scandinavian).	There are a number of disparate recording schemes beyond the Scandinavian countries. Particular interest has been shown for recording top fruit varieties (apples, plums, pears, etc) but no scheme currently exists.	Often linked with traditional agricultural management and multifunctional landscapes; thus potentially a useful indicator for agri-environment and the agricultural sector.	Disappearance of livestock genetic diversity (and of crop wild relatives/ fruit varieties) is also linked to social and demographic change.
7. Nationally designated protected areas	Captured largely as part of reporting in relation to Natura 2000 sites. Quantitative data on the number and area of sites is available but qualitative data in relation to the favourable conservation status of nationally designated protected areas is largely unavailable.	Has additional value as adjunct to Natura 2000 reporting but suffers from same problem in relation to qualitative information.	Such sites are often linked with traditional agricultural and forest/ woodland management and multifunctional (and High Nature Value) landscapes; thus potentially a useful indicator for agri-environment and the agricultural sector.	Nationally designated protected areas may often be highly valuable for public involvement, voluntary efforts and recreation. When they are available as a resource within farmed landscapes they may provide a source of additional revenue in farm diversification

Indicator	Current status of monitoring	Lessons/Gaps	Sectoral links	Issue-based links
				activities.
8. Sites designated under the EU Habitats and Birds Directives	Monitoring of article 17 species and habitats is required of all Member States on a six-year cycle.	The most significant gap is currently the lack of qualitative data in relation to the favourable conservation status of Natura 2000 sites.	Those sites associated with agricultural management often rely on certain forms of often traditional agriculture which are usually maintained by agri-environment type payments. This is particularly the case with semi-natural wet and dry grasslands.	As well as management, the viability of many sites is linked to factors such as ecological connectivity, the quality in terms of biodiversity of the surrounding landscape, temperature and humidity and prevailing climate.
9. Critical load exceedance for nitrogen	Currently monitored across Europe (including countries outside of the Member States).	Another example of an indicator that is (successfully) driven by compliance with external legislation	Driven by non-biodiversity policy instruments such as the Water Framework Directive.	A proxy indicator with varying impacts on biodiversity.
10. Invasive alien species in Europe	A widely monitored indicator with good European coverage. As many invasive alien species have potentially serious economic impacts the monitoring is likely to continue.	The invasive alien species indicator is linked to economic impacts is and therefore likely to have wide coverage and active monitoring.	Because of the widespread impacts of invasive alien species the potential exists for their monitoring by development planners, marine, freshwater, hunting, ecotourism and a range of other business and economic related sectors.	It should be noted that many invasive alien species also impact on native fauna and flora, some of which have recreational (hunting) or cultural (medicinal herbs, etc) value; this factor also drives the likelihood of their being monitored.
11. Impact of climatic change on bird populations	A relatively new indicator that has great potential for linking biodiversity to the wider issue of climate change. For it to be effective future funding will be required.	A good example of a new indicator of being introduced to the SDP I set relatively late in the process; demonstrating flexibility of the approach	Could have the potential to be funded by business and industry that have an impact on climate change and to have some interest in biodiversity issues.	Obvious links to the climate change issue.
12. Marine traffic index of European seas	A widely monitored indicator with good European coverage. As	A good example of an indicator whose measurement is	The fishing industry and other related coastal and marine	Directly linked to a range of social and economic issues

Indicator	Current status of monitoring	Lessons/Gaps	Sectoral links	Issue-based links
	the status of fish stocks house potentially serious economic impacts the monitoring is likely to continue.	driven by economic and, to a lesser extent, legislative requirements.	sectors.	whose realization is largely in the coastal zone.
13. The fragmentation of natural and semi-natural areas	There is an active debate surrounding the methodology applied to this indicator. A number of competing approaches exist and presently the focus is on forest ecosystems but the largely intensified and degraded agricultural landscapes of Western Europewould benefit from some form of 'ecological permeability' indicator.	Presently the focus of this indicator is on forest ecosystems. It might be more effective if it were to be based on opportunity rather than the threat.	The forestry sector. The agriculture sector.	Linked to issues of landscape quality and therefore recreation, tranquil enjoyment of the countryside and tourism/ ecotourism opportunities.
14. Fragmentation of river systems	Presently this indicator has not been completely or adequately developed.	Not yet possible to evaluate.	River engineering, commercial and recreational Freshwater fishery.	Interference with river systems for agricultural or other industrial purposes is widespread but has many associated impacts such as increased flooding, changing agricultural practice, recreational and socio-cultural impacts.
15. Nutrients in transitional, coastal and marine waters	This indicator has patchy European coverage.	A good example of an indicator whose measurement should be driven by economic and legislative requirements, and which is likely to be more widely measured once the Water Framework	The fishing industry and other related coastal and marine sectors.	Directly linked to a range of social and economic issues whose realization is largely in the coastal zone.

Indicator	Current status of monitoring	Lessons/Gaps	Sectoral links	Issue-based links
		Directive is more consistently applied.		
16. Freshwater quality	This indicator has a number of some elements each of which have a slightly different and patchy European coverage.	A good example of an indicator whose measurement should be driven by economic and legislative requirements, and which is likely to be more widely measured once the Water Framework Directive is more consistently applied.	The fishing industry, tourism and recreation.	Directly linked to a range of social and economic issues and, where drinking water is involved, human health.
17. Forest: growing stock, increment and felling's	A widely monitored indicator with good European coverage. As the status of Forest growing stock, increment and fellings has economic impacts the monitoring is likely to continue.	A good example of an indicator whose measurement is driven by economic requirements.	The forestry industry.	Directly linked to a range of economic issues related to forestry. Also with implications for sustainability in relation to sustainable forest management.
18. Forest: Deadwood	Widespread monitoring across Europe (with the exception of the southwest). Linked to forestry practice and therefore likely to continue.	Presently presented by region. Needs to be interpreted according to the differences in forest ecosystems and management practices between countries and regions.	The forestry industry/sector.	Directly linked to a range of economic issues related to forestry. Also with implications for sustainability in relation to sustainable forest management. Cultural implications.
19. Agriculture: nitrogen balance	Currently monitored across Western Europe (some exceptions in Central and Eastern Europe).	Necessary to measure the indicator country by country because it is based on input-output figures that vary based on a range of environmental parameters.	Agriculture sector	A proxy indicator with varying impacts on biodiversity. Linked to human health issues.
20. Agriculture:	Linked to High Nature	Organic farming has	Agriculture sector;	Many cultural

Indicator	Current status of monitoring	Lessons/Gaps	Sectoral links	Issue-based links
area under management practices potentially supporting biodiversity	Value Farmland and areas under organic management; each element measured with a slightly different but widespread distribution across Europe. Measurement of organic farming is likely to continue; HNV farmland is a slightly controversial subject in relation to its definition.	debatable value for biodiversity and HNV farmland is controversial because it is definition may result in unpopular targeting of agri-environment funding at national level.	food retailing sector; tourism and recreation industry.	landscapes can be offered protection through targeting agri-environment funding on HNV farmland.
21. Fisheries: European commercial fish stocks	A widely monitored indicator with good European coverage. As the status of fish stocks house potentially serious economic impacts the monitoring is likely to continue.	A good example of an indicator whose measurement is driven by economic and, to a lesser extent, legislative requirements.	The fishing industry and other related coastal and marine sectors.	Directly linked to a range of social and economic issues whose realization is largely in the coastal zone.
22. Aquaculture: effluent water quality from fin fish farms	Probably an interim indicator because an indicator on the overall sustainability of aquaculture would be more useful to a range of sectors.	Different types of aquaculture generate very different pressures on the environment. It is therefore difficult to use the indicator comparatively.	Fisheries sector; food industry.	Linked to a range of social and economic issues
23. Ecological footprint of European countries	Completed European coverage. Can be measured 'centrally'.	Because it can be collected and presented centrally, ecological footprint represents an effective and cost effective means for monitoring Europe's impact on the renewable natural resources.	Has some relevance to the majority of sectors.	Significantly broader than biodiversity and linked to a range of social and economic issues, human behaviour patterns, choices and lifestyles.
24. Patent applications based on genetic resources	Presently not fully developed.	Not yet possible to evaluate.	Food industry, medical, chemical industries, etc.	Not yet possible to evaluate.
25. The	It has so far proved	When the majority of	Agriculture sector,	The effective

Indicator	Current status of monitoring	Lessons/Gaps	Sectoral links	Issue-based links
financing biodiversity management	problematic to separate financing for biodiversity and management from general agri-environment funding at both national and European level. However this indicator offers the potential for regular and systematic reporting from national to European level.	agri-environment, the rural regeneration and related schemes were set up, little thought was apparently given to their utilization as an indicator of policy commitment in relation to biodiversity management. Future schemes should take this into account	policy makers.	delivery of rural regeneration, agri-environment and related funding is linked to a range of social and economic issues including role and deprivation, education and health, demographic change, etc.
26. Public awareness	Currently measured via of the Eurobarometer and thus capable of repetition outwith the resources of Member States.	An effective measure that can be repeated using central (European Commission) resources.	Public awareness is linked to many factors (such as education, mobility, economic prosperity and culture). Sectors therefore may take a role, for instance agriculture, hunting, transport, business and industry, etc by promoting diversity through their own activities and publicity campaigns.	Climate change has had a high impact on public awareness; this and other related issues can be used as a vehicle for co-promotion of biodiversity.

Annex B: Research initiatives/schemes

BIOTA Projects as of 2010-07-02		
On-going projects		
Project Acronym	**Project title**	**Project duration**
BioStrat	Delivering the EU Biodiversity Strategy	November 2006 - October 2010
CONGRESS	Conservation genetic resources for effective species survival	May 2010 - April 2013
EBONE	European biodiversity observation network	April 2008 - March 2012
ECOCHANGE	Challenges in assessing and forecasting biodiversity and ecosystem changes in Europe	January 2007 - December 2011
EDIT	European Distributed Institute of Taxonomy	March 2006 - February 2011
EVOLTREE	Evolution of trees as drivers of terrestrial biodiversity	April 2006 - September 2010
HighArcs	Highland Aquatic Resources Conservation and Sustainable Development	January 2009 - December 2012
HUNT	Hunting for sustainability	November 2008 - April 2012
LiveDiverse	Sustainable livelihoods and biodiversity in riparian areas in developing countries	February 2009 - January 2012
LifeWatch	E-Science and Technology Infrastructure for Biodiversity Data and Observatories	February 2008 - March 2011
PALMS	Palm harvest impacts in tropical forests	January 2009 - December 2013
PESI	A Pan-European species-directories infrastructure	January 2008 - January 2011
SCALES	Securing the Conservation of biodiversity across Administrative Levels and spatial, temporal and Ecological Scales	May 2009 - July 2014
SESAME	Southern European Seas: Assessing and Modelling Ecosystem Changes	November 2006 - October 2010
SOILSERVICE	Conflicting demands of land use, soil biodiversity and the sustainable delivery of ecosystem goods and services in Europe	September 2008 - February 2012
STEP	Status and trends of European Pollinators	February 2010 - January 2015
TESS	Transactional Environmental Support System	October 2008 - March 2011
Completed projects		
Project Acronym	**Project title**	**End of project**
ALARM	Assessing Large Scale Risks for Biodiversity with Tested Methods	January 2009
ALTER-Net	A Long-Term biodiversity, Ecosystem and awareness Research network	March 2009
BABE	Beekeeping and Apis Biodiversity in Europe	September 1, 2004
BioAssess	Biodiversity assessment tools project	July 2003
BioCASE	A biological collection access service for Europe	January 2005
BIOECON	Biodiversity and economics for conservation	January 2004
BIOFORUM	European biodiversity forum - implementing the ecosystem approach	December 1, 2005
BioHab	A framework for the coordination of biodiversity and habitats	November 1, 2005
BIOMAN	A project about biodiversity and human impact in shallow lakes	January 2003
BioPlatform	European platform for biodiversity	April 1, 2005

BioScene	Scenarios for reconciling the conservation of biodiversity with declining agricultural use in the mountains of Europe	November 1, 2005
BioScore	Biodiversity impact assessment using species sensitivity scores	February 2009
BIOSTRESS	Biodiversity in herbaceous semi-natural ecosystems under stress by global change components	December 1, 2002
CASCADE	Securing gene conservation, adaptive and breeding potential of a model multipurpose tree species (Castanea sativa) in a changing environment	October 2003
Coast Bird Diversity	Maintaining migratory coastal bird diversity: management through behaviour-based predictive population modelling	December 1, 2004
COCONUT	Understanding effects of land use changes on ecosystems to halt loss of biodiversity due to habitat destruction, fragmentation and degradation	November 1, 2008
CONSIDER	Conservation of soil organism diversity under global change	February 2007
CRAYNET	European crayfish as keystone species-linking science, management and economics with sustainable environmental quality	November 1, 2005
DAISIE	Delivering Alien Invasive Species Inventories for Europe	January 2008
ENBI	The European Network for Biodiversity Information	December 1, 2005
EPRECOT	Effects of precipitation change on terrestrial ecosystems - a workshop and networking activity	December 1, 2006
EUMON	EU-wide monitoring methods and systems of surveillance for species and habitats of Community interest	April 1, 2008
EuroCat	The catalogue of life: biodiversity resource and e-science gateway	January 2006
Euro-limpacs	Integrated project to evaluate impacts of global change on European freshwater ecosystems	January 2009
EUR-OCEANS	European network of excellence for ocean ecosystems analysis	December 1, 2008
Fauna Europaea	European advantages in biodiversity indexing and infrastructures	October 2004
Euro+Med PlantBase	The information resource for Euro-Mediterranean plant diversity	August 1, 2003
Fossilva	Dynamics of forest tree biodiversity: linking genetic, paleogenetic and plant historical approaches	September 1, 2003
FRAP	Framework for biodiversity Reconcialition Action Plans	April 1, 2006
FRAXIGEN	Ash for the future: defining European ash populations for conservation and regeneration	June 2005
GEM-CON-BIO	Governance and ecosystems management for the conservation of biodiversity	January 2008
Giant Alien	Giant Hogweed (Heracleum mantegazzianum) a pernicious invasive weed: developing a sustainable strategy for alien invasive plant management in Europe	April 1, 2005
GLOCHAMORE	Global change in mountain regions	October 2005
HERMES	Hotspot Ecosystem Research on the Margins of European Seas	March 2009
IMEW	Integrated Management of European Wetlands	July 2004
IntraBioDiv	Tracking surrogates for intraspecific biodiversity: towards efficient selection strategies for the conservation of natural genetic resources using comparative mapping and modelling approaches	December 1, 2006
LACOPE	Landscape development, biodiversity and co-operative livestock systems in Europe	October 2006
LEDA Traitbase	A database on the life history of the Northwest European flora	October 2005
MACIS	Minimisation of and Adaptation to Climate change: Impacts on biodiverSity	November 1, 2008
MacMan	Maculinea butterflies of the habitats directive and European Red List as indicators and tools for habitat conservation and management	January 2006
MarBEF	Marine Biodiversity and Ecosystem Functioning	January 2009
Marine Genomics Europe	Implementation of high-throughput genomic approaches to investigate the functionning of marine ecosystems and the biology of marine organisms	February 2008
Metabird	Viability of bird metapopulations	Febraury 2003

MIDI-CHIP	Designing and testing DNA microarrays as a molecular tool to monitor the diversity of freshwater cyanobacteria in European lakes	October 2003
MODELKEY	Models for assessing and forecasting the impact of environmental key pollutants on marine and freshwater ecosystems and biodiversity	January 2010
PASCALIS	Protocols for the assessment and conservation of aquatic life in the subsurface	December 1, 2004
PGR Forum	European crop wild relative diversity assessment and conservation forum	October 2005
Plant Dispersal	Dynamics of plant dispersal-related traits in fragmented European habitats: consequences for species survival and landscape management	September 1, 2003
RECIPE	Reconciling commercial exploitation of peat with biodiversity in peatland ecosystems	May 2006
REGHAB	Reconciling gamebird hunting and biodiversity	May 2002
RUBICODE	Rationalising biodiversity conservation in dynamic ecosystems	March 2009
PROBIOPRISE	Creating a European Platform for SMEs and other stakeholders to develop a research programme for pro-biodiversity business	August 1, 2007
SoBio	Mobilising the European social research potential in support of biodiversity and ecosystem management	January 2006
TLinks	Trophic linkages between above and below ground organisms as a key to successful restoration of biodiversity on ex-arable land across Europe	April 1, 2005
TRANSPLANT	Determining the extinction risks and the re-introduction of plant species in a fragmented Europe	February 2004
Source: http://www.edinburgh.ceh.ac.uk/biota/default.htm		

Annex C: National monitoring schemes

Belgium

Institution: Belgian Biodiversity Platform www.biodiversity.be

Belgium has a regionally managed monitoring system with little exchange and coordination. Most inventories are conducted in the frame of on-going research projects or at the request of regional governmental administrations or agencies, howver, for agriculture, some indicators are compiled at national level by the Federal Ministry of Agriculture and by the National Institute of Statistics. Research and nature conservation activities related to the North Sea are also carried out at the Federal level by the Management Unit of the North Sea Mathematical Models and the Sea Fisheries Department , in cooperation with regional institutions.

To overcome coordination problems of biodiversity (-monitoring) projects and organizations, the Belgian Biodiversity Platform has been set up. It serves as the coordinator between institutes, scientists, policy makers, and international partners and is currently establishing a database (http://biobel.biodiversity.be/) to integrate data from different research topics and regions.

One of the most active institutions in biodiversity monitoring is the Research Institute for Nature and Forest (www.inbo.be), associated European Environment Agency (EEA). It uses the DPSIR-framework to report the state of the environment and its impact on biodiversity. Further, it utilizes a field survey method called Biological Valuation Maps (BVM) which is a uniform field-driven survey of the land cover and vegetation in the Flemish Region. The map is drawn at a detailed scale of 1/10.000. Land cover classes and vegetation types are defined by an extensive list of legend units. For fast and easy interpretation the survey is also translated into a biological valuation and depicted by a color code on the map.

Most of the Flemish part is visited by scientists and technicians during the intensive field survey. To complete the mapping of such a vast surface within a reasonable time scale an area is normally visited only once. Nevertheless, an accurate can be obtained result by mapping an area in the most appropriate time of the year, namely the flowering season of the dominant or typical species of a specific vegetation. The data is being digitized with a geographical information system. Aerial photographs, maps and other GIS layers are used to collect additional information. The BVM is used in several legal texts and laws concerning nature conservation and environmental protection. Also, in the framework of the European Natura 2000 network the BVM has proven to be very useful in obtaining a good idea about the location and the surface area of most habitat types.

Czech Republic

Institution: Agency for Nature Conservation and Landscape Protection (ANCLP http://www.ochranaprirody.cz/index.php?lang=en)

The Czech monitoring program is implemented by the ANCLP, part of the Ministry of Environment. It was designed to integrate data collected by various institutes and initiate monitoring projects for

previously uncovered areas. The program strives to use the SEBI indicator framework, but has not established monitoring for several indicators yet (e.g. red list index, ecosystem coverage, public awareness, financing biodiversity management). In fact, only three indicators (Species of European interest, Habitats of European interest, Sites designated under the EU Habitats and Birds Directive) are fully integrated into the national Biomonitoring Program (http://www.biomonitoring.cz/).

Even if the Biomonitoring Program improved coordination, data collection and analysis are still spread out over various institutes and NGOs, resulting in inconsistencies, lack of oversight, and varying quality of data. Further, available data is often not analyzed and integrated into the national and European systems. The responsibility to pass on the monitoring outcomes (to the EUROSTAT, EEA, European Commission and others) lies with the organization/agency assigned to a particular indicator.

The fourth report on biodiversity (saved in folder) repeatedly mentions the lack of resources as the main hindrance for implementation of the biodiversity strategy and adequate monitoring (MoE needs “more people, more money, more time”). Currently, only one full-time employee is dedicated to biodiversity at the MoE, illustrating the severe limitations of the present approach. Funding is solely public, partly national and partly regional funds.

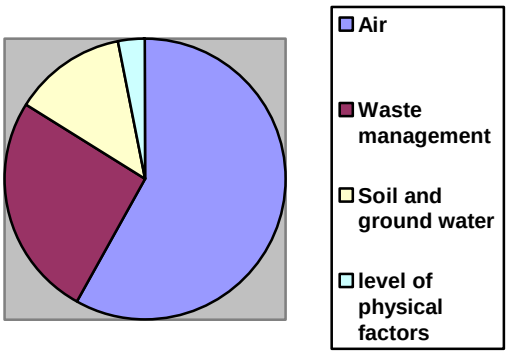


Figure 0.1 Monitoring overview 2007 (€1.63)

Hungary

Initiative: Hungarian Biodiversity Monitoring System (http://www.termeszetvedelem.hu/hbms)

The biodiversity monitoring system in Hungary is based on the requirements of Biological Diversity Convention. The National Authority for Nature Conservation is a coordinator of bio-monitoring and one full-time employed expert in every national park with a help of different experts and NGOs does practical implementation of the bio-monitoring. The monitoring activities are implemented in a frame of 10 different programs. It is foreseen to have the 11th program, which would be dedicated for monitoring implementation according to the Habitats Directive. The Hungarian monitoring system has strong scientific approach, more detailed than reporting is demanded by the Habitats Directive.

The Hungarian monitoring program struggles with no clear guidance from the EC, in particular compatability with indicators, lack of capacity and financial recourses, human resources, there is no way to integrate data that are gathered outside the bio-monitoring program. Although a lot of data

are gathered in a frame of monitoring program, the results do not reflect the “state of nature”, since there is a lack of harmonized assessment of the data.

According to a 2007 review: **“**the Hungarian Biodiversity Monitoring System (HBMS) is a remarkable program to collect data on species, community and landscape diversity and trends”. The early development (1997) of HBMS is exceptional at European level. The concept was developed along the guidelines of the Convention on Biological Diversity, that is, beside populations of species, the diversity of communities, habitats and landscapes is taken into consideration. The development of protocols to carry out field sampling was based on a wide expert community, including botanists, zoologists, mapping experts and ecologists and resulted in a great number of tested guidelines for different components of the living world. Field sampling was made possible in 1998, when monitoring coordinators were employed at the national park directorates that carry out the work regionally. Data are gathered ever since in an increasing volume with the help of researchers and different universities and institutes (Török and Fodor 2001, Demeter et al. 2002).

A review was started in 2003 to summarize the results and to test the value of data gathered during 5 years. The main finding of the process was that the sampling methods are relevant to the task, only minor changes in a few protocols have been suggested. It was concluded, that the HBMS was an important source of information during the every day operation of the national parks. However, the development of the system experienced difficulties as not all the planned activities could be carried out. Even presently, an important drawback is the lack of sufficient staff to coordinate the program and to handle the data.

Lithuania

Programme: financed by Phare – EU support for eastern members (http://www.bef.lt/en/)

The Lithuanian monitoring system was only recently (2005) set-up and still struggles with children diseases.

The biodiversity-monitoring program is a part of the National Monitoring Program. It includes monitoring of all species/habitats of EU concern; however it includes also other components like monitoring of fishing quotas, natural recourses, invasive species and others. The monitoring is planned to be done within 6 years period. The monitoring activities will be carried out not only in the protected areas, but also 25% of monitoring should be implemented outside protected areas.

The main institution responsible for the reporting on the implementation of the Habitats Directive is the Ministry of Environment and the Environmental Protection Agency. For the data collection and analysis different scientific institutions are responsible. The Ministry of Agriculture will also have a role in the implementation of monitoring; however the concrete role is not yet defined.

The main challenges with regard to implementation of biodiversity monitoring in Lithuania is lack of human recourses and precise methodology. The methodology on the conservation status assessment is also not yet defined.

Lithuania so far has not yet developed indicators, but foresees doing it when the methodology for monitoring will be implemented.

Netherlands

Institutions:

- Netherlands Environmental Assessment Agency (www.pbl.nl) using GLOBIO3
- Alterra – Wageningen University (http://www.alterra.wur.nl/UK)
  - www.natuurkalendar.nl
  - Voluntary reporting system
  - Open to the public, feeding into Alterra research
- www.nlbif.nl Biodiversity Information Facility (database for knowledge sharing)

The Dutch National Authority for Data concerning Nature (GAN)

Over the last century, enormous amounts of data on the whereabouts of species in the Netherlands have been collected. However, this information was scattered (and still is to some extent) among different organisations, in different formats and not always digitally available. The aim of the National Authority, founded in 2007, is: make distribution data of plant and animal species available through one National Data Warehouse: the National Database Flora and Fauna (NDFF). The Authority aims at standardizing, validating and collating data, and making them available as completely as possible. All data entering the NDFF are validated. Data that are approved can be extracted from the database by members of the NDFF.

Facts about NDFF.

As per the first of January 2010 the system contains over 30 million records on the distribution of flora and fauna, integratin over 100 databases, and growing daily. Each year more then 2.5 million data are added, and labelled as to origin (who, how, when and where they were collected). All taxonomy and coding used in the system is unique and standardised. All species that occur in the Netherlands are included in the system, regardless their status, so the system provides a complete picture of all habitats in the Netherlands. The system is, among others, used by the local, regional and national government, nature conservation agencies, building companies, various types of consultants and law enforcement, and should function as the basis for reporting for International obligations (EU, CBD).

The Dutch National Network Ecological Monitoring (NEM)

Included in the NDFF database are the monitoring programs for specific species and species groups. These monitoring programs enable the determination of trends in species distribution. In the Netherlands, a number of governmental organizations co-operate to develop a state- of-the-art, low-cost system to monitor biodiversity trends in nature. This combined effort has lead to the Network Ecological Monitoring (NEM). In 1997 a convenant was signed by a number of Dutch governmental partners to found the Network Ecological Monitoring (NEM). The current partners in the NEM are: The Ministry of Agriculture, Nature and Food Quality (LNV), Ministry of Housing, Spatial Planning and the Environment (VROM), Ministry of Transport, Public Works and Water Management (V&W), The Provinces, Statistics Netherlands (CBS), National Nature Data Authority (GAN) & Netherlands Environmental Assessment Agency (PBL).

Core business of the NEM is to arrange ecological monitoring activities in such a way that with minimal efforts, a maximum of purposes can be served. Monitoring purposes range from local

scale, (nature development activities of provinces), via national scale (ecological quality in the National Ecological network) to International scales (Natura 2000, CBD Convention).

The cornerstone of the NEM has been the contribution of volunteers, who carry out field surveys and count plant- and animal numbers. These activities have been coordinated by a number of species-group NGO's. The Dutch Mammals Association (Zoogdiervereniging); SOVON, the Dutch Centre for Field Ornithology; RAVON, the NGO for Reptile, Amphibian and Fish Conservation Netherlands; The Dutch Butterfly Conservation (Vlinderstichting); The Dutch Mycological Society, NMV); The Dutch Bryological and Lichenological Society (BLWG); Flora and vegetation are monitored in the National Monitoring Network Flora for Environmental Quality (LMF). This network is not operated by volunteers but by ecologists hired by Provinces. The NEM has introduced and improved the use of strict monitoring protocols. Volunteers who participate in NEM biodiversity monitoring, are trained to follow specific, repeatable procedures. The observation results are thoroughly quality-checked, processed statistically, and stored in a central database.

The NEM serves a multitude of monitoring goals.

The original goals included: Trends of species mentioned in Birds and Habitats Directives, and in special protection areas; Species in National Species Protection plans; Ecological conditions in the National Ecological Network (EHS); Trends in birds in the protected Wadden Sea, to evaluate the Trilateral Monitoring and Assessment Program, (TMAP, a treaty signed by Netherlands Germany an Denmark); Ecological conditions outside the EHS, especially in rural areas and countryside; Ecological consequences of acidification, desiccation and over-fertilization; Base data for indicators for nature to for the Netherlands Environmental Assessment Agency.

Over time, the number of monitoring goals has increased. A recent revision showed that the goals that demand for biodiversity data has doubled in the past ten years. New goals the include:Trends in population densities in Natura 2000 areas; Ecological quality in agricultural areas; Trend in dispersion of Genetically Modified Organisms (GMO's); Status of Red lists of species groups (butterflies, bird, mammals etc); Good Ecological Condition of Large National Water bodies for Water Framework Directive; Urban Nature. Many of these new goals can be served by slight adaptations to the existing monitoring program. However, the extension to urban and agricultural areas will lead to a need for more financial resources.

NEM data are published as indicators the Environmental Data Compendium (by NEAA/PBL), in National Assessment Reports, in international reporting obligations, e.g. for Natural 2000, Farmland Bird Index and in specific Thematic Assessments, e.g. on Climate Change (see figure 1). The NEM includes now both trend monitoring (densities of species groups in specific habitats) and the monitoring of distribution of species.

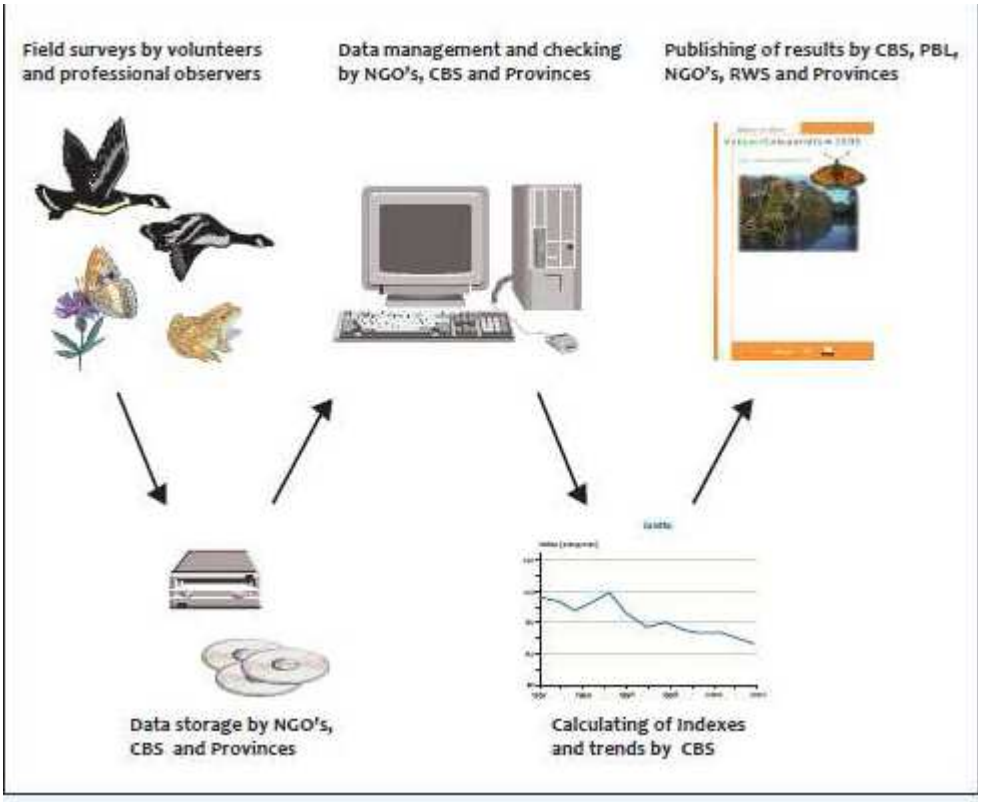


Figure 0.2 Principle and flowchart of the Network Ecological monitoring in The Netherlands (from Knol, 2009)

The NEM is a successful cooperative effort that has tailored individual efforts into a common framework, where biodiversity is measured once, but used many times for local, national and international decision-making. The use of highly motivated volunteers combined with severe quality control, makes the system very efficient and cost-effective.

- The financial aspects of biodiversity monitoring in the Netherlands
- The total annual cost of the biodiversity monitoring system in the Netherland is estimated to be about 4.5 Million Euro. The contributions are :
- Ministry of Agriculture, Nature and Food Quality (LNV): ca 3.000.000 Euro (1/3 for Trends, 1/3 for distribution, 1/3 for statistical analysis)
- . Ministry of Housing, Spatial Planning and the Environment (VROM): ca 150.000 Euro
- Ministry of Transport, Public Works and Water Management (V&W): ca 200.000 Euro
- The Provinces,: ca 1.000.000 Euro
- Ministry of Economic Affairs (Statistics Netherlands (CBS)); part of statistical analysis staff costs)
- Various others: total ca 50.000 Euro

Literature

- Knol, O. (2009) Successful Biodiversity Monitoring in the Netherlands: The Network Ecological Monitoring (NEM). Netherlands Environmental Assessment Agency (PBL), P.O. Box 303, 3720 AH Bilthoven, The Netherlands
- NDFF at WWW.gegevensautoriteitnederland.nl
- Environmental Data Compendium; internet: http://www.compendiumvoordeleefomgeving.nl
- Netherlands Environmental Assessment Agency, 2010, 2009. Nature Balance 2010, 2009 and previous editions.

- Website of NEM (mainly in Dutch); http://www.netwerkecologischemonitoring.nl
- The TMAP Monitoring portal: http://www.waddensea-secretariat.org/TMAP/Monitoring.html

Sweden

Institution: Swedish Biodiversity Centre (CBM) (http://www.cbm.slu.se/eng/index.php) Operated by the Swedish University of Agricultural Sciences and Uppsala University, public funding.

Sweden's €18.5 million (2008) environmental monitoring program is subdivided into ten program areas, each of which is monitored by different institutions. About 50 percent of the program is dedicated to biodiversity monitoring, although there is not always a clear distinction between environmental and biodiversity efforts. The monitoring institutions are coordinated by the Swedish Environmental Protection Agency (EPA), is supported by the Environmental Objectives Council, constituting the link between researching experts and policy makers. The actual research is carried out by various local authorities, research institutes and expert agencies. The most prominent examples include the SMHI (the Swedish Meteorological and Hydrological Institute), the Geological Survey of Sweden (SGU), the National Land Survey (LMV), and the Swedish Species Information Centre at the Swedish University of Agricultural Sciences (SLU). Especially interesting initiatives of the program are shortly outlined below.

National Inventory of Landscapes in Sweden (NILS) (http://nils.slu.se/)

Sweden's most interesting engagement in biodiversity monitoring consists of its Nils program, which was started in 2003, with the first full report in 2007. Adjustments of methods and procedures are still not completed. The system includes all different types of landscapes within the framework of a nationwide random sampling. The random sampling consists of over 600 permanent sample plots (5x5 km) that are inventoried every fifth year. Every year about 120 plots scattered over the entire county are inventoried. NILS, first and foremost, aims to provide data for national environmental protection and follow-up of environmental goals, but will also offer authorities, county administrative boards and other regional programs the benefits of more frequent random sampling. An expansion of NILS will provide increased possibilities of results on a regional level.

Species Gateway (www.artportalen.se)

Species Gateway is an independent site for collecting sightings of species. The site is open to anyone who wishes to contribute their data. The results feed into the research of the Swedish Species Information Centre, part of the Swedish Biodiversity Centre.

In Sweden sufficient financial recourses are allocated for monitoring, however the biggest problem the country is facing is related to lack of human recourses to implement the monitoring (especially in the Northern part of Sweden). In order to improve the situation, there are plans to apply analysis of satellite images. The biodiversity monitoring in Sweden has started in 1994.

Several challenges remain for the Swedish monitoring system: 1) To make good reference values, 2) Common habitats and species – for some of them no inventories have been done, and 3) Poorly known habitats and species

Switzerland

Institution: The Federal office for the Environment (FOEN).

The FOEN is a small external coordination office which is responsible for the overall project and organising the annual gathering of data. The management, evaluation, reporting and quality assurance is also under the authority of FOEN

The field surveys for the main indicators of widespread species have been put out for bid, and contracts have been awarded to the most qualified applicants for a survey period covering several years. The coordination office performs its own surveys at particularly complex sites. Data collection for rare species relies on institutions that already deal routinely with the respective species groups. The BDM also relies on data from numerous other institutions and organizations.

The Biodiversity Monitoring Programme (BDM)[119] is a national program with data collection from 2001. Data is collected under highly standardized forms with only a few indicators surveyed by the BDM, the rest is collected by other programs. The list of indicators is purposely balanced with both rare and common species, trying to avoid bias.

UK

Institution: UK Environmental Observation Framework (http://www.erff.org.uk/activities/uk-eof.aspx)

The UK monitoring community is large and fragmented, involving many organizations, funding bodies and monitoring activities. A clear strategy and structure is missing. Accordingly, coordination and consistency are the main issues of the monitoring program. Major concern for the various reporting organizations is a lack of funding. In addition, approximately one fifth of data collection is carried out by volunteers, endangering the continuity and quality of recording.

The total cost of monitoring could be up to £500m. Only 32% of funds (approximately £28 m) are spent on non-statutory monitoring per year. The remaining 68% are bound up in statutory monitoring, which is perceived as a constraint: “In seeking short-term efficiencies (e.g, through very focused monitoring), the wider application of the results from statutory/compliance is often constrained.”

Annual cost BDM	€
Z7 and Z9	1.5 million
Other indicators	135,000
Specific studies	68,000
Personnel, cost of materials	238,000
Subcontracts	100,000

[119] http://www.biodiversitymonitoring.ch/english/aktuell/portal.php

The challenges for the UK system remains with insufficient data collection, baseline data and long-term trends in specific topic areas, especially soil biodiversity and soil erosion. It also struggles with coordination and communication of results.

Annex D: Interviewed experts

Who?	From where?	On what?
Guy Beaufoy	EFNCP	HNV farming
Annabelle Cuttelod	IUCN	EU Red List
Condé, Sophie	Topic Centre	Questions provided by Anne
Delbaere, Ben	ECNC	Current monitoring systems across Europe
Flies, Robert	DG ENV	Biogeographic regions approach for monitoring
Fritz, Marko	DG ENV	LIFE, Eurostat, green infrastructure, research, etc.
Gantioler, Sonja	IIEP	Questions provided by Anne
Goss, Simon	LIFE+	LIFE+ contributions to biodiversity monitoring
Jones-Walters, Lawrence	ECNC	Current monitoring systems, SEBI, lessons learned, gaps
DuBois, Gregoire	JRC	Monitoring approaches for sub-target 6 (global dimension)
Kaemena, Astrid	DG Research	Research projects with monitoring focus
Legrand, Marine	Vigie Nature	VigieNature as case study of novice monitoring/reporting
Maes, Joachim	JRC	Focus on ecosystem services
O'Briain, Michael	DG ENV	Brief general conversation about monitoring ideas
Pereira Martins, Ivone	EEA	EEA efforts on biodiversity monitoring
Richard, Dominique	Topic Centre	Monitoring systems per sub-target
Romao, Carlos	EEA	Refused to discuss questions proposed by Anne
Rubin, Angelika	DG ENV	Monitoring for sub-target nature conservation
Salsi, Angelo	LIFE+	LIFE hooks for improved biodiversity monitoring
tenBrink, Ben	PBL	Overview current systems; species monitoring in the future
van Strien, Arko	CBS	Overview current systems; species monitoring in the future
Williams, James	JNCC	UK monitoring approaches; UK SEBI; flexible framework
Wolf-Crowther, Marielies	Eurostat	Statistical regulation for some SEBI indicators
Erik Buchwald	Danish ministry of environment	Costs of national biodiversity monitoring
Schutyser, Frederik	EEA	Contacted; but conversation not possible before his sabbatical
Schulte, Ernst	DG ENV	Lessons learned from Forest Focus

Annex E: Table overview of targets, schemes, gaps and proposed changes

	Headline target	1 - Integration and sustainable use of resources	2 - Overexploitation	3 - Fragmentation and green infrastructure	4 - Invasive species	5 - Nature conservation	6 - bio
Target formulations under review	•To halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, restore them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss.	•% of land under a contract to deliver HNV related farming and forestry within and outside HNV areas; •% of CAP direct support directed to HNV (area/farming to be determined) to contribute to good conservation status; •Sub-target for intensive agriculture (e.g. % land under organic farming).	•% of Community stocks fished within Maximum Sustainable Yield; •% of Community stocks outside safe biological limits; •(by extension, the marine trophic index could be used as a sub-target).	•(connectivity and adaptation) Putting in place a Trans-European network of Green Infrastructure through dedicated funding •(natural capital investments) - % EU funding devoted to Green Infrastructure projects (e.g. starting with climate change mitigation/adaptation focus) •(fragmentation / land-use change) - no net loss of natural areas and good functioning soil including compensation obligation which could be based on the maintenance of key ecosystem services / or sealing capping	•Pathways for the introduction and establishment of invasive species have been controlled and established invasive species are identified, prioritised and controlled or eradicated.	•Conservation Status is improved or maintained compared to baseline, with a minimum for improvement to x% (e. g. 25%)120 by 2020 and 100% in 2050; •Less than x% of species/habitats protected under EU legislation are classified as unknown; •-Sufficiency index for designated Natura 2000 sites; •-x% of funding needs for the management of the Natura 2000 network (€6 billion) met; •% of Natura 2000 sites which have an appropriate management plan or equivalent instrument.	•% •% •% •%

[120] including non-known and calculated on the base of Art. 17 report – now at 17%.

	Headline target	1 - Integration and sustainable use of resources	2 - Overexploitation	3 - Fragmentation and green infrastructure	4 - Invasive species	5 - Nature conservation	6 - bio
Existing indicators		•SEBI 01. Abundance and distribution of selected species: a) birds, and b) butterflies. •SEBI 02. Red List Index for European species •SEBI 04. Ecosystem coverage •SEBI 06. Livestock genetic diversity •SEBI 09. Critical load exceedance for nitrogen •SEBI 17. Forest: growing stock, increment and fellings •SEBI 18. Forest: deadwood •SEBI 20. Agriculture: area under management practices potentially supporting biodiversity. •SEBI proposal. OECD statistics on subsidies •CMEF Impact 18. HNV farmland and forestry (measurement: Utilised Agricultural Area (UAA) of HNV) •IRENA 04. Area under nature protection •IRENA 07. Area under organic farming •IRENA 26. Area of High Nature Value (HNV), grassland, etc. •BAP Indicators for AEM for Natura	•SEBI 12. Marine Trophic Index of European sea •SEBI 15. Nutrients in transitional, coastal and marine waters •SEBI 21. European commercial fish stock •SEBI 22. Aquaculture: effluent water quality from finfish farms •IUCN EU Red List. Percentage of EU species threatened by overfishing	•SEBI 04. Ecosystem coverage •SEBI 05. Habitats of European interest •SEBI 13. Fragmentation of natural and semi-natural areas •SEBI 14. Fragmentation of river systems •SEBI 16. Freshwater quality •SEBI proposal. Trends in ecosystems restored •IUCN Red List: Percentage of species threatened by loss of habitat •EEA, ETC/LUSI. Landscape ecological potential, species specialisation index, land accounts	•SEBI 10. Invasive alien species in Europe •IUCN Red List. Percentage of EU species threatened by invasive species	•SEBI 01. Abundance and distribution of selected species: a) birds, and b) butterflies. (organic farming; forestry) •SEBI 02. Red List Index for European species •SEBI 03. Species of European interest •SEBI 05. Habitats of European interest •SEBI 07. Nationally designated protected areas •SEBI 08. Sites designated under the EU Habitats and Birds Directives •SEBI 11. Impact of climactic change on bird populations •SEBI 25. Financing biodiversity management •BAP. Funding for Natura 2000 (for EU, per MS) •BAP. Sites with management plan or equivalent •IUCN EU Red List. Percentage of EU species, including mammals, amphibians, reptiles, birds and	•SE •SE •SE •SE •SE •SE •SE •SE •SE •SE •Ec •IU

	Headline target	1 - Integration and sustainable use of resources	2 - Overexploitation	3 - Fragmentation and green infrastructure	4 - Invasive species	5 - Nature conservation	6 - bio
		2000 •IUCN EU Red List: percentage of EU species threatened by agricultural exploitation				butterflies, which face risk of extinction	
Info on GAPs	•BAP is currently the only means that collects biodiversity info across various sectoral sources. In future, BAP on policy level will change based on new target; but monitoring component will remain similar in terms of methodology. •Knowledge gaps related to biodiversity status can be summarised as the following on a European level: • diversity: genetic diversity, species, habitats • distribution: inventories, atlas, mapping • abundance: monitoring population sizes and habitats surface area, trends • quality: structure & function of habitats/ecosystems. •Knowledge gaps related to Ecosystem services (benefits) (from Anton C, Young J, Harrison PA, et al (2010)): • ecological underpinning of ecosystem services • drivers that affect ecosystems	•Data collection under BAP currently does not reflect integration. An indicator for cohesion policy is missing. •Need to revise the Farm Accountancy Data Network and other CAP statistics? http://ec.europa.eu/agriculture/analysis/fadn /index_en.htm •Include/improve reporting of data linking socio-economic statistics and expenditure with biodiversity and ecosystems in EU policies and, most important, outcomes in terms of maintaining and restoring biodiversity. For example: links between agri-environmental measures, organic farming.	•Include/improve reporting of data linking socio-economic statistics and expenditure with biodiversity and ecosystems in EU policies and, most important, outcomes in terms of maintaining and restoring biodiversity. For example: fisheries measures. •Overexploitation: need of better and more comprehensive statistics on commercial and amateur fishing, hunting, collection and other uses of wildlife.	•Still differences in basic definitions. •No indicators on how to measure how efficient a green infrastructure is in protecting / restoring biodiversity.	•Monitoring of alien species' presence and spread is considered satisfactory, however, the knowledge on impact on ecosystem services is less developed. From over 10,000 alien species registered in DAISIE, the economic impact of only 1347 (13% of total) and the ecological impact of 1094 (11% of total) alien species have been determined121. This gap needs to be filled in order for proper monitoring and cost-benefit analyses for policy action regarding alien species to take place. •Still a need to increase knowledge about distribution and abundance of alien species, ways and means of their expansion and research on invasion	•All proposed sub-targets on nature conservation can be monitored with existing systems (except for financing one might be challenging). •Include/improve reporting of data linking socio-economic statistics and expenditure with biodiversity and ecosystems in EU policies and, most important, outcomes in terms of maintaining and restoring biodiversity. For example: links between maintenance/restoration of biodiversity components.	

[121] Montserrat Vilà, Corina Basnou, Petr Pyšek, Melanie Josefsson, Piero Genovesi, Stephan Gollasch, Wolfgang Nentwig, Sergej Olenin, Alain Roques, David Roy, Philip E Hulme (2010) How well do we understand the impacts of alien species on ecosystem services? A pan-European, cross-taxa assessment. Frontiers in Ecology and the Environment: Vol. 8, No. 3, pp. 135-144.

	Headline target	1 - Integration and sustainable use of resources	2 - Overexploitation	3 - Fragmentation and green infrastructure	4 - Invasive species	5 - Nature conservation	6 - bio
	and their services • biological traits and ecosystem services • valuation of ecosystem services • spatial and temporal scales in ecosystem service assessment • indicators of ecosystem services • habitat management, conservation policy and ecosystem services. •More needs to be known about the interdependence of ecological and social systems for human well-being, including the way ecosystems function, their response to human pressure, and their relationship to biodiversity.				mechanisms.		
Relevant existing monitoring schemes	•Article 17 Reporting as a proxy for biodiversity status (need a clearer picture of what it covers and what it doesn't cover for the new target). •SEBI reporting data. •NGO-based EU-wide bird and butterfly monitoring and reporting. •EU Red Lists are a good source for general overview of progress towards the headline target. •EU Red List is already included in new calls for LIFE+ project proposals. •BioSOS and MS-MONINA aiming to further develop remote sense	•Forest Focus / Futmon data and methodology worked well. But doubtful it could be reinstated for monitoring in the future. •IRENA (focus on agricultural statistics). •Sectoral reporting requirements under CAP and Technical Action Plans for Agricultural Statistics (TAPAS). •Inspire Directive (no direct link).	•EUROCEAN project. •WISE reporting. •Water and Marine Framework Directive Reporting.	•WISE reporting. •Inspire Directive (no direct link). •Plant Protection Regime related data.	•DAISE project on delivering alien invasive species inventories for Europe.	•Reporting obligations under Article 17, Article 12 and Natura 2000 can provide most indicators / data needed for monitoring progress. •Scattered reporting inputs from LIFE+ projects. •Inspire Directive (no direct link).	•e-H

	Headline target	1 - Integration and sustainable use of resources	2 - Overexploitation	3 - Fragmentation and green infrastructure	4 - Invasive species	5 - Nature conservation	6 - bio
	methods for biodiversity monitoring. • - LIFEWATCH which intends "*to collate information on the state of animal and plant species all over Europe. It will combine a system of marine, terrestrial and freshwater observatories, and give the research community common access to interlinked, distributed data from databases and monitoring sites. In addition, it will provide computational facilities in virtual laboratories with analytical and modelling tools as well as user support and training*". • Concerning ecosystem services, the RUBICODE project (FP6) identified fields of research which are relevant for EU biodiversity conservation policy. • The EBONE project – European component of the GEO-BON global programme – aims addressing the lack of data as a major constraint on the development and use of indicators for large scales biodiversity assessment (national, European and global). • The EUMON project (FP6) – EU-wide monitoring methods and systems of surveillance for species and habitats of Community interest – focused on four major aspects important for biodiversity monitoring: the involvement of volunteers, coverage and						

	Headline target	1 - Integration and sustainable use of resources	2 - Overexploitation	3 - Fragmentation and green infrastructure	4 - Invasive species	5 - Nature conservation	6 - bio
	characteristics of monitoring schemes, monitoring methods, and the setting of monitoring and conservation priorities. It further developed tools to support biodiversity monitoring. •Explore the use of SEIS and other such databases. •ECOCHANGE project on challenges in assessing and forecasting biodiversity and ecosystem changes in Europe. •STEP project – status and trends of European pollinators. •JRC project on ecosystem mapping.						

	Headline target	1 - Integration and sustainable use of resources	2 - Overexploitation	3 - Fragmentation and green infrastructure	4 - Invasive species	5 - Nature conservation	6 - bio
Main avenues for future improvement to better monitor the new target	•Reporting obligations under Article 17, Article 12 (Birds), and Natura 2000. (Art. 12 reporting to be streamlined with 6 year cycle of Art. 12 reporting). •Improve the policy relevance of LIFE data and results. → Set up a Flexible monitoring mechanism with LIFE data compatibility ("species dots") as inputs for BISE. These "dots" would be fed in via a standardised reporting format on biodiversity monitoring to be filled in by all LIFE projects (sheet would need to be developed by B.2 and could be made mandatory from 2012 call onwards). •LIFE requirements could be adapted to make an exception in next call to reduce 25% "concrete action" requirement in order to stimulate monitoring projects. •LIFE requirements could be adapted to ask for detailed overview in proposal of how project will contribute to ecosystem services. •EU Red List updates to compare progress with 2007 lists. •EU Red List feasibility study for developing lists for habitats and ecosystems. •Additional EU Red List (new ones to be funded in 2011 for marine habitats and species as well as pollinators and medical plants could be developed). •Adapting LUCAS for biodiversity and ecosystem services component monitoring (e.g. for pollination LUCAS should be a feasible ground monitoring vehicle). On 13 October 2010, the HABISTAT-consortium will organize a Workshop on "Monitoring Europe's biodiversity in a post 2010 era: the	•Use CAP revision process in 2013 for better integrating biodiversity-related monitoring into CAP reporting obligations. •For forest monitoring, all data gathering for biodiversity-related monitoring should be closely linked and channelled though the National Forest Inventories (NFIs). NFIs already use predefined plots and have a well-functioning structure for reporting. DG ENV B.2 would have to feed in biodiversity / ecosystem service indicators to be collected. In terms of timing, this type of improvement should be launched after the Green Paper and in time for the White Paper process / the new forestry policy in 2014.	•Better extraction of information provided through the Water Framework Directive on ecological status (reported every 3 years). •Ensure clear monitoring obligations related to biodiversity and ecosystem services under the MFD.	•LIFE theme on connectivity for 2012 round of projects to estimate connectivity of N2K sites across the EU today. •Include biodiversity benefits for area/region monitoring in already existing annual LIFE ex-post evaluations.	•Integrate monitoring requirements in new legislation currently under development. •Utilise Plant Protection Regime for gathering data on progress.	•If current reporting requirements show gaps in reporting in 2013 round; potential for launching a study on gaps and how to better report on them on MS level.	•Re fo E •De fo / da m •De bi fo ai •Up of

	Headline target	1 - Integration and sustainable use of resources	2 - Overexploitation	3 - Fragmentation and green infrastructure	4 - Invasive species	5 - Nature conservation	6 - bio
Remaining gaps to be filled with additional initiatives	•Introducing statistical regulations for gathering data on some of the more difficult SEBI indicators (i.e. use Eurostat as main vehicle for statistics, as has been done for waste). This approach could be particularly interesting for better capturing progress on ecosystem services (green jobs, energy/transport effects on biodiversity, etc.). •"Tipping Points" approach for monitoring ecosystem services → could be explored (e.g. like cod in the North Atlantic) •If gaps on species level, consider replication of well-functioning approach of EU support to international umbrella NGO for gathering MS level data (i.e. as currently done for birds and butterflies). •Greater use of satellite services (EEA) such as GMES for biodiversity monitoring. Habitat loss and degradation and role of remote sensing (e.g. GMES); current CLC would benefit from refinement in the classification and be available at shorter and more regular intervals; need further research on selection of sensors, methods and algorithms of habitat/land cover classification and translation of spectral data into biodiversity relevant information.	•Develop monitoring for plants and vascular plants → this is currently a big knowledge gap.		•Develop EU-wide strategy on integrated spatial planning to better guide, measure and monitor the change in quality of existing land cover (e.g. development of an underpass for wildlife crossings). First launch study for gaining overview of current approaches in MS.			

	Headline target	1 - Integration and sustainable use of resources	2 - Overexploitation	3 - Fragmentation and green infrastructure	4 - Invasive species	5 - Nature conservation	6 - bio
	• Explore role of business and banks in better monitoring… e.g. via biodiversity-friendly financing (EIB – Peter Carter presentation). This could be especially interesting for improved ecosystem services monitoring since business benefits from these services. • Upscale voluntary (novice) biodiversity reporting, such as VigieNature in France, in order to gather greater quantities for monitoring biodiversity. • Investigate how to better stimulate researchers to report results of all types of projects / studies in a way that can be fed into BISE. • Develop database out of BAP reports (EEA) to make more usable and comparable in the future. This should become a dynamic tool with regular updates in order to be useful for policy-making.						

Annex F: Danish biodiversity monitoring estimates

DENMARK.	Gross estimate of costs for biodiversity monitoring and reporting requirements.								
2007 figures (Annually)									
Similar figures apply to later years	Total			Estimated					
	programme			Biodiversity		thousands			
NOVANA+DEVANO monitoring programme	Mio. DKK			relevance	Mio. DKK	EURO			
Air 1 (Air quaility and atm. deposition)	11,6			10%	1,2	155			
Air 2 (Air quality in towns)	11,8			0%	0,0	0			
Point sources of air pollution	21,1			5%	1,1	141			
Land monitoring (LOOP)	15,2			0%	0,0	0			
Groundwater	23,9			0%	0,0	0			
Water courses	32,2			20%	6,4	859			
Lakes	17,9			20%	3,6	477			
Sea and bays	45,4			20%	9,1	1211			
Species and terrestrial habitat types	31,3			100%	31,3	4173			
Cross-disciplinary activities (data, projects)	6,7			20%	1,3	179			
Marine modelling complex	4,6			0%	0,0	0			
Coordination, Secretariat, Standat	6,8			20%	1,4	181			
Mutual databases	14,5			20%	2,9	387			
Total monitoring programme	243,0				58,2	7762			
Based on the above necessary collected data									

Other costs (administrative, coordinating, reporting)					0,5	67			
GRAND TOTAL ESTIMATE						7.828.667	EUROS annually		
				Mio. DKK		Workyear			
The "Other costs" are based on the following estimates				COST	Workload years	Price	Interval years		
CBD reporting every 4 years				0,09	0,5	0,75	4		
Article 17 Natura 2000 reporting every 6 years				0,06	0,5	0,75	6		
BERN convention reporting				0,08	0,1	0,75	1		
RAMSAR convention reporting				0,03	0,1	0,75	3		
GEO5/UNEP reporting				0,02	0,1	0,75	4		
CITES reporting				0,08	0,1	0,75	1		
HELCOM				0,04	0,05	0,75	1		
OSPAR				0,04	0,05	0,75	1		
AEWA				0,04	0,05	0,75	1		
BONN				0,04	0,05	0,75	1		
Total				0,5					

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