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Suitable Instruments for Integrating Biodiversity Considerations in Climate Change Mitigation Activities, particularly in the Land Use and Energy Sector

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16. Abstract
The objective of the study was to compile and evaluate relevant instruments for the integration of biodiversity requirements into climate change mitigation activities, particularly in the land use, land-use change, and forestry (LULUCF) sector and in the sector of renewable energy. Against this background the study focused on those activities which are eligible under two of the flexible mechanisms of the Kyoto Protocol of the UN Framework Convention on Climate Change, namely the Clean Development Mechanism (CDM) and Joint Implementation (JI).

The analysed instruments comprise environmental impact assessment (EIA), strategic environmental assessment (SEA), guidelines and indicators. All instruments have the potential to integrate biodiversity aspects into climate change mitigation activities. Some of them have already reached a good level of development and can form the basis for preventing significant adverse impacts on biodiversity when designing and realising climate projects. Other instruments, however, have to be elaborated to better consider biodiversity aspects.

Based on the findings of the study a toolkit “Integration of Biodiversity Concerns in Climate Change Mitigation Activities” has been developed. The objective of this toolkit is to give practical guidance on designing climate mitigation projects or activities in a way that will also benefit biodiversity. It is on the one hand designed for experts who plan, implement or evaluate climate change mitigation activities. On the other hand it is also a useful tool for stakeholders, that are involved in a project cycle for CDM or JI projects. The toolkit is published seperately by the Federal Environmental Agency of Germany.

17. Keywords
Climate change (mitigation activities), biodiversity, Convention on Biological Diversity, Kyoto Protocol, sinks, Land use, land-use change, and forestry, Clean Development Mechanism, Joint Implementation, environmental impact assessment, strategic environmental assessment, criteria & indicators, guidelines, afforestation & reforestation, forest-, grazing land-, and cropland management, revegetation, hydropower, energy crops

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Zusammenstellung und Auswertung von geeigneten Kriterien, Indikatoren, UVP und dergleichen für die notwendige Berücksichtigung von Biodiversitätsaspekten bei Maßnahmen des Klimaschutzes, insbesondere bei Landnutzungsänderungen

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15. Zusätzliche Angaben

16. Kurzfassung
Ziel dieser Studie war, geeignete Instrumente für die Berücksichtigung von Biodiversitätsanforderungen bei Klimaschutzmaßnahmen zusammenzustellen und auszuwerten, insbesondere bei Maßnahmen in den Bereichen Landnutzung, Landnutzungsänderung und Forstwirtschaft (LULUCF) sowie erneuerbare Energien. Vor diesem Hintergrund untersucht die Studie insbesondere Maßnahmen, die im Rahmen des Kyoto-Protokolls und der Klimarahmenkonferenz für die flexiblen Mechanismen CDM (Clean Development Mechanism) und JI (Joint Implementation) zugelassen sind.
Zu den analysierten Instrumenten gehören die Umweltverträglichkeitsprüfung (UVP), die strategische Umweltverträglichkeitsprüfung (SUVP), Richtlinien und Indikatoren. Alle Instrumente können dazu beitragen, Biodiversität bei Maßnahmen zur Abschwächung des Klimawandels zu berücksichtigen. Einige sind schon ausgereift und können bereits heute eine gute Grundlage bilden, um Klimaprojekte so konzipieren und umsetzen zu können, dass keine signifikanten negativen Auswirkungen auf die Biodiversität befürchtet werden müssen. Andere Instumente müssen jedoch noch überarbeitet werden, um den Biodiversitätsanforderungen gerecht zu werden.
Praktische Hinweise über geeignete Instrumente und Entscheidungshilfen werden aufgrund der Ergebnisse der vorliegenden Studie im Toolkit (Handlungsleitfaden) “Integration of Biodiversity Concerns in Climate Change Mitigation Activities” (Berücksichtigung von Biodiversitätsaspekten bei Klimaschutzmaßnahmen) gegeben. Das Ziel des Toolkit ist es, für die Entwicklung von Projekten oder Maßnahmen zur Abschwächung des Klimawandels praktische Hinweise für die Berücksichtigung der Biodiversität zu geben. Er richtet sich an Experten, die solche Maßnahmen planen, durchführen oder bewerten. Das Toolkit eignet sich ebenfalls für Personen, die im Verfahrensablauf (project cycle) eines CDM- oder JI-Projekts eingebunden sind. Er wird als ausgegliedertes Dokument vom Umweltbundesamt herausgegeben.

17. Schlagwörter
Klimawandel, Biodiversität, Klimarahmenkonvention, Konvention über die biologische Vielfalt, Kyoto Protokoll, Senken, Landnutzungsaktivitäten, Umweltverträglichkeitsprüfung, Clean Development Mechanismus, Joint Implementation, Indikatoren, Richtlinien, Strategische Umweltverträglichkeitsprüfung, Aufforstung und Wiederaufforstung, Wald-, Grünland-, u. Ackerlandbewirtschaftung, Wiederbegrünung, Wasserkraft, Energiepflanzen

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Content

Acronyms and Abbreviations

ABF	Agri-Biodiversity Framework
AEZ	Agro-Ecological-Zoning
AHTEG	Ad Hoc Technical Expert Group on Biodiversity and Climate Change
ARD	Afforestation, Reforestation, and Deforestation
ATO	African Timber Organization
BCF	Bio Carbon Fund
BIA	Biodiversity Impact Assessment
BINU	Biodiversity Indicators in National Use
CAN	Climate Action Network
CBD	Convention on Biological Diversity
CCD	Convention to Combat Desertification
CDM	Clean Development Mechanism
CER	Certified Emission Reductions
CGIAR	Consultative Group on International Agricultural Research
CIFOR	Center for International Forestry Research
CITES	Convention on International Trade in Endangered Species
C&I	Criteria & Indicators
COP	Conference of the Parties
COP/MOP	Conference of the Parties/Meeting of the Parties
CPPI	Center for Preparation and Implementation of International Projects on Technical Assistance
CSD	Commission on Sustainable Development
DOE	Designated Operational Entity
DNA	Designated National Authority
DPSIR	Driver, Pressure, State, Impact, Response
EB	Executive Board of the CDM
EBI	Energy and Biodiversity Initiative
EEA	European Environment Agency
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMS	Environmental Management Systems
ERU	Emission Reduction Units
ET	Emissions Trading
EU	European Union
FAO	Food and Agriculture Organisation
FMU	Forest Management Unit

FSC	Forest Stewardship Council
GEF	Global Environment Facility
GHG	Greenhouse Gas
GMO	Genetically modified organisms
GS	Gold Standard
IAIA	International Association for Impact Assessment
IDB	Inter-American Development Bank
IEA	International Energy Agency
IPCC	International Panel on Climate Change
IRENA	International Renewable Energy Agency
ITTA	International Tropical Timber Agreement
ITTC	International Tropical Timber Council
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature and Natural Resources
JI	Joint Implementation
JWP	Joint Working Party
KP	Kyoto Protocol
LADA	Land Degradation Assessment in Drylands
LQI	Land Quality Indicator
LMO	Living Modified Organisms
LULUCF	Land Use, Land-Use Change and Forestry
MA	Marrakesh Accords
MEA	Millennium Ecosystem Assessment
MCPFE	Ministerial Conference on the Protection of Forests in Europe
MVP	Monitoring and Verification Plan
NGO	Non-governmental Organisations
NBSAP	National Biodiversity Strategy and Action Plan
NBF	National Biofuels Roundtable
NCI	Natural Capital Index
OD	Operational Directive
OECD	Organisation for Economic Cooperation and Development
OFMP	Operational Forest Management Plan
OLADE	Latin American Energy Organisation
OP	Operational Programme / Policy
OPN	Operational Policy Note
OTA	Office of Technology Assessment of the Congress of the United States
PCI	Principles, Criteria, and Indicators

PCF	Prototype Carbon Fund
PDD	Project Design Document
PEFC	Programme for the Endorsement of Forest Certification Schemes, formerly the Pan European Forest Certification
PEFCC	Pan European Forest Certification Council
PIN	Project Idea Note
PPP	Policy, Plan or Programme
PSR	Pressure, State, Response
RAP	Rapid Assessment Programme
RC	Ramsar Convention
SBSTA	Subsidiary Body for Scientific and Technological Advice of the UNFCCC
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice of the CBD
SEA	Strategic Environmental Assessment
SDS	Sustainable Development Strategy
SFM	Sustainable Forest Management
SLM	Sustainable Land Management
SMART	Specific, Measurable, Achievable, Relevant and Time-bound
SOM	Soil Organic Matter
SSSI	Sites of Special Scientific Interest
TAR	Third Assessment Report
TOR	Terms of Reference
ULRMC	Ukrainian Land and Resource Management Centre
UNCED	United Nations Conference on Environment and Development
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank
WCD	World Commission on Dams
WCMC	World Conservation Monitoring Centre
WEHAB	Water, Energy, Health, Agriculture, Biodiversity
WSSD	World Summit on Sustainable Development
WWF	World Wildlife Fund

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Preface

There is indicative evidence that anthropogenic greenhouse gas emissions are leading to changes in the global climate. The consequences for human beings and the environment as predicted by experts will vary from region to region. Precipitation levels are expected to increase in some regions, and decrease in others. Temperatures are changing, and the incidence of droughts and floods is likely to increase.

The impacts on ecosystems would be manifold. At present, most people are still not directly affected by climate change. And at present, we still have possibilities for at least slowing it. To do so, we must succeed in keeping greenhouse gas emissions at a level that allows ecosystems to adapt naturally to climate change.

At the World Summit in 1992 in Rio de Janeiro, the international community committed itself to climate protection objectives. The global climate protection process set in motion at that time has no doubt been not only difficult, but also fruitful. With this process, States are also making an important contribution to the implementation of the Convention on Biological Diversity (CBD), which was likewise adopted in Rio de Janeiro and which aims to halt the massive and continuing loss of biological diversity – diversity of ecosystems, species and genes – on our planet.

Biodiversity is not just a potential victim of climate change, however. It also helps to mitigate it. Via the “services”, to speak in economic terms, that species and ecosystems provide - such as carbon storage, regulation of the water cycle and the energy balance – conserving biological diversity contributes significantly to climate protection.

Therefore, in the long term, climate protection cannot do without conservation of biodiversity, and the latter cannot do without prevention of dangerous climate changes. These synergies between the two Conventions need to be taken into account.

First steps have been made. In the Kyoto Protocol, Parties to the Framework Convention on Climate Change committed themselves to concrete reductions of greenhouse gas emissions. They want to achieve these through technical measures, through increased use of renewable energy sources, and by using the sinks for carbon dioxide in various ecosystems. Yet, via pollutant inputs and loss of habitats, these

measures could also adversely affect biodiversity. How should we approach this conflict?

In their recent report, biodiversity and climate experts of the CBD Group of Experts on Biodiversity and Climate Change outlined ways to overcome these conflicts. The authors of the present research report follow on from this work. They examine existing instruments and tools with respect to whether they can enhance the “biodiversity-friendliness” of climate protection measures, and give recommendations regarding their use and necessary further development.

The results were transferred into a practical guide entitled “Integration of Biodiversity Concerns into Climate Change Mitigation Activities”. This easy-to-handle guide provides those planning a climate change mitigation activity with tips and hints on how to implement it with less or no harm to biodiversity. To supporters of such activities, it offers assistance in assessing the projects’ compatibility as regards protection of biodiversity.

With the present report and guidance manual, Germany is making an innovative practical contribution towards overcoming the potential conflicts between the two Conventions and towards further strengthening their synergies. It shows that active climate protection and the conservation of all of biodiversity are not mutually exclusive!

Prof. Dr. Andreas Troge

President of the Federal Environmental Agency

1 Scope of the Study

The study focuses on the integration on biodiversity requirements into project-based activities which are eligible under the Clean Development Mechanism (CDM) and Joint Implementation (JI) as part of the flexible mechanisms under the Kyoto Protocol (UN 1997). The project concentrates on those project activities in the energy sector and the area of Land Use, Land-Use Change, and Forestry (LULUCF) in the framework of JI and the CDM, most interlinked with biodiversity aspects.

Within the energy sector the report analyses options of integrating biodiversity in hydropower activities. Climate projects in the windpower sector are also eligible activities under CDM and JI. However, these type of projects are not frequently considered at international level, but might gain importance in the future. Most of the sufficiently large wind parks have been built on the mainland, now more and more wind parks will be constructed also offshore (e.g. in Germany or Denmark). Non-binding guidelines for plants on the mainland already exist (e.g. BfN 2000). Worldwide, larger offshore plants are only emerging and no final guidelines exist because scientific research as to the possible impact on biodiversity is not complete. As soon as comprehensive results of the research on biological impacts of offshore wind parks exist, specific guidelines similar to the ones for mainland plants may be a good means of sufficiently taking into account biodiversity aspects when designing offshore plants.

Another option that is increasingly being discussed as a climate mitigation activity, but which is not eligible within CDM and JI, is the sequestration of CO_2 in the oceans (UNEP/CBD/SBSSTA 2003b). The two technical options, which are currently tested, comprise iron fertilization of marine surface waters in areas where iron is the limiting factor for phytoplankton growth and the injection or deposition of CO_2 in deeper layers of the ocean. However, all marine ecosystems may offer mitigation opportunities for removing CO_2 from the atmosphere, but all proposed oceanic CO_2-storage schemes have the potential to cause severe ecosystem disturbance (RAVEN & FALKOWSKI 1999).[1]

[1] The possible ecological consequences of ocean fertilization are further discussed by the UNION OF CONCERNED SCIENTISTS (UCF 2001), ADHIYA & CHISOLM (2001) and SEIBEL & WALSH (2001).

Therefore, carbon sequestration in marine ecosystems will not further be discussed in the present study. The authors however wish to underline the fact that international discussion on this topic is still ongoing. Negotiations on project types to be authorized for the second commitment period may grow in relevance despite the many reservations expressed. In this case biodiversity requirements should be integrated into further negotiations from the beginning and respective guidelines should be developed.

In addition to climate change mitigation, the international climate change community recognised adaptation[2] to climate change as a field where urgent action, particularly for the protection of the most vulnerable zones on Earth, is needed. As the underlying rationale, the approaches and concrete measures for adaptation differ from those applied for mitigation; adaptation is not addressed in this study.

The following chapter provides an overview on agreements under the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention for Biological Diversity (CBD) which are related to the topic in question.

[2] The third assessment report (TAR) of the International Panel on Climate Change defines adaptation as "any adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC 2001).

2 International Agreements and Institutions

The next chapters refer to those agreements under the UNFCCC (UN 1992) and the CBD (UN 1992a) as well as in international organisations, which are relevant to the interface between biodiversity and climate change.

Under the UNFCCC relevant issues address questions related to aspects of biodiversity, e.g. in the sector of land use, land-use change, and forestry (LULUCF) and the consideration of environmental impact assessment (EIA) in the project design.

Under the CBD a Global Strategy for Plant Conservation and a Strategic Plan with concrete targets have been adopted. Furthermore recent work covered detailed research on the interlinkage between biodiversity conservation and climate change, the development of biodiversity indicators and on the integration of biodiversity requirements into environmental impact assessment and strategic impact assessment.

Chapter 2.3 will address how portfolios of the World Bank and the Global Environment Facility (GEF) consider biodiversity in climate change mitigation activities.

2.1 Agreements under the Kyoto Protocol (KP)

Under the Kyoto Protocol (UN 1997) the three so-called Flexible Mechanisms Emissions Trading (ET), Joint Implementation (JI) and the Clean Development Mechanism (CDM) were designed. CDM and JI are project based mechanisms that are meant to promote projects to reduce emissions of GHG in a host country, compared to what would have happened in the absence of the project. CO_2 credits resulting from such projects can be used by other countries to help to fulfil their commitments. In case of JI projects, both countries must have a reduction commitment for greenhouse gases under the KP (Annex I countries). CDM projects are carried out in countries without a reduction commitment (Non-Annex I) by Annex I countries.

Both mechanisms, CDM and JI, permit projects which started after 1 January 2000. Whereas JI projects can credit emission reductions only with the beginning of the first

commitment period (2008-2012). CDM projects credit emission reductions already from 1 January 2000, onwards.

Marrakesh Accords (MA) and LULUCF Activities

The MA (UN 2002a) contain a package of 15 decisions on the implementation of the Kyoto Protocol. The most important decision on sink activities is Decision 11/CP.7 (LULUCF). It obtains rules for LULUCF activities (see Figure 1), which include three main elements:

1. A set of principles to govern LULUCF activities, e.g.

    - Definitions for important LULUCF related terms (forest, afforestation, reforestation, deforestation, revegetation, forest management, cropland management and grazing land management).

2. Definitions for Article 3.3 activities and agreed activities under Article 3.4, e.g.

    - Provisions for Art. 3.3 activities: “Eligible activities are those direct human-induced afforestation, reforestation and/or deforestation activities that meet the requirements set forth in this Annex and that started on or after 1 January 1990 and before 31 December of the last commitment period” (Decision 11/CP.7, Annex).
    - Provisions for Art. 3.4 which might be chosen by an Annex I Party to account for anthropogenic greenhouse gas emissions by sources and removals by sinks resulting from any or all activities are: revegetation, forest management, cropland management, and grazing land management.
    - National inventory systems shall ensure that areas of land subject to activities under Art. 3.3 and 3.4 are identifiable. Each Party should provide information about these areas in their national inventories.

3. A four-tier capping system limiting the use of LULUCF activities to meet emission targets. The extent to which Parties can account for emissions and removals from specific LULUCF activities, for the first commitment period, is limited by the following four-tier capping system:

Tier 1: If a Party's afforestation, reforestation and deforestation activities result in more emissions than removals, and then the Party may offset these emissions through forest management activities, up to a total level of 9 megatons of carbon per year for the five year commitment period.

Tier 2: The extent to which domestic forest management activities can be accounted for to help meet emission targets beyond 9 megatons of carbon per year is subject to an individual cap for each Party, listed in the MA. This cap includes joint implementation projects involving forest management.

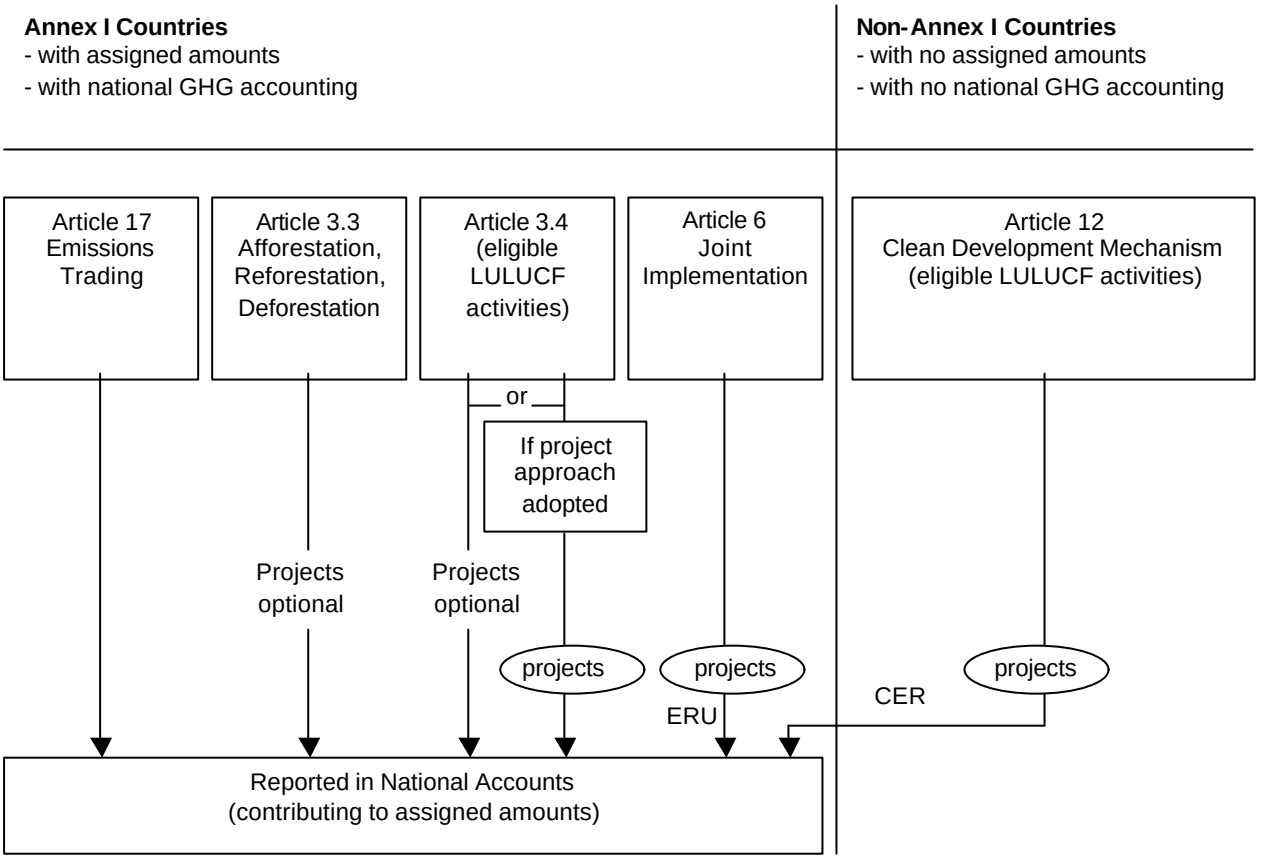
Tier 3: Emissions and removals from cropland management, grazing land management and revegetation can be accounted for to help meet emission targets on a net basis (e.g. changes in carbon stocks during 1990, times five, will be subtracted from the changes in carbon stocks during the first commitment period, in the lands where these activities will take place).

Tier 4: Only afforestation and reforestation projects are eligible under the clean development mechanism. Greenhouse gas removals from such projects may only be used to help meet emission targets up to 1% of a Party's baseline for each year of the commitment period.

The principles in the MA respond to concerns that the use of LULUCF activities could undermine the environmental integrity of the KP. These principles underscore, for example, the need for sound science and consistent methodologies, as well as the importance of conserving biodiversity[3]. They also specify that naturally-occurring removals, including removals as a consequence of indirect anthropogenic effects should be excluded from the system and that any re-release of greenhouse gases (e.g. through forest fires) must be promptly accounted for.

[3] The principles ask explicit "that the implementation of LULUCF activities contributes to the conservation of biodiversity" (FCCC/CP/2001/13/Add.1/1.(e)).

Figure 1: Relationships between LULUCF Projects and Key Elements of the KP (ERU = emission reduction units; CER = certified emission reduction)



Source: IPCC (2000)

2.1.1 Joint Implementation (JI)

The Kyoto Protocol establishes JI between two or more than two countries, whereby an Annex I (industrialised and transition countries) country can receive emissions reduction units (ERUs) by implementing projects that reduce net emissions in another Annex I country (industrialised and transition countries). JI is a “zero sum” operation as the total emissions permitted in each country remains the same. For this reason the MA require less strict control procedures for JI than for CDM (see Figure 2). The MA have no restrictions on the type of technology that can be used in a JI project except for the exclusion of nuclear power.

Figure 2: JI Project Activity Cycle (Track 2[4])

Steps	Designated National Authority (DNA)	Project Developer	Independent Entity	Supervisory Committee
1		Project proposal		
2		PDD[5]		
	Approval			
3			Validation	
4		Monitoring		
5			Verification	
6				Issuance of ERUs

2.1.2 Clean Development Mechanism (CDM)

Furthermore COP 7 established the rules for CDM projects and the Executive Board (EB) to supervise the CDM under the authority and guidance of the COP/MOP. The EB is fully accountable to the COP/MOP. Decision 17/CP.7 defines the tasks of the EB among others as follows:

- Make recommendations on CDM procedures and modalities
- Approve new methodologies (e.g. on baselines)
- Be responsible for the accreditation of operational entities and for review of accreditation standards
- Make publicly available relevant information on proposed CDM projects
- Develop and maintain the CDM registry

[4] "Participation requirements Decision 16/CP.7, Annex, Section D, Article 21 (page12):
a) Party to the Kyoto Protocol, b) Assigned amount has been calculated, c) National registry established, d) Submission of annually required inventory, e) System for the estimation of emissions and sinks established, f) Submission of additional information on the assigned amount. For the host country exists two options:
- Track 1 (fast-track): It meets all criteria listed above national rules for JI of the host country apply or baseline and amount of credits (ERUs) to be transferred are negotiated between participating countries.
- Track 2: It meets criteria a)-c) above CDM-like project cycle applies with validation and verification by an independent entity.
- If either one of criteria a)-c) is not met, no JI activity can take place. Note: project participants are free to choose track 2 (lower risk), even if criteria a)-f) are met." (SAEFL 2004).

[5] See next chapter, e.g. PDD asks also for an analysis of the environmental impacts.

A definite procedure is necessary for the validation of project proposals. In carrying out the validation procedure projects can be accepted as a CDM project activity by the Executive Board (see Figure 3).

Figure 3: CDM Project Activity Cycle

Steps	Designated National Authority (DNA)	Project Developer	Designated Operational Entity (DOE)	Executive Board (EB)
1		Project proposal		
2		PDD		
	Approval			
3			Validation	
4				Registration
5		Monitoring		
6			Verification/ Certification	
7				Issuance of CERs

The CDM project cycle steps in detail[6]:

1. Project proposal/idea
2. Project design

Before a CDM project can be submitted for validation the project developer needs among others a Project Design Document (PDD). The PDD, e.g. for energy projects, is outlined in Appendix B of decision 17/CP7, the PDD for A&R projects (see below) is outlined in Appendix B of decision UNFCCC/SBSTA/2003/L.27.

The PDD is a necessary element of the CDM project cycle (see Figure 3). In order to register a CDM project with the Executive Board, the project participants must prepare a PDD which provides documentation that the project activity meets the requirements

[6] Cf. SAEFL (2004).

of the CDM. The PDD is then submitted to a Designated Operational Entity (DOE) for the purpose of project validation. Key elements of the PDD are as follows:

- A general description of the project.
- Proposed baseline methodology.
- Estimated lifetime of the project and the crediting period.
- Demonstration of how the project generates emission reductions that are additional to what would have otherwise occurred.
- An analysis of the environmental impacts.
- A discussion of the stakeholder consultation process.
- Monitoring and verification plan.

The PDD Version 01[7] of the CDM Executive Board requires project proponents to examine the environmental impacts of a project and to include this information in the PDD. This includes:

- Documentation on the analysis of the environmental impacts, including transboundary impacts.
- If impacts are considered significant by the project participants or the host Party; conclusions and all references to support documentation of an environmental impact assessment that has been undertaken in accordance with procedures required by the host Party should be included into the PDD.

This approach leaves it completely to the project participants or the host Party to decide on the significance of impacts and thus on the necessity of carrying out an environmental impact assessment (see Chapter 4.2). The EB has not developed additional rules, guidelines or standards for the consideration of environmental or biodiversity aspects. The terms of reference for establishing guidelines on baselines and monitoring methodologies in Appendix C of Decision 17/CP.7 do not mention the development of such guidelines.

[7] See http://cdm.unfccc.int/Reference/Documents.

3. Validation

Validation is the process of independent evaluation of a project activity by a DOE against the requirements of the CDM as set out in decision 17/CP.7 and its present annex and relevant decisions of the Conference of the Parties/Meeting of the Parties (COP/MOP), on the basis of the PDD.

4. Registration

Registration is the formal acceptance by the EB of a validated project as a CDM project activity. Registration is the prerequisite for the verification, certification and issuance of CERs related to that project activity.

5. Verification / Certification

Verification is the periodic independent review and ex post determination by the designated operational entity of the monitored reductions in anthropogenic emissions by sources of greenhouse gases that have occurred as a result of a registered CDM project activity during the verification period. Certification is the written assurance by the DOE that, during a specified time period, a project activity achieved the reductions in anthropogenic emissions by sources of greenhouse gases as verified.

6. Request issuance of CERs related to a CDM project activity

The CDM project cycle provides for differentiation between CDM project activities and CDM small scale project activities. The following categories of small-scale project activities are eligible under simplified procedures (UNFCCC/CP/2002/7/Add.3; ANNEX II):

- Renewable energy projects with a maximum output capacity of 15 megawatts.
- Energy efficiency improvement projects that reduce energy consumption by up to 15 gigawatt hours per year.
- Other project activities that reduce anthropogenic emissions by source, which directly emit less than 15 kilo tonnes of CO_2 equivalent annually.

The simplified modalities and procedures for small-scale projects were adopted at the eighth Conference of the Parties in November of 2002 in New Delhi.

Project activities

Non-sink CDM projects

The MA have no restrictions on the type of technology that can be used in non sink CDM projects except for the exclusion of nuclear power. A list of eligible categories exists only for small-scale CDM (see above). That means that there are several possibilities for eligible full-scale project types in the energy sector under CDM. A clear definitions of energy project categories does not exist. The CDM-PDD only provides the following advice:

> *Using the list of categories of project activities and of registered CDM project activities by category available on the UNFCCC CDM web site, please specify the category(ies) of project activities for which this proposed new methodology can be used. If no suitable category(ies) of project activities can be identified, please suggest a new category(ies) descriptor and its definition, being guided by relevant information on the UNFCCC CDM web site.*

As a result eligible **energy projects** in the framework of CDM may include

a) the improvement of energy efficiency;

b) the use of renewable forms of energy;

c) emission control in transport and waste management.

However, as explained under the scope (see Chapter 1), this study is limited to hydropower and dams as an relevant energy activity under the CDM respectively also JI.

Sink CDM projects

The eligibility of land-use, land-use change and forestry activities for projects under Art. 12 (CDM) of the KP is limited to **afforestation and reforestation** (A&R). The total of additions to a Party's assigned amount through these activities may not exceed 1% of base year emissions of that Party, times five (UNFCCC/CP/2001/13/Add.1).

At the ninth meeting of the Conference of the Parties (COP 9), 1 to 12 December 2003 in Milan, the debate on the "modalities and procedures for afforestation and

reforestation activities under the clean development mechanism in the first commitment period of the KP" resulted in the decision UNFCCC/SBSTA/2003/L.27. The provisions of this decision, which are important in the context of this study, comprise the definitions (Annex A paragraph 1 (a) to (i)), and issues to be included in the project design document for afforestation and reforestation project activities under the CDM (Annex G paragraph 12 (c) and Appendix B).

The definitions laid down in this decision complement the definitions under paragraph 1 of the annex to decision 17/CP.7 and the definitions of forest, reforestation and afforestation in paragraph 1 of the annex to decision UNFCCC/SBSTA/2003/L.27. The definitions of the decision UNFCCC/SBSTA/2003/L.27 take the issues of carbon pools, project boundary, baseline net greenhouse gas removals by sinks, actual net greenhouse gas removals by sinks, leakage, net anthropogenic greenhouse gas removals by sinks, temporary CER, long-term CER, and small-scale afforestation and reforestation into account.

Furthermore, the decision calls for including information on environmental impacts in their documentation which has to be submitted to the designated operational entity. This includes impacts on biodiversity and natural ecosystems, and impacts outside the project boundary of the proposed activity. According to Annex G paragraph 12 (c) on validation and registration the designated operational entity has to confirm that the following requirements have to be met within the project proposal:

> *Project participants have submitted to the designated operational entity documentation on the analysis of the socio-economic and environmental impacts, including impacts on biodiversity and natural ecosystems, and impacts outside the project boundary of the proposed afforestation or reforestation project activity under the CDM. If any negative impact is considered significant by the project participants or the host Party, project participants have undertaken a socio-economic impact assessment and/or an environmental impact assessment in accordance with the procedures required by the host Party. Project participants shall submit a statement that confirms that they have undertaken such an assessment in accordance with the procedures required by the host Party and include a description of the planned monitoring and remedial measures to address them.*

The environmental impacts are further specified in Appendix B paragraph 2 j (i) of the decision: The documentation on the analysis of the environmental impacts “should include, where applicable, information, inter alias, hydrology, soils, and risk of fires, pests and diseases”.

2.2 Agreements under the Convention for Biological Diversity

Under the CBD progress has been achieved in formulating global targets, recognising environmental impact assessment and strategic environmental assessment as suitable tools to integrate biodiversity requirements, recognising the need for indicators for monitoring, reporting, and analysing the interrelationship between biodiversity and climate change. The following chapters will summarise the ongoing work in these fields.

Achieving the 2010 Targets

The Strategic Plan for the CBD, adopted on the sixth meeting of the COP (Decision VI/26), includes the overall target to “achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to benefit of all live on Earth” (UNEP/CBD/COP/7/20/Add.3).

The World Food Summit in Johannesburg, South Africa in August/September 2002, endorsed this target and, additionally, emphasised the importance and critical role of biodiversity in sustainable development and poverty eradication.

The WEHAB[8] initiative recognised biodiversity as one basic element necessary for life together with water, energy, health and agriculture, and thus outlines the importance of biodiversity outside the frame of the CBD. The five key areas are recognised as an integral part of an international approach to the implementation of sustainable

development and are included in the Plan of Implementation of the World Summit on Sustainable Development (WSSD) which has been adopted in Johannesburg in 2002 (UN 2002).

Additionally to the Strategic Plan, COP 6 adopted the Global Strategy for Plant Conservation (Decision VI/9) including a number outcome-oriented global targets. These global targets provide a framework for national targets which take into account national priorities and capacities and differences in plant diversity.

At its ninth meeting SBSTTA recommended to further underline the global goals with specific targets addressing, among others (UNEP/CBD/COP/7/20/Add.3):

- The reduction of the loss of the components of biodiversity (biomes, habitats and ecosystems; species and populations; and genetic diversity);
- The threats to biodiversity, including those arising from invasive alien species, unsustainable use, climate change pollution and habitat change;
- Maintaining the flow of goods and services from biodiversity and ecosystems.

Table 1 provides an overview of the provisional framework of goals and sub-targets related to the global 2010 biodiversity target.

[8] The WEHAB initiative was proposed by UN Secretary-General Kofi Annan as a contribution to the preparations for the WSSD. The initiative focuses on five key thematic areas of water, energy, health, agriculture and biodiversity.

Table 1: Framework of Goals and Sub-targets of the Global Strategy for Plant Conservation (CBD) to Achieve the 2010 Target

I Protect the components of biodiversity

Goal 1. Maintain the diversity of ecosystems, habitats and biomes

Target 1.1: At least 10% of each of the world's ecological regions are to be effectively conserved.
Target 1.2: Areas of particular importance to biodiversity are to be protected.

Goal 2. Maintain species diversity

Target 2.1: Restore, maintain, or reduce the decline of populations of species of selected taxonomic groups.
Target 2.2: Status of threatened species improved.

Goal 3. Maintain genetic diversity

Target 3.1: Genetic diversity of crops, livestock, and of commercially harvested species of trees, fish and wildlife and other major socio-economically valuable species to be conserved, and associated indigenous and local knowledge to be maintained.

II Address threats to biodiversity

Goal 4. Reduce pressures from habitat loss, land use change and unsustainable water use.

Target 4.1: Rate of loss and degradation of natural habitats decreased.

Goal 5. Control threats from invasive alien species

Target 5.1: Pathways for major potential alien invasive species controlled.
Target 5.2: Management plans in place for major alien species that threaten ecosystems, habitats or species.

Goal 6. Halt unsustainable use

Target 6.1: Biodiversity-based products derived from sources that are sustainably managed.
Target 6.2: Production areas managed consistent with the conservation of biodiversity.
Target 6.3: No species of wild flora or fauna endangered by international trade.

Goal 7. Reduce pressures from climate change climate change, pollution and soil erosion

Target 7.1: Pressures of climate change, pollution and soil erosion and their impacts on biodiversity and ecosystems reduced.

III Maintain and share benefits from biodiversity

Goal 8. Maintain capacity of ecosystems to deliver goods and services and support livelihoods

Target 8.1: Capacity of ecosystems to deliver goods and services maintained.
Target 8.2: The decline of biological resources, and associated indigenous and local knowledge, innovations and practices that support sustainable livelihoods, local food security and health care, halted.

Goal 9. Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources

Target 9: All transfers of genetic resources in line with the CBD, International Treaty on Plant Genetic Resources for Food and Agriculture and other applicable agreements.

Source: UNEP/CBD/COP/7/20/Add.4

The provisions of the CBD do not define the *loss of biodiversity*. Within the report of the London Meeting (2010 – The Global Biodiversity challenge, 21-23 May 2003) defines it as a concept, which goes beyond extinction, covering the decline in extent, condition or sustainable productivity of ecosystems, the decline in abundance, distribution or sustainable use of populations and species extinction, and genetic erosion.

Indicator Development

As requested by decision VI/7B CBD an expert meeting was convened to further intensify work on indicator development. The meeting resulted in a report including a) a set of principles for indicator development in the form of a guiding manual, b) a list of key questions with reference to the relevant articles of the CBD and c) a list of tested indicators. Decision VII/11 of the CBD "urges all Parties, who have not done so to develop a set of biodiversity indicators as part of their national strategies and action plans". The decision further requires that the targets of the Global Strategy for Plant Conservation and the target to achieve by 2010 a significant reduction in the current rate of biodiversity loss should be taken into account.

Environmental Impact Assessment and Strategic Environmental Assessment

Article 14 of the CBD states that "Each Contracting Party, as far as possible and as appropriate, shall introduce appropriate procedures requiring environmental impact assessment of its proposed projects that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimizing such effects and, where appropriate, allow for public participation in such procedures".

This is endorsed by the COP Decision V/18 which requests Parties "to address the loss of biological diversity and the interrelated socio-economic, cultural and human-health aspects relevant to biological diversity when carrying out environmental impact assessments" and "to consider biological diversity concerns from the early stages of the drafting process, when developing new legislative and regulatory frameworks".

Decision V/18 furthermore requests to use strategic environmental assessments to assess the impact of individual projects, as well as their cumulative and global effects, and to incorporate biological diversity considerations at the decision-making and/or environmental planning level.

SBSTTA has elaborated the recommendations IV/6 (“Incorporation of biological diversity considerations into environmental impact assessment”) and VII/10 (“Further development of guidelines for incorporating biodiversity-related issues into environmental impact assessment legislation and/or processes and in strategic environmental assessment.”). Recommendation VII/10 has been adopted by the 6th COP in 2002 in The Hague in its Decision VI/7 (“Identification, monitoring, indicators and assessments”). The Decision urges Parties to apply these guidelines in the context of their implementation of paragraph 1 of article 14 of the Convention, and to share their experiences through national reporting and the clearing-house mechanism. The ongoing work in this field is further documented in the “proposals for further development and refinement of the guidelines for incorporating biodiversity-related issues into environmental impact assessment and strategic environmental assessment” (UNEP/CBD/SBSTTA/9/INF/18).

Decision VII/11 of the CBD urges Parties to contribute case studies on current experiences in environmental impact assessment and strategic environmental assessment that incorporate biodiversity-related issues as well as experiences in applying the guidelines contained in the annex to decision VI/7A.

Biodiversity and Climate Change

An Ad hoc Technical Expert Group with experts in the fields of biodiversity and climate change reviewed the interlinks between biological diversity and climate change, and came up with recommendations concerning the integration of biodiversity requirements into the implementation the KP. A comprehensive report covers the following topics (UNEP/CBD/SBSTTA 2003):

- Biodiversity and linkages to climate change.
- Climate change and biodiversity: observed and projected impacts.
- Climate change mitigation and adaptation options: links to, and impacts on, biodiversity.
- Approaches for supporting planning, decision making and public discussions.
- Selected case-studies: harmonization of climate change mitigation and adaptation activities, with biodiversity considerations.

For consideration at COP 7 CBD the SBSTTA stressed, that “there are opportunities to implement climate change mitigation and adaptation activities in ways that are mutually beneficial and synergistic, and that contribute simultaneously to the UNFCCC and its KP, the CBD, the United Nations Convention to Combat Desertification (UNCCD), and other international agreements, all within broader national development objectives” (UNEP/CBD/SBSTTA/9/11).

However there are research priorities and information gaps arising from the report of the Expert Group. Parties, governments, funding agencies, research bodies and other organisations should address these gaps in order to help to optimise biodiversity conservation within climate change mitigation and adaptation projects over the long term at the national, regional, and global levels.

As a next step, advice should be provided for the integration of biodiversity considerations, including biodiversity conservation, in the implementation of the UNFCCC and its KP. Draft voluntary guidelines for promoting synergy between climate change, mitigation and adaptation activities and the conservation and sustainable use of biodiversity should be promoted.

Stronger Cooperation

The COP of the CBD has emphasised the necessity of stronger cooperation with other conventions and international organisations. This is particularly important in view of the achievement of the 2010 biodiversity target. However there is agreement that the CBD should lead the process for achieving the 2010 target but at the same time should recognise and encourage other initiatives at all levels to contribute according to their potential and expertise (UNEP/CBD/SBSTTA/9/INF/9).

2.3 Developments in International Organisations

Several international and national organisations are doing or planning to fund climate change mitigation projects in the framework of the Kyoto Protocol. Important ones are the Prototype Carbon Fund (PCF) or the Global Environmental Facility (GEF). This organisations have a good opportunity to set conditions (e.g. guidelines), e.g. that funded projects also contributes to the conservation of biodiversity.

2.3.1 The Prototype Carbon Fund of the World Bank

The PCF was established in 1999 by the Executive Directors of the World Bank. "The PCF will invest contributions made by companies and governments in projects designed to produce emission reductions fully consistent with the KP and the emerging framework for JI and the CDM. Contributors, or 'participants' in the PCF, will receive a pro rata share of the emission reductions, verified and certified in accordance with agreements reached with the respective countries 'hosting' the projects."[9]

The work of the PCF consists in creating partnerships between the private and the public sector to raise funds for climate projects, funding projects within the framework of JI and CDM, and carrying out accompanying capacity-building and research activities (PCF plus).

The PCF has stated a list of minimum requirements which project proponents applying for funding have to fulfil (see Table 13). These minimum requirements do not contain direct reference to environmental standards, impacts assessment procedures or eligibility criteria to be applied in PCF projects. However, the PCF refers to the safeguard policies that are applicable to all projects funded by the World Bank.

Safeguard Policies of the World Bank

"The Bank Group has a body of well-developed, mandatory safeguard policies which apply to all World Bank operations, as well as an extensive set of good practices. These are applied to PCF operations to ensure that they are environmentally and

[9] See www.prototypecarbonfund.org.

socially sound, whether baseline financing is from the Bank Group or from a third party project supplier".

The objective of these policies is to prevent and mitigate undue harm to people and their environment in the development process. The Bank has started a process to increase the importance of these safeguard policies in all bank operations, and to build capacities in the countries where funding operations are carried out to follow these guidelines. There are ten policies[10], comprising the Bank's policy on *Environmental Assessment* (OP/BP 4.01) and those policies that fall within the scope of EA: *Cultural Property* (OPN 11.03), *Projects in Disputed Areas* (OP/BP 7.60), *Forestry* (OP 4.36, also see Chapter 4.4.2), *Indigenous Peoples* (OD 4.20), *Projects on International Waterways* (OP/BP 7.50), *Involuntary Resettlement* (OP/BP 4.12), *Natural Habitats* (OP/BP 4.04), *Pest Management* (OP 4.09), and *Safety of Dams* (OP/BP 4.37, see Chapter 4.4.4.2).

The safeguard policies that are especially relevant for climate projects are the safeguard policies on environmental assessment, on forests, on natural habitats, and on pest management:

OP/BP 4.01: *Environmental Assessment*

This policy is considered to be the umbrella policy for the Bank's environmental safeguard policies. The Bank's operational policies define when an environmental assessment is needed and which aspects have to be taken into account. "EA takes into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and cultural property); and transboundary and global environmental aspects". In a footnote to this paragraph, "adverse impacts on biodiversity" are included into the global environmental aspects, so that biodiversity usually can be considered to be integrated into EA operational policy.

The operational policy on EA requires an environmental screening of each proposed project to determine the appropriate extent and type of EA:

[10] OP/BP is Operational Policy/Bank Procedure; OD is Operational Directive; and OPN is Operational Policy Note.

- Category A for projects that is likely to have significant adverse environmental impacts that are sensitive, diverse or unprecedented. The area affected may be larger than the sites or facilities subject to physical works. For Category A projects, a EIA is usually required that includes elements of other instruments.
- Category B for projects with less adverse potential adverse environmental impacts on human populations or environmentally important areas – including wetlands, forests, grasslands and other natural habitats. These impacts are site-specific; few if any of them are irreversible. EA findings for Category B projects do not require a full EIA, but may be included into the project description (Project Idea Note or Project Appraisal Document).
- Category C for projects with minimal or no adverse environmental impacts, which require no further EA action.
- Category FI refers to projects that are funded through a financial intermediary.

It is not very likely that climate projects will be generally categorized as Category A projects. This means that no EIA procedure as defined by the World Bank is required. Procedures will include only an examination of the project's negative and positive environmental impacts and recommendations for the prevention, minimization, mitigation or compensation for adverse impacts. A comparison for feasible alternatives is not required.

In its *Environmental Assessment Sourcebook Update on Biodiversity and Environmental Assessment* (WORLD BANK 1997), the Bank lists development activities that are likely to induce significant impacts upon biodiversity:

- Agriculture and livestock projects involving land clearance, wetlands elimination, water diversion, use of pesticides, or planting of monoculture crop systems.
- Forestry projects that meet the conditions for Bank involvement (defined in OP 4.36 but nevertheless may involve clear-felling, or other forms of intensive forest harvesting or conversion of natural habitats, construction of access roads, and establishment of forest products industries which may induce development).

- Power projects involving hydroelectric development that inundates or transforms natural habitats and ecosystems, alterations of rivers because of dams or water diversions.

This means that e.g. cultivation of energy crops for bioenergy use could be subject to a full EIA as required for Category A projects.

OP/BP 4.04: *Natural Habitats*

The World Bank defines "natural habitats" in the same way as natural forests: "Natural habitats are land and water areas where (i) the ecosystem's biological communities are formed largely by native plant and animal species, and (ii) human activity has not essentially modified the area's primary ecological functions."

In its operational policy, the Bank states that it "... does not support projects that, in the Bank's opinion, involve the significant conversion or degradation of critical natural habitats." The Bank restricts critical natural habitats to areas that have an official status – e.g. existing protected areas, areas proposed by governments as protected areas or sites identified on supplementary lists prepared by the Bank or an authoritative source determined by the Regional Environmental Sector Unit. This means that only natural habitats that appear on such lists or where the species composition is known would enjoy the strict support denial of the Bank. Since in developing countries many areas that are important for biodiversity are not listed under such an official status, the application of this OP could not prevent that natural habitats could be affected in any case. However, the definition of "significant conversion or degradation" includes some activities that would be possible under the KP, such as replacement of natural vegetation by crops or tree plantations, permanent flooding (e.g. by a reservoir), drainage, dredging, filling or canalisation of wetlands. So these activities could be excluded from eligibility – at least if the site meets the criteria for a "critical natural habitat".

OP 4.09: *Pest Management*

The Bank supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides. OP 4.09 on pest management mentions four criteria for the selection and use of pesticides in Bank-financed projects; one of which refers to the environment: "(c) They must have minimal

effect on no-target species and the natural environment. The methods, timing and frequency of pesticide application are aimed to minimize damage to natural enemies [...]".

In climate mitigation or adaptation projects, pesticide applications would be relevant for projects that:

- Establish plantations in A/R schemes.
- Establish forest or other types of plant cover on degraded sites (e.g. herbicides to remove unwanted herbs, grasses or shrubs).
- Establish energy plantations for biofuel use.
- Remove unwanted plant species from degraded pastures as a precondition for pasture improvement.

Pest attacks in monoculture forest plantations may be a severe problem, especially under the aspect of carbon gains (or losses). So besides single herbicide or pesticide applications during site establishment, pesticide use may be needed continuously to avoid carbon losses.

The Bank Policy does only address pesticide use in agriculture and public health, but not in forestry applications, so that a broad range of possible climate project activities may be missed.

Project Types in the PCF

The development criteria for the PCF restrict land use projects to a maximum of 10% of the Fund's assets, and none of these projects shall be located in a developing country unless the Parties to the UNFCCC deem it appropriate. The website of the PCF includes a list of "illustrative project categories and examples" in its LULUCF Project Idea Note (PIN) template which include afforestation and reforestation, forest management, cropland management, grazing land management activities and bio-fuels (see Table 2).

Table 2: Project Categories and Examples included in the LULUCF PIN Sheet of the PCF

Code	Afforestation and reforestation[11]
1	Rehabilitation of degraded tropical lands (e.g. *Imperata* grasslands) to
1a	Forest
1b	Agroforestry
2	Reforestation of degraded temperate grasslands or arid lands by tree planting
3	Establishing tree/shade crops over existing crops (e.g. coffee)
4	Plantations for wood products
4a	Small scale landholder driven
4b	Commercial scale
5	Landscape rehabilitation through planting corridors, etc.
6	Fuel wood plantings at a commercial scale
	Forest management
7	Improved forest management via fertilizer, in-plantings, etc.
8	Improved fire management
9	Reduced impact logging
10	Alternatives to fuel wood for forest/environmental protection
	Cropland management
11	Reduced till agriculture
12	Other sustainable agriculture
	Grazing land management
13	Revegetation of semi-arid and arid lands with shrubs or grasses
14	Improved livestock management leading to vegetation and soil recovery
	Biofuels
15	Use of biological residue to produce energy

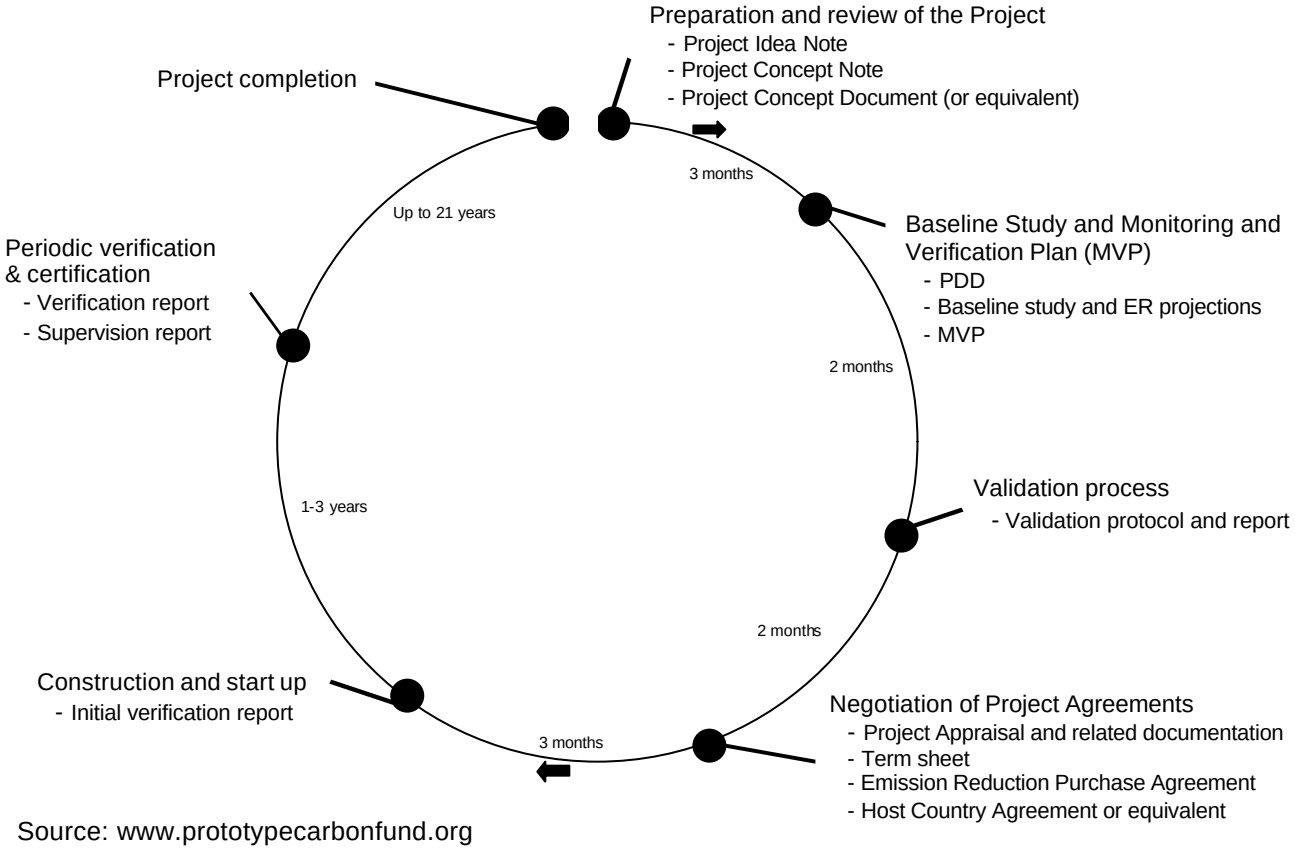
Source: www.prototypecarbonfund.org

[11] This is the only class of activities accepted under the CDM for the first commitment period.

The usual project cycle for proposals includes the following steps (see Figure 4):

- Preparation and review of the project: A three-step proposal procedure which includes Project idea note, Project concept note and project concept document. The projects are selected by the Fund Management Unit and the Participants Committee, which are the decision-making bodies of the PCF.
- Baseline study and monitoring plan, which includes a project design document, baseline study and emission reduction projections and a monitoring plan. The project design document is open for stakeholder comments for 30 days on the website of the PCF.
- Validation process, which is carried out by validators under contract of the PCF and contains a validation protocol and report.
- Negotiation of project agreements with project appraisal, term sheet and emission reduction purchase agreement.
- Construction and start up with initial verification report.
- Periodic verification and certification with verification and supervision report.
- Project completion.

Figure 4: Project Cycle for the PCF of the World Bank



Source: www.prototypecarbonfund.org

The project proposals received by the PCF are published on the website for stakeholder comment for 30 days. “The MA on CDM and JI provide for a 30 day period for comments on the PDD and any supporting information from parties, stakeholders and UNFCCC accredited NGOs to the validator. Once the UNFCCC procedure is set up, the validator will have to make the PDD publicly available through the UNFCCC Secretariat. As long as this is not possible the PCF invites all stakeholders to comment on the PDD and all other project specific documents that are posted in this area.”

Appendix B of UNFCCC/SBSTA/2003/L.27 on Article 12 activities requires that a PDD shall include documentation on the analysis of the environmental impacts (see Chapter 2.1.2), and if these impacts are considered significant by the project participants or the host party, the conclusions and references for support documentation of an environmental impact assessment, undertaken in accordance with procedures as required by the host party.

By end of December 2002, there were 12 projects for which the comment period had expired and 2 projects open for comment. There were 2 projects posted on the website which are in the LULUCF sector. It is interesting to note that these projects have raised much more stakeholder comment than other PCF projects, which were mostly in the energy sector. The following descriptions of proposed projects refer mainly to the biodiversity aspects in these projects, although stakeholders also referred to other aspects as permanence, additionality, etc.

Brazil: Sustainable Fuelwood and Charcoal Production for the Pig Iron Industry in Minas Gerais (The "Plantar" Project)

The "Plantar" project is designed to replace coal and coke in the pig iron industry in the Brazilian State Minas Gerais with charcoal from sustainably produced fuelwood. The project is intended to be established as a CDM project under Art. 12 of the KP. Land use activities in the framework of the project are:

- The establishment of 23.100 ha of high-yielding eucalyptus varieties for charcoal production.
- The regeneration of "cerrado" native vegetation on 478.3 ha of pasture land.

The State of Minas Gerais has passed a law that phased out the use of native forest resources for charcoal production. The use of charcoal from plantation forestry is seen as a means to reduce the pressure on deforestation in the cerrado region. Plantar is already using such plantations for charcoal production, and it has received FSC-certification (see Chapter 4.4.3.4) for its "Curvuelo"[12] plantation. In the environmental assessment, the authors state that the plots foreseen for the plantation are degraded pastures. The PDD mentions several biodiversity aspects such as:

- Reduction of deforestation of the cerrado forest.
- Conservation of the native forests by the FSC-certified Curvuelo plantation.
- Reduction of fire risks in surrounding native forests through the fire control system established at the Curvuelo plantation.

[12] "Curvuelo" is a site name.

For the purpose of biodiversity monitoring, Plantar intends to establish a biodiversity baseline. The PCF has recommended how to improve and measure biodiversity. Seven indicators have been suggested, e.g. total area of legal reserve on the Curvuelo property, reductions in fire incidence, number of native species of birds and ants per sampling effort, biomass increases in native vegetation and testing of Eucalyptus effects on streamflow.

The Plantar project has caused a lot of stakeholder comment on the PCF website, especially on the questions of additionality, permanence and baseline calculation. The stakeholder discussion reveals that it was unclear if the land intended to be used for reforestation activities was really degraded pasture or former eucalyptus plantations which would not be in use for charcoal production after 2007 (and which in this case would not fall under the criterion for reforestation).

Romania: Afforestation of Degraded Agricultural Land

This project is intended to be conducted under Article 6 (JI) of the KP. The project plan is the afforestation of 6,728 ha of state-owned degraded agricultural lowlands in the southwest and southeast of the Romanian Plain – mostly with black locust (*Robinia pseudoacacia*) and the ecological reconstruction of part of the Lower Danube floodplain through the planting of native species. According to World Bank standards, the project has been categorized as Category B project, so that an environmental assessment and an environmental management plan had to be carried out. During the stakeholder comment period, the project has received some criticism due to the use of the non-indigenous Robinia species for large areas of afforestation. A major point of criticism was that black locust usually does not permit the growth of other tree species once it has established on a site, and that an even-aged monoculture of an exotic species could pose the risk of pest attacks and could have little capacity to adopt to changing conditions, e.g. of the climate. It was also criticised that the monitoring plan concentrated on birds as indicator species while the development of understory herbaceous vegetation and soil fauna might be a better indicator.

2.3.2 The BioCarbon Fund of the World Bank

On November 5, 2002, the BCF was publicly launched at the Katoomba Group Forestry Meeting in Tokyo, Japan. While the Prototype Carbon Fund is mainly aimed at energy-related projects and can only invest up to 10% of the funds in carbon sink projects, the BCF will concentrate on sink-related projects. The public/private partnership is intended to provide $100 million USD for this purpose. The BCF has not yet published templates for project design documents; suggestions for eligibility criteria are under review. The template for the PIN does not contain specific reference to biodiversity or environmental assessment. It is interesting to note that the PIN only asks for the possible environmental *benefits* of the project but not for possible *negative impacts*.

A number of possible project activities are mentioned on the BCF website (http://biocarbonfund.org/). It is unclear if this is a conclusive list or if other activities are also considered. The fund seeks to establish two project windows: one that is compatible with Kyoto regulations for the first commitment period, and a second one that goes beyond Kyoto and tries to broaden the types of projects within the fund portfolio. The project types suggested for the two "windows" are summarised in Table 3 and are based on a presentation by Ken Newcombe, the World Bank's Senior Manager for Carbon Finance. By June 2003, the BCF has received over 80 project proposals, 60 of which are considered as "possible viable" by the BCF (pers. comm. K. NEWCOMBE, The World Bank).

Table 3: Suggestions for Project-based Activities under the BCF during the First Commitment Period and Future Commitment Periods

	CDM (Art. 12)	JI (Art. 3.3, 3.4)
1st window	Plantations Afforestation/Reforestation ▪ Forest restoration ▪ Biodiversity corridors	Plantations Afforestation/Reforestation Forest management ▪ Fire control Wetland restoration Prevented deforestation ▪ Forest conservation after restitution ▪ Reduce illegal logging
2nd window	Revegetation ▪ Restoring degraded landscapes ▪ Soil loss prevention Forest management ▪ Reduced-impact logging Soil carbon management ▪ Agroforestry systems ▪ No-till, live fences, mulching in small-holder agriculture ▪ Legume rotation in fallows of broad-acre agriculture Watershed management Prevented deforestation Forest conservation	No need for extension; all activities fully eligible

Source: NEWCOMBE & BOSQUET (2002)

This overview suggests that during future commitment periods, it is possible that more project types from the land use, land use change and forestry sector will be eligible. According to the BCF, the following types of projects could be supported in the future (see Table 4).

Table 4: Project types that could be supported in the future by the BCF

Afforestation and Reforestation
Rehabilitation of degraded tropical lands (e.g. *Imperata* grasslands) to:
Forest
Agroforestry
Reforestation of degraded temperate grasslands or arid lands by tree planting
Establishing tree/shade crops over existing crops (e.g. coffee)
Plantations for wood products:
Small scale landholder driven
Commercial scale
Landscape rehabilitation through planting corridors, etc.
Fuel wood plantings at a commercial scale
Forest Management
Improved forest management via fertilizer, in-plantings etc.
Improved fire management
Reduced impact logging
Alternatives to fuel wood for forest/environmental protection
Cropland Management
Reduced till agriculture
Other sustainable agriculture
Grazing Land Management
Revegetation of semi-arid and arid lands with shrubs or grasses
Improved livestock management leading to vegetation and soil recovery
Biofuels
Use of crop residues to produce energy combined with a carbon sequestration asset

Source: http://carbonfinance.org/biocarbon/home.cfm

The BCF has developed a question-sheet for the eligibility of projects, which are under review and likely to change (the following list contains the status of February 2003):

Climate and Environment

- Will there be real gains in carbon sequestration or net greenhouse gas emission reductions (considering all greenhouse gases); what amount and at what cost?
- Does the project meet the likely requirements of the CDM? A project can still be considered even if it does not fulfil this requirement as the Fund will have CDM compliant and CDM non-compliant windows.
- Does the project clearly meet sustainability criteria and contribute to the goals of the major environmental conventions such as the CBD, the UNCCD and the Ramsar Convention on wetlands?

Poverty Alleviation

- Will the project improve the livelihoods of a significant number of local/low-income people?
- Will the World Bank's Safeguard Policies be met?

Project Management and Learning

- Is the project cost effective?
- What learning opportunities does the project offer? Can we learn about, and address, design, finance, institutional arrangements, implementation, monitoring, leakage and permanence issues?
- Is there an adequate enabling environment in place? (Factors to consider here include the general political/security situation, a national climate change policy framework, etc.)
- Do appropriate institutions exist to serve as intermediaries between the BCF as a buyer and local communities as sellers?

Portfolio Balance

- How replicable (transferable) is the experience and knowledge gained from this project?

- Does this project add to the range (project type, economic situation, geographic distribution, social environment) and learning experience in the portfolio?

To assess that a project will not be harmful for the local environment and livelihoods, the Fund will apply local environment and social assessment requirements and the World Bank's Safeguard Policies. It is intended to prepare a baseline and monitoring plan for these additional benefits, and will be validated by a Designated Operational Entity or Accredited Independent Third Party.

2.3.3 GEF Project Funding

The GEF was established in 1991 and funds projects and programs in developing countries that protect the global environment. It is the designated financial mechanism for the international agreements on biodiversity, climate change, and persistent organic pollutants. Other areas of funding are combating desertification, protection of international waters and the ozone layer.

In 1995, the GEF laid down an Operational Policy. It concentrates its work on four focal areas and 10 operational programmes and a multi-focal area:

Biodiversity

- Arid and Semi-Arid Zone Ecosystems
- Coastal, Marine, and Freshwater Ecosystems
- Forest Ecosystems
- Mountain Ecosystems
- Conservation and Sustainable Use of Biological Diversity Important to Agriculture

Climate Change

- Removal of Barriers to Energy Efficiency and Energy Conservation
- Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs

- Reducing the Long-Term Costs of Low Greenhouse Gas Emitting Energy Technologies
- Promoting Environmentally Sustainable Transport

International Waters

- Water Body-based Operational Program
- Integrated Land and Water Multiple Focal Area Operational Program
- Contaminant-Based Operational Program

Multi-focal Area

- Integrated Ecosystem Management

Up until now, no LULUCF activities that meet the Kyoto requirements, especially within the mechanisms of CDM or JI are funded under the Climate Change Programme. However projects funded under the multi-focal area "Integrated Ecosystem Management", which is aimed at bridging the gap between the single GEF focal areas, lists "reduction of net emissions and increased storage of greenhouse gases in terrestrial and aquatic ecosystems" in its Programme Objectives and thus potentially includes sink activities under the framework of the KP. Eligible projects include, e.g. investments in:

(a) "rehabilitation and/or improved management of rangelands to restore indigenous vegetation and improve water management;

(b) rehabilitation and/or improved watershed management of a forested watershed or floodplain wetlands such as sustainable forest management to achieve multiple benefits, including improvements in soil and water conservation, aquatic biodiversity conservation, flood control, minimization of sedimentation of globally important water bodies, and reduction of net emissions or improved storage of greenhouse gases".

GEF excludes the following activities from funding:

- Conversion of natural landscapes into forest plantations or other monoculture systems.
- Introduction of alien species.

- Establishment of agricultural systems that displace affected communities to marginal lands.

The exclusion of species introductions is a criterion which is much stricter than the guidelines laid down in the Safeguard Policies of the World Bank.

3 Climate Change Mitigation Projects within the KP and Possible Areas of Conflict

This chapter summarises the effects of project types eligible under the CDM and JI of the KP regarding biodiversity (Table 7). In line with the scope of the study this overview focuses on selected activities and project types of the energy and LULUCF sectors (see Table 5).

Table 5: Overview of Selected Activities and Project Types and their Eligibility under the Kyoto Mechanisms JI and CDM

Project type	JI	CDM
Afforestation & Reforestation	X	X
Forest management	X	
Cropland management	X	
Grazing land management	X	
Revegetation	X	
Cultivation of energy crops and the use of biomass	X	
Hydropower an dams	X	X

The project types which aim at climate change mitigation might enhance as well as destroy natural biodiversity and habitats. This depends overall on the site-conditions and measures applied for each project type.

Afforestation & Reforestation

Afforestation[13] and reforestation[14] (A&R) projects can have positive, neutral or negative impacts on biodiversity. They are allowed for both JI and CDM projects. The impact

[13] "Afforestation is the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources" (11/CP.7; Annex A).

depends strongly on the level and nature of biodiversity of the ecosystem being replaced (UNEP/CBD/SBSTTA 2003), or restored or conserved, whether the project explicitly is designed to benefit biodiversity (e.g., by building corridors, maintaining natural ecosystem landscapes), the specific species and projects activities, the appropriate or inappropriate integration of project activities into the landscape matrix and the spatial scale being considered.

Specific sites may be better candidates for implementing such activities than others, based on past and present uses, the local or regional importance of their associated biological diversity and proximity to nearby, natural forests. For instance degraded lands may offer the best opportunities for such activities to enhance biodiversity, as these lands have already lost much of their original biodiversity whereas A&R activities that replace native non-forest ecosystems (e.g. species-rich native grasslands, wetland, heathland or shrubland habitats) by non-native species, or by a single or few species of any origin, can negatively affect biodiversity (UNEP/CBD/SBSTTA 2003).

As part of A&R **agroforestry** projects can also be an eligible CDM project activity, if they prior do not fulfil the definition of forest[15], but after the project it will be fulfilled. Agroforestry projects have a great potential of delivering environmental benefits (biodiversity and others) as well as socio-economic benefits. Like A&R it is mainly positive if not established on areas of natural ecosystems. Therefore agroforestry is not discussed separately in the further process of this study.

[14] "Reforestation is the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989" (11/CP.7; Annex A).

[15] "Forest is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5 metres at maturity *in situ*. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30 per cent or tree height of 2-5 metres are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest" (11/CP.7; Annex A).

Forest management

Because forests are enormous repositories of terrestrial biodiversity at all levels of organization (genetic, species, population, and ecosystem), improved management activities, that can enhance carbon uptake or minimize carbon losses and conserve biodiversity may have positive or negative effects on biodiversity (see UNEP/CBD/SBSTTA 2003). Also forest ecosystems are extremely varied and therefore positive or negative impact of any forest management operation will differ according to soil, climate, and site history, including disturbance regimes (such as fire). Possible forest management project activities under JI that are likely to alter carbon stocks comprise the following are examples[16]:

- Forest regeneration
- Forest fertilization
- Pest management
- Forest fire management
- Harvest quantity and timing
- Low-impact harvesting
- Reducing forest degradation

During forest management activities like fertilization, pest management or fire management can have an adverse impact on biodiversity, a lot of other activities are very suitable to combine carbon sequestration with enhancing biodiversity. Examples are extending the rotation period, enhancing deadwood or changing from same age class forests to multi storied forests with different tree ages.

Cropland management

Depending on the design of the measures cropland management can have both positive and negative effects. These effects can directly address biodiversity and ecosystems or the resources on which they depend, such as soil and water. One major issue which determines the impact is the form of pre-cultivation. The conversion of

[16] A brief descriptions of these activities you can find in Chapter 4 of the IPCC Special Report on Land Use, Land-Use Change, and Forestry (IPCC 2000).

natural ecosystems results in both loss of organic carbon and of biodiversity and is thus not advisable.

The major project activities under JI of cropland management which can be used to sequester carbon comprise intensification, erosion control, conservation tillage and irrigation. These activities may enhance as well as harm biodiversity and the ecosystems. Intensification practices such as fertiliser use and chemical weed and pest control may affect biodiversity and soil and water quality. In order to avoid these effects any practice for intensification should follow site-specific sustainable agricultural guidelines.

Similarly irrigation can pose certain risks to biodiversity and soil and water resources. This includes both on-site impacts, such as groundwater pollution and salinisation as well as off site-effects, such as pollution and eutrophication of freshwater ecosystems.

Conservation tillage results in most cases in an improvement of conditions on which biodiversity depend. This includes i.e. the improvement of soil quality and an increased water retention capacity, the reduction of wind and water erosion, soil removal and the siltation of waterways. In particular cases the increase of the water retention might cause additional leaching coupled with salinisation.

Similar effects as mentioned under conservation tillage are induced by erosion control measures, i.e. by shelterbelts or vegetation strips. The benefits include the reduced siltation and pollution of waterways resulting in better soil and water quality, reduced fertiliser use, leaking and salinisation resulting in the enhancement of both on-site and off-site biodiversity.

Grazing land management

Grazing land management project activities under JI that sequester carbon above or below ground comprise livestock and grazing management, set-aside, productivity improvements and fire management. Depending on the design of the measures the may benefit or reduce biodiversity. Non-native species, which are introduced to increase productivity may suppress native species on the area itself as well as on neighbouring areas due to the distribution of seeds. The lack of site-specific management of grazing land and the prevention of overgrazing will benefit biodiversity. Furthermore additional fertilisation will lead to a decrease in biodiversity.

Revegetation

Revegetation project activities are also allowed only for JI projects. Revegetation includes various activities to increase plant cover on eroded, severely degraded or otherwise disturbed land (UNEP/CBD/SBSTA/9/INF/12). Revegetation is often an intermediate step of long-term restoration of natural ecosystems. In these cases revegetation aims i.e. at erosion control, soil stability, increased productivity of such land. The impact of revegetation on biodiversity and its ecosystems may be positive or negative depending on the site conditions and the type design of measure. On the one hand, generally measures that prevent further degradation and enhance environments for the resettlement of natural vegetation will be positive. On the other hand, measures that are only focusing on plant cover and the production of biomass by using exotic species and fertiliser might result in the suppression of the development of natural vegetation.

Cultivation of energy crops and the use of biomass

The use of bioenergy and biomass as a fuel source is generally considered as a valuable option for mitigation of climate change as biological resources can replace fossil fuel and thus avoid the emission of greenhouse gases and are allowed both for CDM and JI projects. Most of the current use of bioenergy today is traditional biomass use – in some countries in Africa up to 90%. Globally, about 7% of the primary energy use is derived from traditional use of biomass such as wood, charcoal and dung (WBGU 2003a). However, bioenergy use and the cultivation of energy crops is gaining importance also in industrialised countries, partly as a measure to mitigate climate change.

There are several possible conflicts and synergies that could arise in the context of land cultivation or use of the biomass resources needed for energy production.

Many of the conflicts arising from the use and cultivation of biomass depend on the type of ecosystems that are replaced for energy crops, or on the way the bioenergy resource would have been used alternatively. For example, if animal dung is dried and burnt for traditional energy use, it cannot be used for crop fertilization and thus may increase the degradation of cultivated lands.

As far as energy crops are concerned, perennials require less use of agrochemicals than annual crops, which can be considered as an advantage for biodiversity (UNEP/CBD/SBSTTA 2003). The sustainability and biodiversity impact of energy crops also depends on species selection (see Table 8). Some species provide shelter for native animals, resemble natural ecosystems in their structure and require little use of fertilizer, agrochemicals or machinery for soil cultivation. Attention should also be given to the invasive potential of energy crops, especially if a new species is introduced into a region where no experiences with this species exist.

Several estimates on the global potential for the use of bioenergy have been made, but only few of them consider the restrictions that reduce this potential because of biodiversity or other ecological considerations. WBGU (2003a) considers some of these aspects in its estimate and arrives at a much lower figure than e.g. the IPCC (2001) or FISCHER und SCHRATTENHOLZER (2001). The Ad Hoc Technical Expert Group (AHTEG) (UNEP/CBD/SBSTTA 2003) compares these three estimates (Table 6) and stresses that for the IPCC scenario, a massive conversion of natural vegetation to bioenergy plantations would be necessary to reach this aim. WBGU (2003a) has divided the global estimate into regional estimates. In most regions (Europe, former Soviet Union, Africa, North and Latin America), the current use of biomass is lower than the potential. In Asia, however, the current use of bioenergy resources already exceeds the potential.

Table 6: Global Bioenergy Potential as Calculated by Different Authors

Study	IPCC (2001)	WBGU (2003a)	FISCHER & SCHRATTENHOLZER (2001)
Potential [EJ]	396 (+45)	104	370–450
Area for energy crops	~ 10% of land area (16% of Africa, 32% of Latin America)	2.5% of land area	Whole grassland area
Yields for energy crops [t ha^{-1} a^{-1}]	High: 15	Moderate: 6-7	Moderate: 4.7
Average residue use [t ha^{-1} a^{-1}]	No data	Agriculture: 0.7	Agriculture: 1.2 Forest: 1.4

Hydropower and dams

For a detailed description and assessment of the relevance of these activities for biodiversity, see Chapter 4.4.4.2, Table 7 or Chapter 4[17] of the report of the AHTEG on Biological Diversity and Climate Change (UNEP/CBD/SBSTTA 2003).

Table 7: Selected Climate Change Mitigation Options under CDM and JI and their Possible Effects on Biodiversity

Possible land use activities	Circumstances for potential positive impacts on biodiversity	Circumstances for potential negative impacts on biodiversity
Afforestation and reforestation	• If activity improve connectivity between habitat patches or fragments • If activity took place on degraded pasture and agricultural sites • If clearing of pre-existing vegetation and thinning is minimized • If natural regeneration and native species are used that reflect structural properties of surrounding forests • If tree density respects biodiversity needs • If mixed age classes stands are established • If areas for habitats for different species are considered • If chemical use is excluded	• On areas where natural ecosystems are destroyed for the activities (e.g. plantations on recently cleared tropical forests) • If other vegetation is completely cleared before and during the activity • If monocultures of exotic species are used on large areas • If single age-class stands are established • If chemicals are used • If no habitats are created • If short rotation periods are used • If tree density is very high

[17] Chapter 4 addresses climate change mitigation and adaptation options: links to, and impacts on, biodiversity.

Possible land use activities	Circumstances for potential positive impacts on biodiversity	Circumstances for potential negative impacts on biodiversity
Forest management	• If natural forest regeneration occurs	• If natural and semi-natural forests are replaced by monospecific and even-aged plantations • If inappropriate species are planted, e.g. invasive alien species and genotypes or GMOs • If natural regeneration suppressed • If abundant chemical use occurs • If fire management disrupts natural fire regeneration cycles • If poor logging practices (high-impact harvesting) occurs, e.g. use of damaging machinery • If large scale clear-cuttings occurs in areas without natural large scale disturbances • If important forest structures such as dead and decaying wood are removed • If drainages are used.
Cropland management	• If reduced tillage is used without increased application of herbicides	• If reduced tillage is used with increased application of herbicides and pesticides • Increase in cropping intensity has mainly negative impacts • If established on areas of natural ecosystems
Grazing land management	• Mainly positive if no natural areas are destroyed • If no exotic species are used • If fire management respects natural fire regeneration cycles	• If established on areas that previously contained natural ecosystems • If non-native species are introduced
Revegetation	• If measure increases richness of native plant species over time; • If measure prevents further degradation and protects neighbouring habitats.	• If measure destroys endemic species • If exotic species for revegetation invade native habitats • Possible increase on N2O emissions because of fertilizer use
Cultivation of energy crops and the use of biomass		
Annual energy plants	• Conversion of degraded cropland or non-native pastures • Use of native species (e.g. switchgrass in North America)	• Conversion of natural forests or grasslands for energy crop production • Conversion of diverse agroecosystems or set-aside lands (fallow) for energy crop production

Possible land use activities	Circumstances for potential positive impacts on biodiversity	Circumstances for potential negative impacts on biodiversity
Perennial energy plants	• Conversion of degraded cropland or non-native pastures • Use of native species	• Conversion of natural forests or grasslands for energy crop production • Conversion of diverse agroecosystems for energy crop production • Loss of breeding bird and mammal species • Fragmentation of open landscapes • Even-aged monoculture stands
Residues from forest products, crop and animal production	• If additional nutrients from residues transformation complement natural nutrient cycle	• If natural nutrient cycle is disturbed
Traditional biomass use (mainly fuelwood collection)	• If fuelwood collection is limited to a sustainable extend	• If dead wood collection affects deadwood communities • If living branches are used and thus shelter or nesting areas for a variety of species are affected • In areas where fuelwood remains plentiful then particular preferred fuelwood species may be targeted and these can decline and eventually disappear • Extensive removal of branches and fallen leaves can break the nutrient cycle, lower productivity and lead to soil erosion
Storage dams[18]	Hydropower projects always lead to the loss of land coupled with irreversible loss of species populations and ecosystems. However there are options to minimise these effects, i.e. small and micro-scale schemes, run-off river projects or if most suitable technology is used concerning type and condition of pre-dam ecosystem, type and operation of dams, height of dam and area of reservoir. Nevertheless cumulative effects may arise.	• If fish migration is prevented • If flow, flood pulse oxygen and sediment content is altered

In cropland and grazing land management as well as biomass production the ecological impacts do not only depend on the design of the measures but also on the site-specific selection of crops and species and their requirements. KALTSCHMITT & HARTMANN (2001) list the following ecological aspects for selected crops commonly used in the temperate zone (see Table 8).

Table 8: Different Crops and their Ecological Impacts

Energy crop	Positive ecological aspects	Negative ecological aspects
Fast-growing trees (*Populus ssp., Salix ssp*)	▪ Low fertilizer input ▪ Low agrochemical input ▪ Increase of soil fertility ▪ Provide nesting and shelter for birds and mammals	▪ High water use ▪ Herbicide use necessary during establishment ▪ Increased pressure of pests and diseases if larger areas are cultivated
Switch grass (*Panicum virgatum* L.)	▪ High water use efficiency ▪ Low input of fertilizer ▪ Reduces erosion (perennial cover) ▪ Provides shelter for animals ▪ Low competitiveness of young plants makes invasive behaviour unlikely	▪ Herbicide application and tillage necessary for establishment ▪ Irrigation may be necessary for establishment
Reed canarygrass (*Phalaris arundinacea L*.)	▪ Reduces erosion ▪ Low input of agrochemicals necessary	▪ High input of water and nutrients necessary ▪ Rhizomes may spread beyond cultivated area
Pasture grasses (*Lolium perenne* L., *Dactylus glomerata* L., *Arrhenaterum elatius* L., *Festuca arundinacea* L.)	▪ Low input of agrochemicals ▪ Reduce erosion by perennial cover	▪ Negative if species-rich meadows are replaced by monoculture stands
Grain crops (wheat, rye, etc.)	▪ positive if residues are used	▪ intensive use of pesticides ▪ if monoculture structures are established ▪ competition between food and energy use for communities
Oilseed rape (*Brassica napus* L.)	▪ positive influence on soil fertility	▪ high nitrogen input necessary, may increase eutrophication of water ▪ high input of agrochemicals against pests and diseases ▪ cross-pollination with close wild relatives possible
Sunflower (*Helianthus annuus* L.)	▪ Improving the soil structure, ▪ increasing soil organic matter	▪ erosion, soil compaction and nutrient losses can occur
Hemp (*Cannabis sativa* L.)	▪ efficient use of nutrients and water ▪ little application of pesticides necessary	
Sugar beet (*Beta vulgaris* L.)		▪ high risk of erosion ▪ reduction of soil organic matter ▪ high fertilizer and pesticide input necessary
Sweet sorghum (*Sorghum bicolor* (L.) Moench)	▪ high water use efficiency	▪ high risk of erosion, soil compaction and nutrient losses
Jerusalem artichoke (*Helianthus tuberosus* L.)	▪ high water use and nutrient use efficiency ▪ perennial cultivation possible	▪ invasive potential

Source: KALTSCHMITT & HARTMANN (2001)

4 Instruments for the Consideration of Biodiversity Aspects During Planning, Approval and Implementation of Climate Change Mitigation Activities

This section presents general considerations at the beginning of a planning process as well as a range of instruments that could be used for the consideration of biodiversity aspects in climate change mitigation activities. Most of these instruments are applied widely across countries, sectors and regions. Especially SEAs and EIAs have frequently been mentioned in official documents of UNFCCC and CBD negotiations as a means to integrate biodiversity aspects into climate projects. The following chapters present these instruments and discuss their aptitude for the consideration of biodiversity in climate change mitigation activities.

4.1 General Considerations in the Planning Process of Climate Change Mitigation Activities

BIBBY & ALDER (2003) stress that a thorough review of existing information sources, programmes and plans as well as legally binding areas of conservation of the region of activity is a pre-condition for proper project planning and development and that placing the project into the network of ongoing activities is likely to contribute to successful project implementation. Furthermore the legal framework related to nature conservation has to be taken into account.

The following list (see Table 9) provides an overview on information sources including species based approaches as well as ecosystem-based approaches:

Table 9: Species and Ecosystems Assessment and Information Obtained by Various Organisations

Approach/Indicator	Responsible Institution	Description
Endemic bird areas	BirdLife International http://www.birdlife.net	Analysis of all the world's bird species with a breeding range of 50,000 km² or less, identification and mapping of all areas with two or more such species
Important Bird Areas	BirdLife International http://www.birdlife.net	
Centres of plant diversity	IUCN, WWF http://www.iucn.org/themes/ssc/ plants/plantshome.html	Identification of globally important areas for the conservation of plant diversity
Global red List	IUCN http://www.redlist.org	Species at risk of extinction
Global river basin analysis/ Fish family diversity	UNEP-World Conservation Monitoring Centre (WCMC) www.wcmc.org.uk	Biodiversity richness in 157 major river basis worldwide; combination with river basin vulnerability
Hotspots	Conservation International http://www.biodiversityhotspots.org/xp/Hotspots	25 regions that are rich in endemic species and threatened by habitat loss
Vavilov Centres	http://www.icarda.cgiar.org/Location.htm	Areas of genetic diversity of wild relatives of domestic crop plants; particularly important in relation to agricultural biodiversity, 25 areas identified
Ecofloristic zone analysis	Among others FAO, WCMC http://www.unep-wcmc.org/forest/data/cdrom2/zones.htm http://www.fao.org/wairdocs/x5309e/x5309e02.htm	Analysis of protected area coverage in the tropics, digitised by FAO as part of FAO Forest Resources Assessment
WWF-US Global 200 Eco regions	WWF-US http://www.panda.org	Global priority eco regions identified
Large Marine Ecosystems	www.unep.org/DEWA/water/MarineAssessment/reports/germany_report/LME-GIWA.doc	50 units have been mapped and identified, defined as ocean space encompassing near-coastal areas from river basins and estuaries

Furthermore a preliminary process has to assess whether the area of activity covers a designated protected area or a site with legally protected species. The following list provides an indicative overview on the legal framework at global, European and national levels:

- Global level
    - World Heritage Site (Convention for the Protection of the World Cultural and Natural Heritage)
    - Site under the Ramsar Convention (Convention on Wetlands of International Importance Especially as Waterfowl Habitat)
    - Sites hosting species listed under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals)
    - Sites hosting species listed under CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna)
    - Site hosting species under the Bern Convention (Convention on the Conservation of European Wildlife and Natural Habitats)
- European level
    - Sites of the Natura 2000 network (sites designated under the Habitats Directive (92/43/EEC) and the Birds Directive (79/409/EEC))
- National/regional level
    - Areas or species protected by national or regional legislation
- Other non-legally binding site of conservation
    - Biosphere Reserve (UNESCO Man & Biosphere Programme)

Political Framework

From the political point of view the preparatory period of a climate change mitigation measure should answer the following questions:

- Who are the relevant stakeholders taking care of biodiversity protection in the envisaged project area?

- Did the country of action already complete a National Biodiversity Strategy and Action Plan (NBSAP)[19]? How might the project link up to the broader objectives of the strategy?
- Did the region of action already establish any plans, programmes or policies related to sustainable land use or resource management? How might the project link up to these initiatives?

4.2 Environmental Impact Assessment (EIA)

The instrument EIA has been in use for a long time in many countries of the world to assess the environmental impacts of a project proposal before its implementation. Many countries have established legislation on EIA, and many donor or funding agencies require project proponents to carry out an EIA as a precondition for funding.

4.2.1 EIA: Definition

The International Association for Impact Assessment and International Energy Agency (IEA) defines EIA as:

> *The process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made (IAIA & IEA 1999).*

4.2.2 Biodiversity Aspects in EIA

Biodiversity is not always a legally binding aspect in EIA regulations. However, it can usually be applied as one aspect of the environmental issues to be considered. For a practical approach like EIA, it is important to split the term „biodiversity“ into more specific issues which can be monitored or where information is available. According to

[19] A list of completed NBSAPs is available at http://www.undp.org/bpsp/nbsap_links/nbsap_links.htm.

the definition of biodiversity, it is most useful to use the different levels of biodiversity for this distinction: genetic, species, and ecosystem level. TREWEEK (2001) suggests a checklist of biodiversity elements to consider in EIA or SEA that includes some additional elements:

- Landscape (e.g. areas of high endemism or high global diversity, connectivity of habitats).
- Ecosystem (e.g. key ecological processes and functions, productivity of ecosystems).
- Species (e.g. protected species or characteristic species, species with low reproductivity).
- Population (declining populations, isolated populations).
- Genes (e.g. risk of invasion by alien species, genomes or genes of agricultural crop varieties).

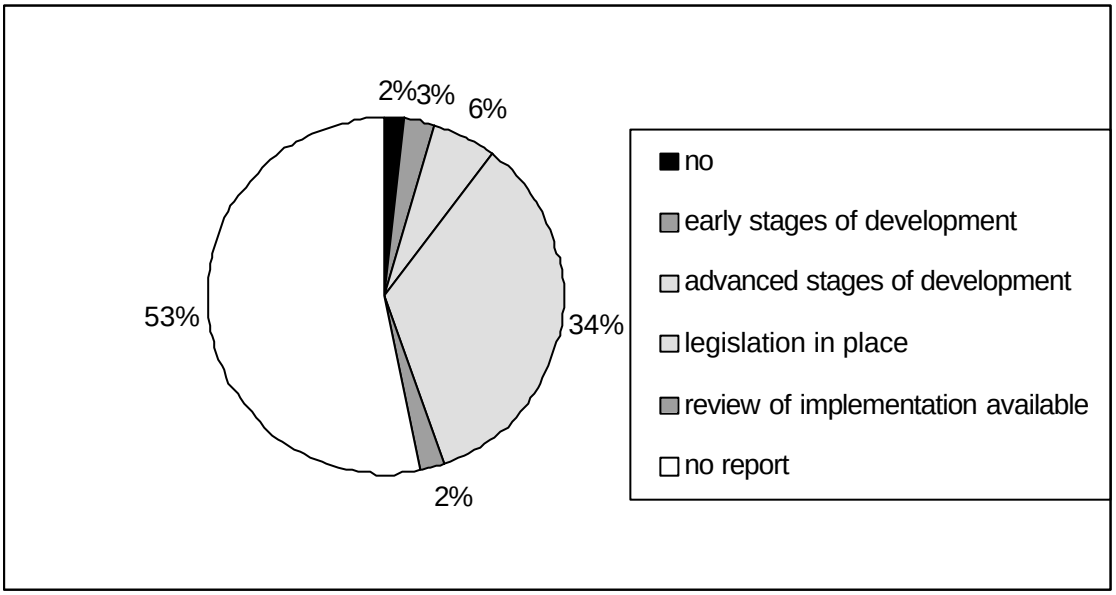
The CBD COP, in its decision VI/7, makes a distinction between use and non-use values at the genetic, species and ecosystem level. TREWEEK (n.d.) stresses that failure to include consideration of gene-level effects in EIA is a particular problem for sectors such as agrobiodiversity, forestry and aquaculture.

A review of EIA legislation in eighteen countries and two international organisations carried out by the Netherlands National Commission for EIA in 1995 (SADLER 1996) found that 13 countries had provisions that require biodiversity aspects to be addressed in an EIA. Two thirds of the countries reviewed were industrialised countries, mostly from Europe. This means that even if EIAs are regularly carried out for the assessment of climate projects, there is no guarantee that biodiversity aspects will be adequately monitored if the national legislation does not require the inclusion of these aspects.

4.2.3 Status of EIA Legislation with Respect to Biodiversity

EIA can only be applied efficiently if it is backed by national legislation. An analysis of the Second National Reports of the Parties to the CBD on EIA shows that 34% of CBD Parties have legislation in place to assess the impacts of projects on biodiversity.

Figure 5: Answers of CBD Parties in their Second National Reports to Question 196[20]



Source: Data from Second National Reports of Parties to the CBD (www.biodiv.org/reports)

About half of the 63 countries that have legislation in place are developing countries. Still, biodiversity considerations are often inadequately addressed in impact assessments. There is a growing recognition of this and increasing actions are taken to correct this problem.

The website of the CBD lists some major barriers for the inclusion of biodiversity aspects in impact assessment processes. These are:

- low priority for biodiversity

[20] Question 196: "Is legislation in place requiring an environmental impact assessment of proposed projects likely to have adverse effects on biological diversity (14(1a))?"

- lack of capacity to carry out the assessments
- lack of awareness of biodiversity values
- inadequate data
- and post-project monitoring.

4.2.4 Stages of the EIA Process

This section summarises the major steps in the EIA process and reviews recommendations from existing literature on the integration of biodiversity aspects into the process. At the end of each section, the relevance of these approaches for climate projects is discussed.

The International Association for Impact Assessment (IAIA) has summarised the steps which an EIA usually should include. These are:

- Screening
- Scoping
- Examination of alternatives
- Impact analysis
- Mitigation[21] and impact management
- Evaluation of significance
- Preparation of EIS or report
- Review of the EIS
- Decision making
- Follow up (monitoring and evaluation)

It is important to provide sufficient stakeholder consultation in each step, because lack of data and information on biodiversity will often limit the examination. Involvement and

[21] The term mitigation is used here in the context of EIA and comprises activities that compensate or reduce the negative impacts caused by a development. It is not equivalent with the term mitigation in the context of the UNFCCC and the KP which refers to measures that limit the emissions of greenhouse gases and protect and enhance greenhouse gas sinks or reservoirs (UNFCCC, Art. 4 §2).

consultation of local experts and communities can often compensate the general lack of biodiversity information.

4.2.4.1 Screening

Screening is the step in an EIA in which is decided whether an EIA (or what type of EIA) is to be carried out for a proposed project activity. Usually, a set of criteria is applied to decide in which category a project falls, and whether a full EIA, a limited assessment or no assessment has to be carried out. However, these screening criteria often fail to include biodiversity aspects (CBD Decision VI/7) or they are very general in that they require an EIA for any proposal affecting an area with important elements of biodiversity (TREWEEK 2001). The most common screening criterion is risk of impacts on protected areas (TREWEEK 2001), but this criterion fails to consider many other aspects of biodiversity. Species and habitat criteria are most commonly used (TREWEEK n.d.). While some countries require some form of EIA for all proposals, in other cases the magnitude or type of the proposed activities determines the necessity of an EIA, while still others require EIAs to be carried out for proposals falling in certain categories (e.g. risks of major accidents).

Decision VI/7 of the CBD provides examples for existing screening mechanisms (positive lists of projects requiring EIA, negative lists excluding projects not subject to EIA, expert judgement, or a combination of both). In Appendix 2 (see Figure 6) to the decision, the COP provides a list of screening criteria that reflect the different levels of biodiversity (genetic, species, ecosystem level) and that result in three categories of projects.

Figure 6: The Screening Criteria

This is a suggested outline of a set of screening criteria, to be elaborated on country level. It only deals with biodiversity criteria and thus is an add-on to already existing screening criteria.

Category A: EIA mandatory:
Only in the case criteria can be based on formal legal backing, such as:

- National legislation, for example in case of impact on protected species and protected areas;
- International conventions such as CITES, the CBD, Ramsar Convention on Wetlands, etc.;
- Directives from supranational bodies, such as the European Union Directive 92/43/EEC of 21 May 1992 on conservation of natural habitats and of wild fauna and flora and Directive 79/409/EEC on the conservation of wild birds.

Indicative list of activities for which an EIA could be mandatory:
(a) At the genetic level (relates to screening question I in Appendix 1 above):

- Directly or indirectly cause a local loss of legally protected varieties/cultivars/breeds of cultivated plants and/or domesticated animals and their relatives, genes or genomes of social, scientific and economic importance e.g. by introducing living modified organisms that can transfer transgenes to legally protected varieties/cultivars/breeds of cultivated plants and/or domesticated animals and their relatives.

(b) At species level (relates to screening question II and III in Appendix 1 above):

- Directly affect legally protected species, for example by extractive, polluting or other disturbing activities;
- Indirectly affect legally protected species, for example by reducing its habitat, altering its habitat in such a manner that its survival is threatened, introducing predators, competitors or parasites of protected species, alien species or GMOs;
- Directly or indirectly affect all of the above for cases which are important in respect of e.g. stop-over areas for migratory birds, breeding grounds of migratory fish, commercial trade in species protected by CITES;
- Directly or indirectly affect non-legally protected, threatened species.

(c) At ecosystem level (screening questions IV and V in appendix 1 above):

- Are located in legally protected areas;
- Are located in the vicinity of legally protected areas;
- Have direct influence on legally protected areas, for example by emissions into the area, diversion of surface water that flows through the area, extraction of groundwater in a shared aquifer, disturbance by noise or lights, pollution through air.

Category B: The need for or the level of EIA is to be determined:
In cases where there is no legal basis to require an EIA, but one can suspect that the proposed activity may have a significant impact on biological diversity, or that a limited study is needed to solve uncertainties or design limited mitigation measures. This category covers the frequently referred to but difficult to use concept of “sensitive areas”. As long as so-called sensitive areas do not have any legal protected status it is difficult to use the concept in practice, so a more practical alternative is provided.
The following categories of criteria point towards possible impacts on biological diversity, and further attention is thus required:
(a) Activities in, or in the vicinity of, or with influence on areas with legal status having a probable link to biological diversity but not legally protecting biological diversity (relates to all five screening questions in Appendix 1 above). For example: a Ramsar site has the official recognition of having internationally important wetland values, but this recognition does not automatically imply legal protection of biological diversity in these wetlands).

Other examples include areas allocated to indigenous and local communities, extractive reserves, landscape preservation areas, sites covered by international treaties or conventions for preservation of natural and/or cultural heritage such as the UNESCO biosphere reserves and World Heritage Sites;

(b) Impacts on biological diversity possible or likely, but the environmental impact assessment is not necessarily triggered by law:

(i) At the genetic level:

- Replacing agricultural, forestry or fishery varieties or breeds by new varieties, including the introduction of living modified organisms (LMOs) (screening questions I and II).

(ii) At the species level:

- All introductions of non-indigenous species (questions II and III);
- All activities which directly or indirectly affect sensitive or threatened species if or in case these species are not yet protected (good reference for threatened species is provided by the IUCN Red Lists); sensitive species may be endemic, umbrella species, species at the edge of their range, or with restricted distributions, rapidly declining species (question II). Particular attention should be given to species which are important in local livelihoods and cultures;
- All extractive activities related to the direct exploitation of species (fisheries, forestry, hunting, collecting of plants (including living botanical and zoological resources), etc.) (question III);
- All activities leading to reproductive isolation of populations of species (such as line infrastructure) (question II);

(iii) At the ecosystem level:

- All extractive activities related to the use of resources on which biological diversity depends (exploitation of surface and groundwater, open pit mining of soil components such as clay, sand, gravel, etc.) (questions IV and V);
- All activities involving the clearing or flooding of land (questions IV and V);
- All activities leading to pollution of the environment (questions IV and V);
- Activities leading to the displacement of people (questions IV and V);
- All activities leading to reproductive isolation of ecosystems (question IV);
- All activities that significantly affect ecosystem functions that represent values for society. Some of these functions depend on relatively neglected taxa;
- All activities in areas of known importance for biological diversity (questions IV and V), such as areas containing high diversity (hot spots), large numbers of endemic or threatened species, or wilderness; required by migratory species; of social, economic, cultural or scientific importance; or which are representative, unique (e.g. where rare or sensitive species occur) or associated with key evolutionary or other biological processes.

Category C: No EIA required:

- Activities which are not covered by one of the categories A or B, or are designated as category C after initial environmental examination.

The generic nature of these guidelines does not allow for the positive identification of types of activities or areas where EIA from a biodiversity perspective is not needed. At country level, however, it will be possible to indicate geographical areas where biological diversity considerations do not play a role of importance and, conversely, areas where they do play an important role (biodiversity-sensitive areas).

Source: UNEP/CBD/COP/6/20, Decision VI/7, Appendix 2

TREWEEK (2001) proposes similar screening criteria, but also adds the issues of cumulative effects of similar project developments, and if the biodiversity resources are threatened by developments of a similar type throughout their range.

For the consideration of biodiversity aspects into climate projects it would be important that useful screening criteria make sure that all possible project types with impacts on biodiversity are included into a category that requires EIA. As national legislation on EIA (and on screening criteria) differs considerably, this decision will be subject to the EIA framework of the host country or the project proponent (according to the current stage of UNFCCC negotiations). The screening criteria proposed in Decision VI/7 of the CBD are useful in that they consider not only biodiversity aspects at the species level, but also at the ecosystem and genetic level, which is an important but often neglected aspect in agriculture or forestry-related projects. However, the approach to make EIA mandatory only in cases when legally protected areas or species/varieties are affected could be of little use in regions where national legislation on biodiversity conservation is not advanced. According to WBGU (2001), only 5% of the global land area is legally protected.

The Bali Action Plan (McNeely and Miller 1984) contains the aim that at least 10% of every bio geographic province (e.g. tropical rainforest, temperate steppe, etc.) should be under legal protection. Some biome types, like temperate steppes, temperate coniferous forest, lakes or cold deserts are far from this target. For example, 20% of the habitats of endemic bird species are not in areas with legally protected status. The screening questions suggested by the CBD COP may be difficult to answer in regions with poor data availability. For example, it may be impossible to judge whether a local loss of legally protected varieties/cultivars/breeds of cultivated plants could occur, or if non-legally protected, threatened species are affected. In such cases it would be necessary to gather the relevant data first to determine the possible vulnerability of any components of biodiversity in the considered project area.

The criteria for category B projects proposed in Decision VI/7 are project- and activity-specific and could include many possible climate activities, e.g. afforestation/reforestation. Some criteria also refer to the biodiversity status of the areas in which activities are planned, e.g. areas with high numbers of endemic or threatened species or areas required by migratory species. This means that for a large

proportion of possible climate mitigation and adaptation activities, the decision whether an EIA is carried out or not is largely based on national legislation of the host country where an activity takes place. The creation of an internationally valid set of minimum standards to be considered in an EIA could help to overcome the danger that countries with high standards in EIA would be forced to sell their carbon at a higher price than countries with lower standards.

4.2.4.2 Scoping

Scoping is the step in which the issues and impacts that are likely to be important are identified and the terms of reference for the EIA are established (IAIA & IEA 1999).

Common procedural steps with respect to biodiversity are (TREWEEK n.d.):

- Interpretation of the proposal and associated sources of stress or disturbance for biodiversity.
- Identification of important components of biodiversity and determination of the need for additional information.
- Identification of possible interactions between development actions and biodiversity.
- Definition of study limits, decision on study methodology, range and focus.
- Definition of terms of reference (TOR).

However, in practice many EIAs fail to include biodiversity in their TORs. TREWEEK (n.d.) thus recommends developing sample TORs for different development sectors.

Scoping is usually based on existing information and should include information on (TREWEEK 2001):

- Locations and characteristics of protected areas,
- Locations and characteristics of sensitive or important ecosystems, e.g. wetlands,
- Distribution of protected species,

- Distribution of habitat for protected species,
- Experts in different components of biodiversity, including taxonomy experts.

Public consultation can help to overcome lack of available data, and to make use of local or indigenous knowledge about local biodiversity.

Decision VI/7 suggests the following procedure for scooping:

- Describe the type of project, its nature, magnitude, location, timing, duration and frequency;
- Describe the expected biophysical changes in soil, water, air, flora and fauna;
- Describe biophysical changes that result from social change processes as a result of the proposed project;
- Determine the spatial and temporal scale of influence of each biophysical change;
- Describe ecosystems and land-use types potentially influenced by the biophysical changes identified;
- Determine for each ecosystem or land-use type if the biophysical changes affect one of the following components of biological diversity: the composition (what is there), the temporal/spatial structure (how are biodiversity components organized in time and space), or key processes (how is biodiversity created and/or maintained);
- Identify in consultation with stakeholders the current and potential use-functions, non-use functions and other longer-term less tangible benefits of biological diversity provided by the ecosystems or land-use types and determine the values these functions represent for society;
- Determine which of these functions will be significantly affected by the proposed project, taking into account mitigation measures;
- For each alternative, define mitigation and/or compensation measures to avoid, minimize or compensate the expected impacts;

- With the help of the biodiversity checklist on scoping, determine which issues will provide information relevant to decision making and can realistically be studied;
- Provide information on the severity of impacts, i.e. apply weights to the expected impacts for the alternatives considered. Weigh expected impacts to a reference situation (baseline), which may be the existing situation, a historical situation, or an external reference situation;
- Identify necessary surveys to gather comprehensive information about the biological diversity in the affected area where appropriate.

The COP of the CBD suggests in its decision VI/7 a biodiversity checklist (see Table 10) on scoping for the identification of the impacts of proposed projects on components of biodiversity. The checklist covers the three main levels of biodiversity.

Table 10: Biodiversity Checklist on Scoping

Levels of biological diversity	Components of biological diversity			
	Composition	**Structure (temporal)**	**Structure (spatial)**	**Key processes**
Genetic	Minimal viable population (avoid destruction by inbreeding/gene erosion) Local cultivars Living modified organisms	Cycles with high and low genetic diversity within a population	Dispersal of natural genetic variability Dispersal of agricultural cultivars	Exchange of genetic material between populations (gene flow) Mutagenic influences Intraspecific competition
Species	Species composition, genera, families, etc, rarity/abundance, endemism/exotics Population size and trends Known key species (essential role) Conservation status	Seasonal, lunar, tidal, diurnal rhythms (migration, breeding, flowering, leaf development, etc.) Reproductive rate, fertility, mortality, growth rate Reproductive strategy	Minimal areas for species to survive Essential areas (stepping stones) for migrating species Niche requirements within ecosystem (substrate preference, layer within ecosystem) Relative or absolute isolation	Regulation mechanisms such as predation, herbivory, parasitism. Interactions between species. Ecological function of a species

Ecosystem	Types and surface area of ecosystems Uniqueness/ abundance Succession stage, existing disturbances and trends (=autonomous development)	Adaptations to/ dependency on regular rhythms: seasonal Adaptations to/ dependency of on irregular events: droughts, floods, frost, fire, wind Succession (rate)	Spatial relations between landscape elements (local and remote) Spatial distribution (continuous or discontinuous/patchy) Minimal area for ecosystem to survive Vertical structure (layered, horizonts, stratified)	Structuring process(es) of key importance for the maintenance of the ecosystem itself or for other ecosystems

Source: CBD Decision VI/7, Appendix 4

This procedure combined with the checklist provides a good starting point for project scoping of climate mitigation or adaptation projects. In contrast to the aspects mentioned in Appendix E of UNFCCC/SBSTA/2003/L.13 (definitions and modalities for including afforestation and deforestation activities under Article 12 of the KP), the recommendations of SBSTA on the information to be included into the PDD, these criteria are much more detailed, especially because they systematically distinguish between impacts at the genetic, species and ecosystem level. However, many of the criteria mentioned in the checklist are probably not available (e.g. mutagenic influences, dispersal of natural genetic variability), so that many of these questions will remain unanswered.

TREWEEK (2001) suggests to refine the TORs derived from scoping by using generally applicable criteria. She suggests the approach “identification of valued ecosystem components”. Such valued components could be protected species, keystone species, endemic species, indicator species, rare habitats, wetlands, and globally threatened habitats.

4.2.4.3 Examination of Alternatives

The examination of alternatives to the proposed project is one of the main weaknesses of many EIA studies, especially in developing countries. WERNER (1992) mentions that practical experience from Thailand and the Philippines shows that out of several thousand impact statements produced during EIAs, not a single project was denied clearance due to environmental reasons.

Project-based EIA often fails to consider a series of alternatives because it is very site- and project type-specific and leaves little potential for “real” alternatives. For example, an EIA for a dam project for hydroelectricity will only consider different sizes or types of dams in a specific valley as alternatives, but it will not consider e.g. wind farms or other means of electricity generation or other, potentially less vulnerable catchments. This is a strength of SEA, which can include larger regions or several economic sectors in their search for alternatives.

In the case of climate projects, alternatives could include:

- Use of indigenous species instead of exotic species in afforestation; reforestation or grassland improvement projects;
- Multi-species instead of monoculture stands;
- Small-scale versus large-scale plantation;
- Small-scale versus large-scale hydropower.

4.2.4.4 Impact Analysis

Impact analysis is the step in which the likely environmental, social and other related effects of the proposal are identified and predicted (IAIA & IEA 1999). The results of this analysis are often written down in an Environmental Impact Statement (EIS).

It is necessary to define a baseline of biodiversity conditions against which the impacts can be measured. In many cases, baseline data on the specific project area may be lacking, so that a postulated baseline based on expert judgement, the historical/pre-industrial situation or an external reference of similar habitats can be adequate (TREWEEK 2001).

The main impacts as identified in the scoping stage should be assessed according to their nature, magnitude, extent, timing, duration and a judgement of their significance. This means that a judgement is made whether impacts

- are acceptable to stakeholders,

- require mitigation or,
- are unacceptable.

Decision VI/7 (CBD) admits that biodiversity information for impact analysis and assessment is often limited, and that standards or objectives against which the criteria can be evaluated yet have to be developed. One possibility for guidance to develop criteria can be found in the priorities and targets set in the National Biodiversity Action Plans as required by the CBD. However, these targets are very general and thus can only provide limited guidance for the situation in which criteria for project-based activities have to be developed.

TREWEEK (2001) suggests to

- use mainly primary sources of information for impacts assessment,
- define “impact zones” based on proposed development activities during construction, operation and decommissioning,
- base the study area on impact zones and spatial and temporal biodiversity distributions (take an ecosystem approach),
- agree on a definition of baseline conditions for biodiversity, and
- measure impacts against the baseline.

Examples of biodiversity impacts resulting from climate mitigation and adaptation projects could be:

- Destruction of xx ha habitat of a rare/threatened/legally protected species by afforestation activities.
- Reduction of wetland area of xx ha by dike construction.
- Reduction of endangered/endemic fire-adapted species by changed fire management.

4.2.4.5 Mitigation and Impact Management

In this step, the measures that are necessary to avoid, minimize or offset predicted adverse impacts are established and incorporated into an environmental management plan. Mitigation measures can include:

- Decision to adopt the “do-nothing” option;
- Omitting specific activities that damage biodiversity;
- Seek alternative locations or project designs;
- Avoid areas with high vulnerability or high levels of biodiversity;
- Avoid critical times for construction works (e.g. breeding season);
- If avoidance is not possible, reduction of severity of impacts e.g. through timing of activities or fencing during construction work;
- If neither avoidance nor reduction of impacts is possible, options for replacement or restoration of biodiversity on-site should be sought;
- A last option is compensation for damage to biodiversity, e.g. off-site measures.

TREWEEK (2001) also stresses the importance of creating a legal requirement for the implementation of mitigation. In current EIA practice, often unrealistic mitigation recommendations are made without evidence of their likely effectiveness. Thus she recommends creating a summary of proposed mitigation measures, together with a provisional implementation plan that includes basic information about proposed techniques, locations and costs.

4.2.4.6 Preparation of EIS or Report

The EIS documents the impacts of the proposal, the proposed measures for mitigation, the significance of effects and the concerns of the interested public and the communities affected by the proposal (IAIA & IEA 1999).

The purpose of the EIS is (CBD Decision VI/7)

- to assist the proponent to plan, design and implement the proposal by eliminating or minimizing the negative effects and maximizing the benefits,
- to help the government or responsible authority in decision-making whether the proposal should be approved,
- to assist the public to understand the proposal and its impacts.

The decision stresses the need to take into account the ecosystem approach (see Chapter 4.4.1) to consider regional and transboundary impacts.

4.2.4.7 Review of the EIS

The review of the EIS should be carried out to determine whether the report meets its terms of reference, provides a satisfactory assessment of the proposal and contains the information necessary for decision-making (IAIA & IEA 1999).

Decision VI/7 calls for biodiversity experts to carry out the review and to disseminate information on standards for good practice. Public involvement and stakeholder consultation are also important at this stage. However, according to TREWEEK (2001) there are few examples of good practice for biodiversity review criteria.

4.2.4.8 Decision Making

This is the step in which the proposal is approved or rejected and the terms and conditions for its implementation are established (IAIA & IEA 1999). In practice, project rejection seldom occurs (WERNER 1992). The project proponent and the decision-making body should be two different entities to avoid bias in decision-making. Decision VI/7 of the CBD calls for the application of the precautionary approach in the case of scientific uncertainty.

4.2.4.9 Follow up (Monitoring and Evaluation)

Monitoring, review and evaluation are important steps in the EIA process – however, they pose one of the major weaknesses of environmental assessment. The consequences of lack of follow-up are summarised by TREWEEK (2001):

- Predictions are not tested or verified.
- Implementation of mitigation proposals is not "policed".
- Success of mitigation cannot be evaluated.
- No corrective action can be taken should impacts prove worse than predicted.
- No corrective action can be taken should mitigation measures fail to safeguard biodiversity.
- Biodiversity monitoring data cannot be obtained and the predictive base is weakened as a result.

BAKER & DOBOS (2002) presented the Strategy of Environment Canada – a Federal Government Department – for the creation of a framework for EA follow-up, which was developed to overcome this perceived weakness of the EIA process. The first step has been to propose several amendments to the existing Canadian Environmental Assessment Act. In anticipation of the proposed changes by the Act, Environment Canada has worked out a 5-step framework for the inclusion of sound follow-up into EIA processes. The steps are:

- **Screening of projects to determine the need for an EA follow-up programme**. For this purpose, a series of screening criteria have been developed, e.g. if the project involves a new technology, new or unproven mitigation technology, is placed in an environmentally sensitive area. If one or more of 11 questions are answered with "yes", the need for an EA follow-up is suggested.
- **Design and implementation of the EA follow-up programme**. This includes the definition of roles and responsibilities of key participants, the selection of the issues to be addressed in the follow-up programme, and the selection of methodologies and tools.

- **Evaluation of the follow-up results and outcomes**. This step should determine the completeness and adequacy of the information provided.
- **Management of the EA follow-up issues**. This includes further adaption of the follow-up programme, e.g. if proposed mitigation measures have not been implemented or were not effective, if unexpected environmental impacts were identified, or if the EA was incorrect in its predictions of the anticipated effects of the project.
- **Reporting of EA follow-up programme results.** For climate mitigation projects, a good approach to identify issues relevant for monitoring in a follow-up process would be to select those aspects that received particular stakeholder attention during the public consultation phase.

4.2.5 EIA and Biodiversity at the World Bank

The World Bank has published a series of guidelines, operational policies and toolkits that refer to the consideration of biodiversity aspects in environmental impact assessment. The most important publications are:

- Environmental Assessment Sourcebook Update No. 20: Biodiversity and Environmental Assessment (1997).
- Biodiversity and Environmental Assessment Toolkit (2000).
- Operational Policies on Forests (2002) (see Chapter 4.4.2), Natural Habitats (2001), Environmental Assessment (1999) and on Pest Management (1998) (see Chapter 2.3.1).

The Biodiversity Toolkit and the EA Sourcebook Update provide information on resources and guidelines for the different steps in an EIA, as well as a review of current Bank experience and perceived problems with the integration of biodiversity into the EIA process.

The EA Sourcebook Update lists development activities that are likely to induce significant impacts upon biodiversity. Significant impacts in the terms of the Bank's Policy qualify a development as "Category A", which means that an EIA is mandatory.

Developments with likely significant impacts that could be relevant in the context of climate projects are (WORLD BANK 1997):

"**Agriculture and livestock projects** involving land clearance, wetlands elimination, water diversion and inundation for storage reservoirs, displacement of wildlife by domestic livestock, use of pesticides, or planting of monoculture crop systems."

Pesticides, especially herbicides are often used if degraded lands are reclaimed and resistant vegetation is eliminated to establish the desired crop/vegetation cover. Monoculture crop systems can be established as energy source for bioenergy projects. So some types of possible climate projects would probably fall into this category.

"**Forestry projects** that meet the conditions for Bank involvement (defined in OP 4.36 on Forests) but nevertheless may involve clear-felling, or other forms of intensive forest harvesting or conversion of natural habitats, construction of access roads, establishment of forest products which may induce development." It cannot be excluded that natural habitats are converted in A&R or forest management projects. This can only be judged properly if a detailed map with existing habitats in the proposed project area exists, and if this map can be compared with detailed – mapped – information on the location, extent and type of activities in these areas.

The Biodiversity and Environmental Assessment Toolkit provide some practical information on important questions such as:

- Selection and enabling of biodiversity specialists.
- Criteria to be used during screening and scoping for the identification of impacts.
- Strategies and resources for cost-effective data- and information-gathering, including baseline data (e.g. Rapid Assessment Programmes (RAP)).

The toolkit provides a lot of information on literature, organisations and web resources that can be used for these purposes.

4.2.6 Biodiversity Impact Assessment: an IUCN Approach

BAGRI & VORHIES (1997) present a new IUCN approach called "Biodiversity Impact Assessment" in a draft discussion paper for SBSTTA 3 of the CBD. The authors characterize Biodiversity Impact Assessment (BIA) as a:

> *...new technique which helps existing techniques achieve the CBD's three objectives. Introducing biodiversity concerns into conceptual stages of planning, BIA achieves the integration needed to spur innovative solutions which place biodiversity conservation, sustainable use, and equitable sharing at the core of planning processes.*

Similarly to the work of TREWEEK (2001) and Decision VI/7 of the CBD, the authors provide some criteria and biodiversity-specific aspects for the different stages of the EIA or SEA process. An additional idea of BIA is, however, to include biodiversity aspects much earlier into the planning process than commonly achieved in the stages of the EIA process and to identify biodiversity impacts from a biophysical perspective. This includes:

Identification of an impact on biodiversity (independent from planned developments but as an analysis of the current status quo of biodiversity in a given region). An example would be the decline of a population of a certain species in this region:

- Establishment of the causes of the impact (e.g. habitat loss, introduction of species, over-exploitation of plant and animal species).
- Determination of alternate means of addressing the impact.
- Assess costs and benefits of each alternative.
- Select an alternative.
- Develop the project, programme or policy.
- Implement the project, programme of policy.
- Monitor the progress.
- Audit the progress.

The “classic” EIA or SEA process only starts at the stage of the development of project, programme or policy. The authors think that an EIA will seldom be necessary for such projects, while they recommend carrying out a SEA process.

The BIA approach provides only limited guidance for the integration of biodiversity aspects into climate-related projects because the starting point for such projects is the climate policy of a country (in the case of domestic action) or a project idea note with an already proposed project (in the case of JI or CDM projects). The opportunity to start the project from a biodiversity perspective and provide an analysis of the status quo of biodiversity in that region is going to be missed in this case.

A feasible application of the BIA approach in climate-related projects would be to identify biodiversity challenges in a given region and then select project types from the climate portfolio that would help to address these problems. For example, the creation of wetlands for flood retention (as an adaptation strategy) in a region where rivers have been channelled throughout their course could provide additional habitat for wetland plants and animals and wintering grounds for migrating birds.

The cost-benefit analysis described in the IUCN approach uses a matrix that lists as far as possible quantified costs (e.g. implementation of a hunting ban on an endangered species) and benefits for biodiversity (e.g. estimated rise in numbers of the species due to the project activity) and for the relevant stakeholder groups (e.g. hunters, conservationists) for all proposed project alternatives and for the “do-nothing”-option. This matrix can help to identify the least expensive and most effective option.

4.2.7 Conclusions and Recommendations

TREWEEK (2001) summarises the main barriers to effective incorporation of biodiversity aspects in EIA, in the order of importance:

- Lack of capacity (institutional, regulatory) for enforcement of EIA regulations.
- Lack of public awareness (development and environment).
- Lack of reliable, up-to-date data on biodiversity distributions, status and threats
- Lack of follow-up or post project monitoring.

- Lack of biodiversity / EIA expertise (lack of trained professionals).

IUCN (2001) stresses the possible links between the development of a NBSAP and SEA/EIA and calls on the SBSTTA of the CBD to consider how NBSAPs and National Development Strategies could be better integrated and to explore the role of strategic environmental assessment as a tool for such an integration, and promote the establishment of clear conservation targets through the NBSAP process and the use of those targets for the screening and scoping stages of EIA and for developing mitigation measures.

TREWEEK (2001) mentions NBSAP as a good means to draw information for impact assessment. NBSAPs provide information on the status and distribution of biodiversity and objectives against which impacts on biodiversity could be evaluated. In their second national reports, 33% of the Parties state they had completed, adopted or already implemented their National Biodiversity Strategy and 25% had completed, adopted or implemented their National Biodiversity Action Plan. Approximately 48% of all Parties have not yet submitted their second National Reports (www.biodiv.org). However, the information and targets given in the NBSAP are mainly on a sectoral and national basis and are given on a high level of aggregation. This limits the use of NBSAPs for the application for project- and site-specific questions as relevant for project-based EIA. NBSAPs could be more relevant for strategic environmental assessments (see Chapter 4.3).

EIA as an instrument for including biodiversity aspects into climate projects has several strengths and weaknesses.

The strengths of EIA are:

- EIAs are a commonly applied tool in many countries.
- In most countries, the implementation of EIAs is based on national legislation.
- Important funding agencies like the World Bank have developed standards and policies for the implementation of EIA.

- EIA has been included into important decisions on the CDM and on JI within the context of the international negotiations of the UNFCCC and its KP[22].

The weaknesses of EIA are:

- Biodiversity criteria are not mandatory for EIA procedures in many countries, and are more often neglected in EIA practice. This means that even if an EIA is carried out for a climate project, there is no guarantee that the relevant biodiversity aspects will be adequately considered.
- As a project-based tool, EIA leaves only limited space for the consideration of alternatives. In most cases, only minor changes to the project design will be carried out as a result of an EIA.

To overcome these weaknesses and to establish EIA as a powerful instrument for the inclusion of biodiversity aspects into climate projects, activities and measures on several levels are necessary:

National guidelines and regulations for EIA and guidelines of funding organisations:

- Countries should seek to review their national regulatory frameworks and explicitly require that biodiversity aspects be considered in EIA.
- Organisations that fund climate-related projects should provide clear guidelines on EIA processes to be implemented by project applicants.
- National frameworks should strengthen the step of follow-up and monitoring within EIA.
- To simplify EIAs of climate projects, sample terms of reference should be developed for the most common types of activities.

The political process and further development of the CBD and UNFCCC/KP:

- For future commitment periods, a clear framework for the inclusion of biodiversity aspects into climate mitigation and adaptation activities should be developed. This should not only apply to CDM and JI projects but also to domestic activities.

[22] FCCC/CP/2001/13/Add.2, Annex §33(d), FCCC/CP/2003/L.27 Annex § 12(c), Appendix B 32 (j) (ii).

- The UNFCCC COP should either agree on minimum standards for EIA to be fulfilled by project proponents or exclude countries from participation in the flexible instruments of the Kyoto Protocol if they have no EIA regulation in place.

The practice of EIA:

- Project developers, funding organisations and other operational entities should seek to include biodiversity experts into the teams that carry out EIA for climate projects. The Biodiversity and Environmental Assessment toolkit of the World Bank provides lists of organisations and professional societies that provide information on biodiversity experts.
- Public consultation, especially with local experts could be a useful approach to overcome the lack of biodiversity data in EIA.
- Cost-effective methods for data and information gathering could overcome the problem of poor data availability (e.g. choosing from the indicator sets worked out by the SBSTTA of the CBD), carry out rapid RAPs or draw on international sources of secondary data on biodiversity.

4.3 Strategic Environmental Assessment (SEA)

4.3.1 Definition and Types of SEAs

SEA is an environmental assessment of a strategic action like a policy, plan or programme (PPP). A more detailed definition is given by THÉRIVEL et al. (1992): SEA is

> *the formalized, systematic and comprehensive process of evaluating the environmental effects of a policy, plan or programme and its alternatives, including the preparation of a written report on the findings of that evaluation, and using the findings in publicly accountable decision-making.*

Other terms used for assessments at the strategic level are policy environmental assessment, policy impact assessment, sectoral environmental assessment, programmatic environmental impact statement, environmental assessment of policies,

plans and programmes and integration of environmental assessment into policy-making (THÉRIVEL & PARTIDÁRIO 1996). SEA can be applied to:

- Sectoral PPPs (e.g. energy, tourism, forestry).
- Area-based or comprehensive PPPs which cover all activities in a given area (e.g. land use plans).
- Actions that do not result in projects but nevertheless have significant environmental impacts (e.g. agricultural practices).

LULUCF activities in a country or region are usually sectoral PPPs, or they are mostly based in specific sectors like forestry and/or agriculture. The level of a SEA can range from local to national/international.

Participation and the inclusion of the public opinion are often difficult in SEA approaches, because many PPPs are still at the stage of internal debate or confidentiality when a SEA would be applied.

Usually, SEAs are conducted by the authority that is responsible for a proposed policy or plan. In the case of climate projects, this would often be the Ministry of Environment.

4.3.2 Techniques, Methods and Procedures

SEA as an instrument for environmental assessment is not as well-established as project-based EIAs are. Only few countries have established a legal framework for SEA, and thus SEA techniques, methods and procedures still vary considerably. THÉRIVEL & PARTIDÁRIO (1996) raise the point that too early regulation of SEA and concentration on one standard procedure would counteract the current developments of methodologies. They conclude that at the moment, the development of SEA guidelines may be preferable to that of SEA regulations. However, the following elements and stages are widely used in SEA practice:

- Setting Objectives and Targets
- Identifying Alternative PPPs
- Describing the PPP

- Scoping
- Establishing Environmental Indicators
- Describing the Baseline Environment
- Predicting Impacts
- Evaluating Impacts and Comparing Alternatives
- Mitigation
- Monitoring

The following section describes these steps in more detail and suggests how they could be implemented in a SEA process that seeks to find sustainable ways of dealing with the issue of LULUCF in a country's climate mitigation strategy.

The CBD COP, in its decision VI/7 stresses the importance of strategic environmental assessments and of including biodiversity aspects into the development of new legislative and regulatory frameworks, and at the level of decision-making and/or environmental planning.

4.3.2.1 Setting Objectives and Targets

In most cases, PPPs are introduced with a specific purpose, which can be stated as one or several objectives. This step is necessary in a SEA process in order to provide the framework within which the effectivity of the PPP in achieving these objectives is measured. Objectives can be rather general (increase the amount of wind energy generated in region x) or more specific (reduce greenhouse gas emissions by x% by 2025). In the case of LULUCF issues, a possible target could be: "To reduce greenhouse gas emissions by x% by the year y through environmentally sound activities" for Annex I countries, while for Non-Annex I countries the focus could be more on attracting foreign investment into projects that contribute to sustainable development.

4.3.2.2 Identifying Alternative PPPs

Identifying alternative PPPs to the PPP subject to a SEA is a crucial step in the process to provide information for decision-makers and help finding the best option. THÉRIVEL & PARTIDÁRIO (1996) provide examples on types of alternatives that could be considered in a SEA:

- The “do-nothing” or “continue with present trends” option.
- Demand reduction (e.g. for water or energy).
- Different local approaches.
- Different types of development which achieve the same objective (e.g. produce energy by gas, coal, wind, etc.).
- Fiscal measures.
- Different forms of management.

For project-based activities in the context of the KP, SEA alternatives may include: domestic action vs. JI/CDM projects, inclusion/exclusion of the LULUCF sector, or inclusion/exclusion of certain activities (e.g. “no large-scale plantation projects”).

4.3.2.3 Describing the PPP

Descriptions of the PPP may include information on:

- the sectors affected by the PPP,
- the activities following from implementation of that policy,
- the phases of the PPP;
- the time-scale over which the PPP is expected to operate.

Assumptions about the developments likely to result from implementation of the PPP, a list of measures and maps showing possible development areas or areas with environmental constraints can be part of the description.

In the case of climate policy activities, such a description could include the types and estimated magnitude of activities, the estimated amount of carbon sequestered through these activities, the approximate locations of possible activities (for the host country in case of CDM or JI projects), the countries where JI or CDM would be located, areas to be excluded from activities (e.g. protected areas, habitats of species with local/national or international significance for conservation, natural forests) and additional information on criteria for project eligibility or procedures to be carried out to include biodiversity considerations into the design and implementation of such projects.

4.3.2.4 Scoping

Scoping is the step in which the key environmental issues that will influence decision-making are identified. THÉRIVEL & PARTIDÁRIO (1996) point out that scoping for a PPP is often more complex than for a single project, because it may involve many types of activities, the spatial scale considered is usually larger, a wider range of alternatives is possible and it is subject to more legislation and policies. It is important to distinguish between local, regional, national and global effects and impacts.

Techniques for scoping can include:

- Checklists
- Comparison with impacts of similar PPPs
- Literature
- Overlay maps
- Public consultation
- Expert judgement

In the case of climate projects, the key environmental issues to be considered could be:

- Compatibility with national regulations and international commitments (e.g. NBSAPs, CBD, Ramsar Convention)
- Impacts on soil, water and air

- Impacts on the emissions of greenhouse gases
- Impacts on protected areas and/or species
- Impacts on endangered habitats and/or species
- Impact on the sustainable use of resources
- impacts on indigenous communities
- Economic impacts of the policy

4.3.2.5 Establishing Environmental Indicators

Indicators are used to measure and describe environmental trends. For this purpose, they provide information on baseline conditions, possible impacts, and a comparison of alternatives and monitoring of the implementation of a PPP. Usually, a distinction is made between pressure, state and response indicators. Current approaches on indicators for biodiversity and sustainable forestry are discussed in more detail in Chapter 4.4.3.

4.3.2.6 Describing the Baseline Environment

The impacts of a PPP have to be evaluated against a “status-quo”-situation. This requires a description of this situation as the “baseline” of the PPP. The baseline description can apply the environmental indicators, and it focuses on the key environmental issues that have been identified in the process of scoping. The baseline description should also include an estimate about future developments without the PPP. THÉRIVEL & PARTIDÁRIO (1996) state that data collection for a SEA baseline description can be problematic, as a wide range of environmental issues may be covered and the areas to be taken into account are often large. However, in the case of SEA for LULUCF projects, a lot of baseline information on greenhouse gas emissions and on biodiversity on a national level is already contained in the national reports/ communications which all Parties of the UNFCCC and the CBD have to submit regularly.

Such information may include: status and location of forests, conservation areas, protected and endangered species or habitats, forestry and land-use practices which have an influence on biodiversity.

Techniques to describe the baseline environment include written descriptions, maps and GIS applications. The latter, however, can be time- and cost-consuming, although they provide a good combination of data-based and spatial information.

4.3.2.7 Predicting Impacts

Impacts of a PPP can be positive or negative. The task of impact prediction does not only involve a description of the type of likely impacts, but also should include information on:

- the magnitude of these impacts
- the time-scale of the impacts
- reversibility and an estimate whether they are easy or difficult to mitigate
- cumulative effects
- indirect impacts

Techniques usually applied in impact prediction are:

- checklists
- compatibility or consistency assessment
- scenario analysis
- overlay maps or GIS
- index, indicator or other weighting methods
- computer models
- expert opinion

The impacts associated with LULUCF projects, e.g. for A/R activities could be:

- Increase of monoculture plantation area in a given region

- Destruction/fragmentation of natural forests
- Replacement of non-forest habitats with high relevance for conservation
- Conservation of remaining natural forest areas
- Benefits for local communities

4.3.2.8 Evaluating Impacts and Comparing Alternatives

In this step, the significance of the described impacts is evaluated and tested whether they are consistent with the objectives of the PPP. Significance means a combination of the magnitude and type of the PPP and the sensitivity of the environment where the impacts are likely to occur. Criteria for the determination of significance can be regulations, guidelines, and the objectives of the PPP, carrying capacity of the affected ecosystems, equity issues or public opinion on the PPP.

A common technique for the comparison of alternatives is the use of a matrix, in which the environmental components and the alternatives are used as the two axes. The cells in the matrix can contain quantitative data, indices or qualitative descriptions.

4.3.2.9 Mitigation

Mitigation measures are measures that avoid, reduce, repair or compensate for a PPPs impacts. THÉRIVEL & PARTIÁRIO (1996) provide some examples of possible mitigation measures:

- planning future developments to avoid sensitive sites,
- placing constraints on, or establishing a framework for lower-tier PPPs,
- establishing or funding the establishment of new areas of nature conservation or recreation, and
- establishing management guidelines for the implementation of the PPP.

After proposing the mitigation measures, the impacts of the mitigated PPP should also be assessed.

In the case of LULUCF projects, such mitigation measures could include the creation of a framework for lower-tier PPPs or EIAs, exclusion or restriction of projects to certain areas or requirements about management guidelines for project implementation.

4.3.2.10 Monitoring

Monitoring is the step which allows to:

- test whether the PPP achieves its objectives/targets,
- identify negative impacts that remain in spite of the proposed mitigation measures;
- help to ensure that proposed mitigation measures are implemented.

THÉRIVEL & PARTIDÁRIO (1996) point out that in today's SEA practice, monitoring is still a weakness that should be improved.

For LULUCF projects, SEA monitoring could include the portfolio development of the projects in a country, the real versus the estimated amount of carbon sequestered in a given time, the impacts on plant or animal species, habitat area, species and structure development in newly-planted forest or other vegetation. The problem is that many of the impacts of the PPP will only become clear after a long time, and that monitoring will thus be a long-term, time-consuming process. Thus it is important to include reasonable monitoring mechanisms into the design of a SEA from the very beginning and to develop measures to be taken when monitoring reveals that program targets are not met.

4.3.3 Status quo of SEA

With SEA being a relatively new instrument, most countries in which SEAs are carried out have not yet established a legal framework for SEA. Internationally, most SEA applications have taken place at the level of plans and programmes, with fewer examples of higher level policies (KJORVEN & LINDHEJM 2002). Table 11 provides an overview over SEA practice and regulations in different regions of the world. Many of

the SEA projects carried out in developing countries have been funded by the World Bank. In countries of the economies in transition, Poland has a very advanced system in place. However, due to the acquis communitaire, those countries that are accession candidates for the EU will have to adopt the EU-wide regulations within a certain time.

Table 11: Application and Regulations on SEA in Different Regions of the World

Country/Region	SEA Application	Existing regulations
USA (federal) (1)	Plans Programmes	Provisions for SEA included in the NEPA (National Environmental Policy Act), 1970
Canada (1)	Policies and programmes to cabinet	Cabinet directive of June 1990
New Zealand (1)	PPP	Provisions for SEA under Resource Management Act, 1991 and Environmental Protection and Enhancement Procedures, 1974
Australia (federal) (1)	PPP	No formal regulations
European Union		SEA Directive 2001/42/EC adopted in 2001
The Netherlands (1)	PPP Cabinet decisions	1987 EIA require SEA for activities in the positive list
Denmark (1)	PPP Bills and other government proposals	No formal regulations
Sweden (1)	PPP	No formal regulations
Germany (1)	PPP	No formal regulations
Finland (1)	PPP	No formal regulations
France (1)	PPP	No formal regulations
Bulgaria (2)	National development programmes, territorial development and urban development	EIA as required in Environmental Protection Act (1991)
Czech Republic (2)	Development concepts SEA required for energy, transport, agriculture, waste treatment, mining, processing of minerals, recreation and tourism	Act on Environmental Impact assessment, 1992,
Estonia (2)	Plans Programmes	EIA and Environmental Auditing Act, 2000
Poland (2)	Broad strategy and land-use plans	Law on access to Information on the Environment, 2000, including the EC SEA directive
Slovakia (2)	Development policies (energy, supply, mining, industry, transport, agriculture, forestry, water and waste management, tourism) Legislative proposals	Act on Environmental Impact Assessment, 1994
Lithuania (2)	Initial EIA of territorial planning	-
Slovenia (2)	EA of land-use plans	Environmental Protection Act, 1993
Russia (4)	SEA has been carried out to determine whether Russian Federation should ratify the KP or not (2001)	-
Independent states of Former Soviet Union (3)	Little or no development	All laws, programmes, plans and projects are subject to environmental assessment
China (3)	Regional development plans	Work for legislation under way
Indonesia (3)	Energy and water resources	Work for legislation under way

Country/Region	SEA Application	Existing regulations
Thailand (3)	Energy and water resources	-
Vietnam (3)	Energy and water resources	-
Nepal (5, 3)	Bara Forest Management Plan, hydropower development options (World Bank)	-
Pakistan(3)	National drainage programme	-
India (3)	Transport and rural sectors	-
Korea (3)	Regional development plans	-
Taiwan (3)	Regional development plans	-
Brazil (3)		State legislation in Sao Paulo State
Chile (3)	Urban zoning plans	-
Colombia (3)		Work on guidelines is under way
Egypt (3)	Coastal tourism development	-
Ethiopia (3)	National road programmes	-
Tanzania (3)	SEA is part of the national park planning process	-
South Africa (3)		Guidelines for SEA have been developed

Sources: PARTIDÁRIO 1996 (1), DUSIK et al. 2001 (2), KJORVEN & LINDHEJM 2002 (3), CPPI 2001 (4), KHADKA et al. 1996 (5)

4.3.4 The EU Directive on SEA

On 31 May 2001, the European Parliament and on 5 June 2001, the Council formally adopted the SEA Directive 2001/42/EC ("Directive 2001/42/EC of the European Parliament and of the Council on the assessment of the effects of certain plans and programmes on the environment").

The Directive requires Member States of the EU to bring into force national laws, regulations and administrative provisions to comply with the directive until 21 July 2004.

As the directive refers only to plans and programmes, and not to policies, it is debateable whether SEA as required in the directive would apply to a policy such as adoption of the KP. "Plans and programmes" are defined in Article 2 as "plans and programmes, including those co-financed by the European Community, as well as modifications to them:

- which are subject to preparation and/or adoption by an authority at national, regional or local level or which are prepared by an authority for adoption, through a legislative procedure by Parliament or Government, and

- which are required by legislative, regulatory or administrative provisions;"

The implementation of the KP in many cases gives rise to national climate programmes or other activities, which would fall under this definition. Some countries, e.g. Belgium, are preparing sectoral or regional plans (e.g. "CO_2 – Rational Use of Energy Plan" or "Climate Policy Plan for the Flemish Region").[23] LULUCF activities are usually part of a larger national or regional climate programme or plan. Parties have to include information on such plans, programmes and policies into their national communications.

According to the EU Directive, a SEA has to be carried out for plans and programmes which are likely to have *significant* environmental effects. EIAs have to be "...carried out for all plans and programmes which are prepared for agriculture, forestry, fisheries, energy, industry, transport, waste management, water management, telecommunications, tourism, town and country planning or land use and which set the framework for future development consent of projects listed in Annexes I and II to Directive 85/337/EEC or (b) which, in view of the likely effects on sites, have been determined to require an assessment pursuant to Article 6 or 7 of Directive 92/43/EEC (Art. 3)". This means that potentially, all types of climate mitigation activities would be included in the scoping of a SEA. However, Art. 3.3 of the directive leaves it to the Member States to determine whether plans which determine the use of small areas at local level are likely to have significant environmental effects.

The Directive names criteria for the determination of significant effects in Annex II. They refer to the characteristics of the plans and programmes (e.g. the degree to which the plan or programme sets a framework for other projects or activities, the degree to which the plan or programme influences other plans and programmes, the relevance of the plan or programme for the integration of environmental considerations, environmental problems relevant to the plan or programme) and the characteristics of the effects and of the area likely to be affected (probability, duration, frequency and reversibility of the effects, risks to human health or the environment, the magnitude and spatial extent of the effects, the value and vulnerability of the area and the effects on areas or landscapes which have a recognized national, community or international protection status.)

[23] http://unfccc.int/resource/docs/natc/belnc3.pdf

The SEA Directive refers specifically to the requirements of the Convention on Biological Diversity, which "...requires Parties to integrate as far as possible and as appropriate the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans and programmes"(§3).

The elements of the SEA process which are regulated in the directive are:

- Screening/determining which plans
- Scoping/programmes require an SEA
- Environmental Report (Art. 5)
- Consultations (Art. 6)
- Transboundary consultations (Art. 7)
- Decision making (Art. 8)
- Information on the decision (Art. 9)
- Monitoring (Art. 10)

Although some guidance on the information to be included in the environmental report is given in Annex I, the Directive does not prescribe a draft methodology or standard procedure for SEA.

4.3.5 SEA Activities of the World Bank and other International Funding Agencies

The World Bank

The World Bank is increasingly applying SEA systematically as part of its Bank operations. This is laid down in the Bank's Environment Strategy (WORLD BANK GROUP 2001). For implementation purposes, the Bank has started a "Structured Learning Programme" on SEA over 3 years.

Several projects have been funded during the last years in developing countries. KJORVEN & LINDHEJM (2002) summarise the status quo of World Bank experience with this instrument. Most projects were sectoral SEAs in the sectors roads, water supply,

water resources management, urban development, power and mining. One project in Argentina dealt with climate change adaptation ("El Niño Emergency Flood Project", 1998), but as this project has been categorized as Category C project (likely to have minimal or no adverse environmental impact), no further EA action beyond screening is required according to the Bank's Operational Policy on EA.

Key learnings from past SEA experience in World Bank activities are summarised as follows by KJORVEN & LINDHEJM (2002):

- Many SEAs have modest scope, and are hardly undertaken from the very beginning of a project onward.
- Sufficient baseline data can be generated at low cost.
- It is important to integrate socio-economic aspects.
- The assessment of cumulative aspects is still a challenge.
- The analysis of alternatives becomes more viable, which overcomes a typical weakness of environmental impact assessments.
- The nature and extent of public consultation is a critical variable.
- SEA may limit the need for subproject EA work, e.g. by eliminating those subprojects that would be environmentally or socially problematic.

4.3.6 LULUCF-Specific Examples of SEA (SEA and Biodiversity)

In current SEA practice, there are not many examples that could be used as a blueprint for SEA of climate policies, plans and programmes, especially in the LULUCF sector. Only a few examples of SEAs have been carried out in the forestry or agriculture sector. In the following section the Bara Forest Management Plan are presented as an example for SEA based in the forestry sector.

Bara Forest Management Plan, Nepal

In the Bara District of Nepal, a new Operational Forest Management Plan (OFMP) was proposed to meet the increasing demand for forest products and to improve Nepal's economy. Deforestation rates in this region of lowland forest are high, and natural sal

(*Shorea robusta*) forests are rapidly declining in this area. The aim of the proposed OFMP was to achieve higher volumes of timber and fuelwood production on a sustainable basis, higher revenues to local and national governments, increased local employment and reduced levels of environmental and forest degradation (KHADKA et al. 1996). Although EIA is not a very common tool in Nepal, the national EIA guidelines and the sectoral EIA guidelines for the forestry sector require forestry management plans to undergo SEA. The SEA was carried out by the International Union for Conservation of Nature and Natural Resources (IUCN) Nepal. Only two alternatives, the "do-nothing" and the options of the proposed plan were assessed.

The consultants determined 150 major impacts, which were grouped into 19 broad issues. These issues were discussed for both alternatives and ranked by magnitude, extent and duration of the impacts. Examples for impacts are: employment, poaching of wildlife, fuel wood gathering for domestic purposes, timber harvesting methods, and loss of habitats and biodiversity. For this last issue, an environmental survey was recommended which should be incorporated into the management plan as a biodiversity implementation manual.

As the consultants had some difficulty in collecting enough quantitative data for the assessment, the impacts were discussed during a series of workshops attended by NGOs, consultants, proponents, stakeholders, policy-makers and forest administrators and ranked as indicated above. The result of this process was that the implementation of the plan had more beneficial effects than the "do-nothing" alternative. For addressing the possible negative impacts of the plan, a series of mitigation measures were recommended, including an inventory of environmentally sensitive areas and the development of strategies for biodiversity conservation. It was recommended to monitor and evaluate the plan, but the authors provide no information on the implementation of such monitoring activities.

Lessons that can be learned from this example for the application of SEA for LULUCF-related projects are:

- Biodiversity issues were identified as a critical issue, which needed further clarification and further investigation to be appropriately considered.

- The SEA of the forest management plan served well as a tool to identify and assess a wide range of possible impacts of the project previously not considered in the original plan.

4.3.7 Conclusions and Recommendations

The instrument SEA is an appropriate tool for including biodiversity considerations into climate-related plans, programmes and policies. The main actors who would apply SEAs are national and regional authorities or governments, and donor or funding agencies that fund climate projects. However, a broad application of SEA, especially for LULUCF projects, depends on the national regulatory frameworks and on the question if SEAs are considered compulsory for the type of projects and activities possibly considered. It also depends on the question whether project-based activities are part of a formally stated policy, plan or programme or if they are just planned and carried out independently and negotiated directly between the investor and the host. The adoption of a formal national or regional policy, plan or programme is not a binding requirement for participation in the CDM or JI (Decisions 17/CP.7 and 16/CP.7).

The strengths of SEA with respect to the consideration of biodiversity aspects into climate projects can be summarised as follows:

- SEA overcomes an important weakness of project-based EIA in that it can be used to assess a wider range of possible alternatives. Different mitigation options, e.g. including or excluding LULUCF sector activities, could be tested against each other.
- If SEA is carried out early, certain activities, project types or areas could be excluded from the very beginning before the planning stage. Through SEA, a country could exclude certain activities or define eligibility criteria beyond the Kyoto targets and set a framework for environmentally sound mitigation activities.
- SEA is currently gaining importance worldwide, especially in organisations like the World Bank that are working in the field of carbon funding.

- Past experience with SEA shows that it does not need to be expensive, and that it can even minimize costs by eliminating unsustainable project alternatives at an early stage.
- SEA can assess the cumulative effects of several (smaller) projects in one area - e.g. the effect of a new hydropower dam in catchments where dams already exist.

However, there are also some weaknesses of SEA that have to be overcome if this instrument should serve for the purpose of integration of biodiversity aspects.

- So far, not many countries have established binding regulations on SEA, especially developing countries lack legislation on this instrument. If this aspect is not considered in the negotiated guidelines in the UNFCCC process, countries without SEA regulations might be preferred as host countries for CDM projects over countries with binding SEA requirements. However, a lot of SEA projects in developing countries have been funded by donor and funding agencies, so that even without formal legislation, a SEA could be carried out.
- As SEA is a relatively new tool, there are no standard methods that could be applied internationally. While this may be an opportunity to use tailor-made, adapted methodologies for each assessment, the danger emerges that the quality of the assessment can vary considerably or that SEA is not applied because it would require too much effort for developing the methodology.
- The costs for a SEA are usually not borne by the project proponent, as in EIA, but by the public. This could be a disincentive for developing countries to apply the instrument, as they would have to bear the additional costs.

For successful application of this instrument, further development and institutional strengthening are necessary. Since few developing countries have SEA legislation in place, negotiations on modalities and guidelines for afforestation and reforestation should seek to include SEA as an instrument for consideration of biodiversity aspects – not only if the respective host country requires such EA, but as a general rule.

4.4 Management Guidelines and Related Instruments

The guidelines presented and discussed in this chapter provide a framework for the sustainable use of land in the context of forestry, agriculture and energy and follow the internationally agreed principles of the Rio Declaration to guide national and international actions on environment, development, and social issues.

The following selection of guidelines focus on those with international, regional (e.g. Europe) or national importance. They contribute to facilitate policy options, planning mechanisms and management processes for effective implementation of sustainable land use systems. Considering these different tasks and the various fields of application it is obvious that the guidelines vary in scope, target and depth.

Guidelines are also well-known instruments for integrating biodiversity requirements into policy sectors other than environment, i.e. in the forestry, energy and agricultural sectors. These guidelines are thus of increasing relevance in a lot of climate change mitigation activities, especially in the LULUCF sector. Many comprehensive guidelines already exist in the areas of sustainable use of forests and land. In the energy sector respective sources are rather limited at the current stage, but some initiatives still have been initiated.

This study deals with guidelines in areas which are relevant for the different types for climate mitigation. This includes the sectors forestry (afforestation, reforestation and deforestation (ARD), and forest management), land management (cropland management, grazing land management, and cultivation of energy crops) and energy (e.g. hydropower and dams).

The process of guideline development often, but not necessarily, leads to the development of adequate criteria and indicators. This is particularly the case in the forestry sector as the international discussion in this field is already quite advanced. For the purpose of this study the analysis of guidelines, criteria and indicators in the field of forestry is conducted in one chapter. In the field of agriculture and energy guideline and indicator development often arise from different processes. They do not always depend upon each other, however they might be complementary. Additionally to the sub-chapter on “Guidelines in Other Sectors”, a separate chapter discusses indicators related to land management and energy (see Chapter 4.5.3).

4.4.1 General Guidelines

The articles of the UNFCCC under the KP and the MA provide criteria and guidelines for sink activities (see Chapter 2.1). For example the following CDM criteria and conditions can be derived from the texts on this subject in the UNFCCC and it's KP:

- Legal and institutional compliance
- Changes in carbon uptake must be real and measurable
- Financial and **environmental additionality**
- Technology transfer to non Annex I country
- Environmental sustainability
- Social sustainability
- **Sustainable development requirement**
- No unjustifiable discrimination between host countries
- Non-Annex I country will benefit from CDM projects
- Carbon sequestration before 2000 can not be accounted
- Public as well as private entities can participate
- Permanence needs to be ensured
- Sovereignty needs to be ensured

Similar conditions exist for JI project activities. However, the texts in these articles provide only a framework for activities carried out under the KP and can not be viewed as listing any operational criteria. Especially not in only one aspect, like the biodiversity. There are too many possibilities for different interpretations of the same text by different actors. These articles must therefore be viewed only as rough guidelines for JI/CDM projects. More detailed there already is the MA (UNFCCC/CP/2001/13/Add.1). Several guidance for LULUCF activities are given, latest with the "modalities and procedures for A&R project activities under the CDM in the first commitment period of the KP" (UNFCCC/SBSTA/2003/L.27) at the COP 9 (see Chapter 2.1.2).

The Ecosystem Approach (EA) of the CBD

The EA (UN 2000) of the CBD which acknowledges the three objectives of the CBD is a strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way (CBD Decision V/6). The ecosystem approach does not preclude other management and conservation approaches, such as protected areas or single species conservation programs, but rather can be used to integrate all these approaches in order to achieve better management of complex situations. The strength of the ecosystem approach lies in the participation of stakeholders; the consideration of all knowledge, including traditional knowledge; and in the balance it strikes among ecological, economical and social interests (HÄUSLER & SCHERER-LORENZEN 2001). Adaptive management is an integral part of the ecosystem approach, allowing prompt responses to changing situations and new knowledge. The ecosystem approach is based on twelve inter-related guiding principles which facilitate decision-making concerning biological diversity (see Table 12).

In the meantime, several studies have been conducted concerning the implementation of the ecosystem approach in different ecosystems. All studies agree more or less on the fact that EA principles are a good and reliable basis for the integration of biodiversity aspects in land use activities; however for the use in specific projects they can be interpreted in too many different ways. For this reason there is only limited use for EA in climate change mitigation activities/projects, e.g. when elaborating a PDD. Apart from that, EA should be a general requirement as a basis for any activity.

Table 12: The 12 Principles of the Ecosystem Approach of the CBD

1. The objectives of management of land, water and living resources are a matter of societal choice. 2. Management should be decentralized to the lowest appropriate level. 3. Ecosystem managers should consider the effects (actual and potential) of their activities on adjacent and other ecosystems. 4. Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programmes should: - Reduce those market distortions that adversely affect biological diversity; - Align incentives to promote biodiversity conservation and sustainable use; - Internalise costs and benefits in the given ecosystem to the extent feasible. 5. Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach. 6. Ecosystems must be managed within the limits of their functioning. 7. The ecosystem approach should be undertaken at the appropriate spatial and temporal scales. 8. Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term. 9. Management must recognize that change is inevitable. 10. The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity. 11. The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices. 12. The ecosystem approach should involve all relevant sectors of society and scientific disciplines
Operational Guidelines 1. Focus on the functional relationships and processes within ecosystems. 2. Enhance benefit-sharing. 3. Use adaptive management practices. 4. Carry out management actions at the scale appropriate for the issue being addressed, with decentralization to lowest level, as appropriate. 5. Ensure intersectoral cooperation

Source: CBD Decision V/6

The Gold Standard (GS)

The GS has been initiated by the World Wildlife Fund (WWF) in conjunction and consultation with a wide range of environmental, business and governmental organisations and on the basis of work already carried out by other groups (e.g. the Climate Action Network – an umbrella group of environmental NGOs working on climate change). The GS has been developed as a best practice benchmark for greenhouse gas offset projects in the framework of CDM/JI. It has been developed to provide project developers with a tool to ensure that CDM and JI projects deliver credible projects with real environmental benefits (WWF 2003). The GS only provide

renewables and energy efficiency projects[24]. But surely it also contains a lot of components which are useable generally for climate projects. The GS builds upon the guidance given by the PDD.

In 2003 the GS was conglomerated in several workshops to the CDM-PDD from the UNFCCC with extra requirements that have to be fulfilled in order for a project activity to be eligible as a GS CDM project. The present study refers to some project activities among others which are eligible under the GS like renewable energy projects, use of biomass (energy crops, agro-processing and other residues), windpower or hydropower (small low-impact hydro, with a maximum output capacity equivalent of up to 15 megawatts, complying with WCD guidelines (see Chapter 6.4.5.3)). Furthermore it would be desirable to apply a GS for LULUCF activities. This remains still to be developed.

Any project seeking to achieve the GS should demonstrate clear benefits in terms of sustainable development. The contribution of project activity to the sustainable development is based on a matrix containing indicators of three broad components:

- Local/regional/global environment sustainability;
- Social sustainability and development;
- Economic and technological development.

The local/regional/global environment component includes:

- Water quality and quantity;
- Air quality (emissions other than GHGs);
- Other pollutants: (including, where relevant, toxicity, radioactivity, stratospheric ozone layer depleting gases);
- Soil condition (quality and quantity);
- **Biodiversity** (species and habitat conservation).

[24] Following extensive consultations, it became clear that focusing on renewables and energy efficiency are the only project types that will gain global NGO support (further information see www.panda.org/about_wwf/what_we_do/climate_change/what_we_do/ business_industry/gold_standard.cfm).

The component biodiversity is used to evaluate the contribution of the project to local biodiversity. The change in biodiversity is estimated on a qualitative basis considering any destruction or alteration of natural habitat compared to the without projects scenario. A positive change will be given by previously disappeared species re-colonizing the area, a negative change will be given by species disappearing or by introduction of foreign species. In judging this, inputs from local communities should be considered a key resource.

Finally the GS is strongly including the EIA (see Chapter 4.2), respectively is setting store by stakeholder consultation. Hence the GS is not only a guideline rather it is a comprehensive tool which deals with different instruments, and annexes which are allowing a specification, to consider biodiversity aspects proportionally well in climate projects.

4.4.2 Guidelines of Funding Agencies and Other Organisations

Prototype Carbon Fund (PCF)

The PCF assessment (see Chapter 2.3.1) for projects in which it participates is based on a number of criteria. Of course, the main objective is that the projects contribute to meeting the KP targets. The Fund has specified criteria on the quality of the projects in which it participates. The PCF project selection quality criteria are summarised in Table 13. The decisive item is that PCF projects must be consistent with the World Bank's Country Assistance Strategy and ensuring complementarily with the GEF's operations. Because five of the GEF operational programs (see below) and also some World Bank’s policies are in the biodiversity focal area biodiversity aspects are taken more or less into account (see Chapter 2.3.1).

Table 13: PCF Eligibility Criteria

• Consistency with the UNFCCC and/or the KP rules and procedures;
• Consistency with the relevant national criteria for Kyoto Mechanism projects;
• Consistency with the World Bank's Country Assistance Strategy;
• Ensuring complementarity with the GEF's operations;
• Contributing national and local environmental benefits;
• Consistency with the Fund's own Strategic Objectives and Operating Principles;
• Consistency with the guidance provided by investors as implementation proceeds and international regulatory framework is better defined.

Example Operational Policy and Bank Procedure (PO/BP) 4.36 *Forests* of the World Bank

First in 1993 the World Bank issued an operational policy *Forests* for use by World Bank staff as a guidance for funding projects in the forestry sector. The overall aim of current WB forests policy is to reduce deforestation, enhance the environmental contribution of forested areas, promote afforestation, reduce poverty and encourage economic development. The Bank states: "Where forest restoration and planting developments are necessary to meet the overall aim, the Bank assists borrowers with forest restoration activities that maintain or enhance biodiversity and ecosystem functionality."

On 31 October 2002, the Bank published its new Operational Policy 4.36 on Forests, along with definitions and its bank procedure. The new OP edition also contains special biodiversity aspects:

- "Plantations that involve any conversion or degradation of critical natural habitats, including adjacent or downstream critical natural habitats" will be not eligible for Bank financing. "When the Bank finances plantations, it gives preference to sitting such projects on unfrosted sites or lands already converted (excluding any lands that have been converted in anticipation of the project). In view of the potential for plantation projects to introduce invasive species and threaten biodiversity, such projects must be designed to prevent and mitigate these potential threats to natural habitats."

- Commercial harvesting must be certified under an independent forest certification system (e.g. see Chapters 4.4.3.4 and 4.4.3.5).

The Bank Procedure also requires that for each project under the scope of the policy, an EA category is assigned. Projects with the potential for conversion or degradation of natural forests[25] or other natural habitats that is likely to have significant adverse environmental impacts that are sensitive, diverse or unprecedented is classified as category A (see Chapter 2.3.1).

Global Environment Facility (GEF)

GEF developed operational strategies for the different thematic areas, e.g. biological diversity and climate change as well. Operational programs have been formulated for the operational strategies. As of March 2003, there have been 14 operational programs through which the GEF provides grants. OP 12, Integrated Ecosystem Management, encompasses cross-sectoral projects. Eleven of these reflect GEF's original focal areas: four in climate change and three in international waters. And five more in the biodiversity focal area:

1. Arid and Semi-Arid Zone Ecosystems
2. Coastal, Marine, and Freshwater Ecosystems
3. Forest Ecosystems
4. Mountain Ecosystems

13. Conservation and Sustainable Use of Biological Diversity Important to Agriculture

[25] The World Bank defines natural forests as "...forest lands and associated waterways where the ecosystem's biological communities are formed largely by native plant and animal species and where human activity has not essentially modified the area's primary ecological functions" (World Bank 2002).

The Bank conducts also environmental screening of each proposed project (see GLOBAL ENVIRONMENT DIVISION 1998), to determine the appropriate extent and type of EA to be undertaken, and whether or not the project may trigger other safeguard policies. The Bank classifies the proposed project into one of four categories (A, B, C, and FI) depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts (see Chapter 2.3.1, OP/BP 4.01).

4.4.3 Guidelines in the Forestry Sector

One of the first international agreements was initiated in 1992 by the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro: the forest declaration and its fifteen principles. Even if this declaration is not binding for the Nations, these principles reflect the first global consensus on all types of forests - natural and planted in all geographical regions and climatic zones, including austral, boreal, sub temperate, temperate, subtropical and tropical. As a result on national and international level, a series of rules has been evolved to define the meaning and elements of “sustainable forest management” (SFM).

HEROLD et al. (2001) provides an overview about the initiatives which developed guidelines for SFM and a short description of their formation process. The present study is based on this study. In the following, the main attention is set to the question how these guidelines take into consideration biodiversity aspects. The present study also introduces new developments in the processes since that time.

Several international organizations have developed guidelines that define SFM such as:

- The International Tropical Timber Organization (ITTO) in collaboration with the Initiative of the African Timber Organization (ATO)
- The Ministerial Conference on the Protection of Forests in Europe (Helsinki Process)
- Criteria and Indicators for Sustainable Forest Management in Dry-zone Africa
- The Montreal Process

- The Tarapoto Proposal: Criteria and Indicators for the Sustainability of the Amazonian Forest
- Criteria and Indicators for Sustainable Forest Management in the near East
- The Central American Process
- Dry Forest Asia

Very prominent guidelines are also the international certification schemes coordinated by the:

- Forest Stewardship Council (FSC)
- Pan European Forest Certification Council (PEFCC).

Other organisations that are related to the development of guidelines for sustainable forest management are e.g. the Center for International Forestry Research (CIFOR). The CIFOR developed documents like the “Guidelines to monitor reduced impact logging in the Amazon” (CIFOR 2003) or the “Reduced impact logging guidelines for lowland and hill *dipterocarp* forests in Indonesia” (SIST et al. 1998). In the end, many countries have also developed sub-national guidelines with criteria and indicators for SFM.

4.4.3.1 ATO/ITTO

During the 29th session of the International Tropical Timber Council (ITTC) held in Yokohama, Japan in November 2000, the collaboration between ATO (African Timber Organization) and ITTO was resolved in order to refine the ATO Principles, Criteria, and Indicators (PCI) and make them consistent with the ITTO C&I. Therefore both sets were examined and combined using the strengths of each in a draft of harmonised PCI for African tropical forests. During a regional ATO/ITTO workshop in Yaoundé, Cameroon, held just prior to the 30th Session of the ITTC at the same venue, the draft was finalised as the ATO/ITTO principles, criteria and indicators for the sustainable management of African natural tropical forests. This document comprises 1 principle,

5 criteria, 33 indicators and 44 sub-indicators at the national level[26], and 3 principles, 15 criteria, 56 indicators and 140 sub-indicators at the Forest Management Unit (FMU) level. An innovative feature of the ATO/ITTO PCI is the inclusion of sub-indicators which provide a basis for the development of specific verifiers and standards of performance relevant to the assessment of sustainable forest management at the FMU level in African tropical forests.

4.4.3.2 Montreal Process

After the Montreal Process, participant countries have endorsed the Santiago Declaration (1995) and committed to use an agreed-upon set of seven national-level criteria and 67 indicators as a guideline to the conservation and sustainable management of temperate and boreal forests. C&I were to be used as assessment and monitoring tools at the national level. After this, a Technical Advisory Committee has been established to develop definitions of terms and rationale statements for all indicators, to consider data collection approaches for all indicators, and to consider approaches to assembling, compiling, and reporting indicators derived from sub-national data. It was agreed at the 10th Meeting of the Working Group in Moscow (1998) to publish a set of "technical notes". For each indicator, there would be a rationale statement, definition of key words, and suggested approaches for measuring the indicator. At the 12th Meeting of the Montreal Process in Beijing (2000), the Working Group agreed on the guidelines, outline, and format of the First Montreal Process Forest Report.

[26] "To get a full picture of the evolving condition of the forest, it is necessary to examine changes (and therefore the indicators) at both the national level and that of the forest management unit. Because the sources of information for these two levels are often different (the national values being frequently an aggregation of all the values from the forest management units) and because the work may be carried out by different staff, the Manual is divided for convenience into two parts: Part A - Indicators at National level. Part B - Indicators at Forest Management Unit level" (ITTO 1999).

4.4.3.3 Asia Dry Forests

Guidelines have been completed also for the Regional Initiative for the Development and Implementation of National Level Criteria and Indicators for the Sustainable Management of Dry Forests in Asia.

In 1998, the 17th session of the Asia-Pacific Forestry Commission recognized the advances made by several countries[27] in the development and application of criteria and indicators for sustainable forest management, but at the same time noted that many countries remained outside the established international processes. The Commission therefore requested FAO, in collaboration with partner organizations, to facilitate and enhance the involvement of such countries in understanding the potential of criteria and indicators for monitoring progress toward sustainable forest management. In the sequel, a workshop was held in Bhopal in 1999 including representatives of forestry agencies from nine countries with dry forests in Asia (Bangladesh, Bhutan, China, India, Mongolia, Myanmar, Nepal, Sri Lanka and Thailand). The target was to evolve a guideline with C&I for the dry forests in Asia. It was also intended to facilitate the implementation of international level (e.g. ITTO) and national-level criteria and indicators in Asia like e.g. the Bhopal-India Process or the criteria and indicators for sustainable forest management in Buthan, Mongolia, Nepal, and China. As shown in Annex 1, the criteria referring to biological biodiversity are very close together.

[27] Five Asia-Pacific countries (Australia, China, Japan, Republic of Korea and New Zealand) participate in the Montreal Process. In addition, ten Asian countries are also in the process of adapting the ITTO criteria and indicators for their use.

Table 14. A Comparison of ITTO and Dry Zone Africa's Biodiversity Criteria and Indicators with those proposed for the Dry Forests of South Asia Comparison of Criteria

ITTO	Dry Zone Africa	Dry Zone South Asia
Criterion 5: Biological diversity	Criterion 2: Conservation and enhancement of biological diversity in forest ecosystems	Criterion 2: Maintenance, conservation and enhancement of biodiversity
Areas of protection forests and production forests within the permanent forest estate	Ecosystem Indicators 2.1 Areas by types of vegetation (natural and man-made)	See indicator 1.1
The representativeness of the protected areas network at the current or planned reservation program	2.2 Extent of protected areas	2.1 Area of protected and fragmented ecosystems
	2.3 Fragmentation of forests	See 2.1 in the cell above.
	2.4 Areas cleared annually of forest ecosystems containing endemic species	See indicator 1.2
	2.8 Average number of provenances 2.2 Number of forest dependent species with reduced range 2.10 Population levels of key species across their range 2.11 Management of genetic resources 7.6 Number of forest dependent spp. 7.7 Number of forest dependent species at risk 7.8 Resource exploitation systems	2.2 Number of rare, endangered, threatened and endemic species, including tiger population 2.3 Level of species richness and density 2.4 Canopy cover 2.5 Medicinal and aromatic plants and other NWFPs 2.6 Level of non-destructive harvest

Source: FAO RAP Publication (2000): Development of National-level Criteria and Indicators for the Sustainable Management

4.4.3.4 Forest Stewardship Council (FSC)

In September 1993 in Toronto, 130 representatives of timber users, traders and representatives of environmental and human-rights organizations from around the world came together to hold the Founding Assembly of the FSC. In October 1993, an agreement was reached to launch FSC, and by August 1994 a definitive set of principles and criteria were agreed on and approved by the votes of the Founding Members. Currently nearly 37 million hectares are certified all over the world in all types of forests. While the principles on an international level as well as in the other processes are more to be understood as basic guidelines, the national level principles are very specific. E.g. in Germany, the forests which are managed according to the principles of FSC, from the ecological point of view much more than comply with the legal standard.

4.4.3.5 Pan-European Forest Certification (PEFC) Council

The PEFC[28] Council was officially launched in Paris on June 30th 1999, as a result of a voluntary private sector initiative, to provide a means of assuring customers of woodland owners that the products they buy come from sustainably managed forests, independently certified to standards complying with the resolutions of the Helsinki and Lisbon Ministerial Conferences on the Protection of Forests in Europe. Currently PEFC has in its membership 26 independent national forest certification schemes of which 13 to date have been endorsed by PEFC. These 13 schemes account for over 48.5 million hectares of certified forests. The other national member's schemes are at various stages of development and are working towards mutual recognition under the PEFC processes.

Based on six general criteria (Helsinki Criteria), each country develops its own standards. As a consequence, the definition of standards pursuant to these six criteria is different in each country. The fact is also that in some countries like in Germany the settled standards are simply reflecting the legal standard. However, making the general

[28] In 2003, the PEFC Council approves new name. PEFC is now the Programme for the Endorsement of Forest Certification Schemes and has board members from Europe, Canada, Malaysia and the US.

criteria more detailed and binding makes them harder to realise at the same time. Therefore, the six frame criteria are probably sufficient for international use.

4.4.3.6 Others

As shown in Annex 1, similar guidelines with the same objectives of Sustainable Forest Management have been published for **Dry Zone Africa**, the **Near East** region and **Central America** (Lepaterique Process) (HEROLD et al. 2001).

4.4.4 Guidelines in Other Sectors

The following chapters provide an overview about guidelines in the areas of land management and energy which are relevant for climate mitigation projects.

Contrary to the forest sector, defined and internationally agreed criteria do not exist in agricultural land management and in the energy sector. However any guidelines or indicators should be applied in accordance with the global 2010 biodiversity targets and the objectives set out in the national biodiversity strategies. Additional support is given by specific sets of guiding principles, as developed by ALLISTER et al. (2001) for dam construction, by KARTHA & LARSON (2000) for biomass production or by the EUROPEAN COMMISSION (2001b) for agricultural land management. The application of these principles will serve to further concretise guidelines and set indicators in a certain frame.

4.4.4.1 Agricultural Land Management

Under the roof of sustainable development different concepts have been developed which either address certain resources such as soil or water or consist of integrated approaches such as the management of land or resources. Sometimes these concepts are used interchangeably. The following sections summarise some major approaches, which have also proven success in practice.

A distinction is made between concepts which have an impact on biodiversity or integrate biodiversity and those which aim at integrating biodiversity requirements into other policies.

Soil quality or soil management concepts address the capacity of specific soils to function within a natural or managed ecosystem to sustain plant and animal production, maintain or enhance water quality and support human health (DUMANSKI 1997). Soil management plays a major role in the context of agricultural intensification and thus might be considered in climate mitigation projects involving such intensification.

Land quality refers to the condition, state or health of land relative to human requirements, including agricultural production, forestry, conservation, and environmental management.

The concept of sustainable land management (SLM) calls for integrating technologies, policies and activities in the rural sector, particular agriculture. This involves both, enhancing economic performance and at the same time maintaining the quality and environmental functions of natural resources (soil, water and air). Furthermore sustainable land management directly contributes to the broader concept of natural resources management (TRAEGER et al. 1997) and to the overall concept of sustainable development (see Figure 7). The benefit of SLM therefore lies in the applicability at different levels at different scales while resolving different issues (DUMANSKI 1997).

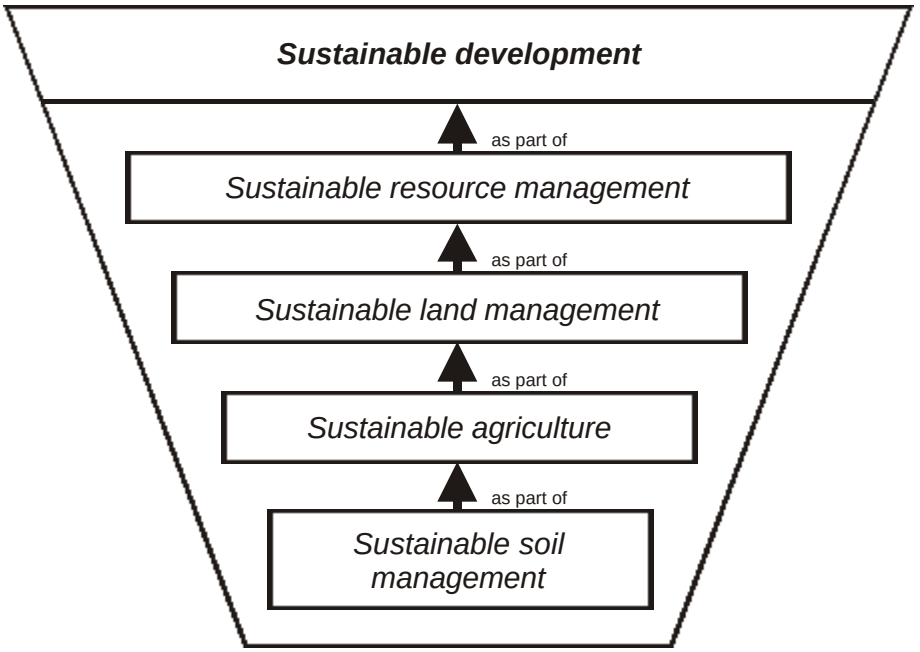
SLM is the result of a workshop in Chiang Rai, Thailand, in 1991 which recommended the establishment of an international working group of the International Society of Soil Science to further elaborate the concept, definition and monitoring procedure on sustainable land use systems. A series of further workshops[29] promoted and elaborated indicators of sustainable land management as instruments for monitoring and evaluation.

Five criteria, which are necessary to achieve sustainable land management, were identified: productivity, security, protection, viability and acceptability (DUMANSKI 1997).

[29] Workshops were held in Lethbridge, Canada in 1993; Acapulco in 1994; Cali, Columbia in 1995; Nairobi, Kenia, in 1995; Washington DC in 1996; Naurod, Germany, in 1997; and Enschede in 1997).

Building up on these criteria international agreement had been achieved on several sets of land quality indicators (see Chapter 4.5.3.1). A further important step is on implementing SLM at local, national and global levels.

Figure 7: Relationship among Sustainable Development, Sustainable Agriculture and Sustainable Land Management



Source: DUMANSKI 1997

Sustainable land management delivers a suitable tool in the context of climate mitigation projects because land provides an environment for different uses, in many countries particularly for agriculture, and at the same time land is the target for improved environmental management, such as source/sink function for greenhouse gases, ameliorating and filtering of pollutants which in turn have an remarkable impact on biodiversity (DUMANSKI 1997). Furthermore the proper design of sustainable land management approaches will ensure, that agriculture becomes part of a solution which benefits the environment rather than remaining an environmental problem. However even if agriculture seems to be the predominant issues, SLM definitely goes beyond agriculture and includes other aspects such as wildlife, waterfowl and biodiversity management.

FAO develops strategies and develops technologies for sustainable crop and grassland production systems. Furthermore the collection of data on native species with high production potential, the exchange of technologies and information among regions with similar ecologies, and the production of guidelines on biodiversity conservation are being promoted.

Finally FAO produces guidelines for management of low-input grassland systems, and develops strategies for the maintenance of grasslands biodiversity. Its work on grassland biodiversity is being enhanced through an FAO/Netherlands partnership programme, focused on South African grassland ecosystems.

Additionally to management approaches which consider biodiversity to a larger or smaller extent there are certain strategies which foster the integration of biodiversity and which should be considered while designing climate mitigation projects.

Article 6 of the CBD requires the development and implementation of a NBSAP[30]. Looking at the broader environment of a project or even linking a project to a NBSAP can demonstrate that the project potentially contributes to the objectives of the CBD while aiming at first at climate mitigation. The same is true for considering local Biodiversity action plans or Agenda 21 initiatives which might be relevant for site-specific projects. Furthermore small-scale projects might contribute to superior goals of biodiversity conservation as set out by the CBD. This might represent a chance rather than a constraint for considering biodiversity requirements in climate mitigation projects.

Based on the provisions of Article 6 CBD the European Commission released Biodiversity Action Plans for different sectors, i.e. agriculture, to improve or maintain biodiversity status and prevent further biodiversity loss.

The European Community Biodiversity Action Plan for Agriculture (EUROPEAN COMMISSION 2001b) stresses the relationship between agriculture and biodiversity and points out both the mutual benefits but also the pressure on biodiversity from farming. This analysis resulted in the following priorities for the action plan (see Table 15).

[30] A list of complete NBSAP is available at http://www.undp.org/bpsp.

Table 15: Priorities for Agricultural Land Management Set Out by the European Community Biodiversity Action Plan for Agriculture

Priorities for agricultural land management
Keeping intensive farming at a level which is not harmful to biodiversity. This can be achieved by the application of the good agricultural practice, and establishing sustainable resource management;
Ensuring that farming activities are economically viable, socially acceptable and safeguard biodiversity;
Implementing agri-environmental measures for the sustainable use of biodiversity;
Ensuring that the necessary ecological infrastructure exists;
Supporting measures related to maintaining local breeds and varieties and the diversity of varieties used in agriculture;
Preventing the spreading of non-native species.

Source: EUROPEAN COMMISSION 2001b

The European Community Biodiversity Action Plan for Agriculture lists tentative monitoring and evaluation indicators (see Annex 9).

Revegetation

According to the UNCCD definition land degradation describes a natural process or a human activity that results in a loss of sustainability and economic functions.[31] Land degradation describes a severe problem of global dimension which is particularly associated with desertification in arid, semi-arid and sub-humid zones, commonly subsumed under the term “drylands”. The focus of this section will be on land degradation in drylands.

In order to face the problem of land degradation in drylands the GEF together with FAO, UNEP, the Global Mechanism of the UNCCD and other partners support the project Land Degradation Assessment in Drylands (LADA).

The project seeks to strengthen the support to land degradation and develop and implement strategies, tools and methods to asses and quantify the nature, extent, severity and impacts of land degradation on ecosystems, watersheds and river basins, and carbon storage in drylands. The project further aims at national, regional and global assessment capacities to enable the design and planning of activities to mitigate land degradation and establish sustainable land use and management practices. The

LADA project will further contribute to deliver reliable information on degradation in dryland areas. Although the work in this field is at an initial state there might be a high potential for carbon mitigation activities, as these can be directly included from the beginning while developing new land management strategies in line with the objective of biodiversity conservation.

KARTHA & LARSON (2000) stress that the restoration of degraded land has a high potential to benefit the environment but at the same time this requires optimal site-specific strategies and depend on a large number of aspects. Therefore general recommendations are difficult to make. In developing a new strategy it is fundamental to take the pre-use into account and offer appropriate alternatives to the local communities.

Any revegetation measure should respect the priorities listed under agricultural land management (see Table 15).

Cultivation of Energy Crops

There are two main types of energy plantations: grass/reed and forests. On the one hand, in the forest sector, the different SFM guidelines may be applied (see also Chapter 4.4.3). On the other hand, for energy plantations with grass reed, the guidelines for cropland management are relevant (see Chapter 4.4.4.1).

However, some of the existing SFM guidelines do not cover all aspects of biodiversity for energy plantations as their C&I mainly consider the actual management phase and how to achieve as lasting an effect as possible. As a rule, laying out energy plantations means converting the land; for this reason, the guidelines concerned also need to take into account this special situation. If the plantation replaces primary forest this has a negative impact on biodiversity but when degraded land or even cropland is converted bearing in mind certain aspects (e.g. no monoculture or non-native species) this may influence biodiversity in a positive way.

[31] See Article 1 (f) UNCCD.

A lot of work has been conducted on socio-economic impacts of cultivation of energy crops, in some cases resulting in guidelines. The minority of policy-makers and researchers focuses on the environmental impact of cultivation of energy crops.

Summing up the different aspects of cultivation of energy crops and considering the relative lack of studies that examine specifically the effects of the cultivation of the relevant energy crops on biodiversity, only a few general criteria can be concluded by KARTHA & LARSON (2000) (Table 16).

Table 16: Criteria and General Recommendations for Sustainable Cultivation of Energy Crops

General criteria for cultivation of energy crops
For the cultivation of energy plants, perennial crops should be preferred over annual crops because they generally require less soil cultivation, less use of fertilizer and pesticides and provide better shelter for wildlife.
Multi-species stands should be preferred over monoculture stands, because they reduce the risk of diseases and provide more food and shelter for wildlife. Biodiversity enhancing measures should accompany monoculture stands, if these cannot be avoided.
Native species should be preferred over exotic or invasive species. Plant species with invasive potential should be excluded from cultivation. Plants for which the invasive potential is unknown in the considered region should not be introduced without prior research/risk assessment of their invasive potential.
Extensive cultivation should be preferred over intensive cultivation.
The impact of the cultivation of energy crops also depends on the likely alternative of the land-use activity. Special attention should also be given to the crop or land use type that is replaced by crops for bioenergy use: the replacement of intensively cultivated fields or degraded sites should be preferred over the replacement of natural forests or grasslands.
Crop types should match native ecosystem types, for example trees in woodland regions, perennial grass species in savannah regions. Crops should meet the conditions of the broad ecological region, but also the ecological characteristics of the specific cropping site.

Source: KARTHA & LARSON (2000)

An overview on papers, studies and guides which refer to the interlink between biomass production and environment is given in BEWINGA & VAN DER BJIL (1996), NBF (1994), OLADE & IDB (1994), OTA (1993) and KARTHA & LARSON (2000).

In their Bioenergy primer, KARTHA & LARSON (2000) stress that bioenergy systems have a wide range of potential environmental impacts and that energy crops has to be produced in a manner that is sensitive to the local ecological conditions.

In one chapter the primer guides through various environmental impacts concerning – among others- soil quality and fertility, hydrology and biodiversity and proposes detailed options for responses. Biodiversity is considered in relation to soil biodiversity, biodiversity of crops and guest species and biodiversity of contiguous natural habitats.

Generally a managed area which is as similar to a natural habitat as possible enhances biodiversity to a large extent. This requires a cropping system with a high degree of inter-species and intra-species variation.

The integration of biomass production and the restoration of degraded lands can enhance biodiversity and other natural resources. However this requires proper restoration strategies which take the site-specific natural and climate conditions into account (see Chapter 4.5.3.1).

In the course of the WSSD in Johannesburg (2002) the International Conference "Renewables 2004"[32] will further promote the global strengthening of renewable energies. The conference will also target the question of the big energy potential of biomass and the challenge of its sustainable use. The integration of biodiversity concerns in this process should be considered.

4.4.4.2 The Energy Sector

Mitigation options in the energy sector that may affect biodiversity include increasing renewable energy sources such as biomass energy, wind-, solar-, and hydropower. But like explained in the scope (see Chapter 1) this study just consider hydropower.

[32] 1 to 4 June 2004 in Germany.

Hydropower and Dams

With the World Commission on Dams (WCD) publishing the final report “Dams and Development - a New Framework for Decision-making” in 2000, a worldwide guideline for planning dams has been created. Chapter 3 of this final report also discusses biodiversity aspects. Accordingly, the generic nature of the impacts of large dams on ecosystems, biodiversity, and downstream livelihoods has become increasingly well known. The impacts are e.g. the loss of forests and wildlife habitat, the loss of species populations and the degradation of upstream catchment areas due to inundation of the reservoir area, the loss of aquatic biodiversity, of upstream and downstream fisheries. It is not possible to mitigate many of these impacts of reservoir creation on terrestrial ecosystems and biodiversity. Nevertheless, Chapter 9 tries to set up guidelines and criteria that need to be considered when designing a dam. These guidelines describe in general terms how to assess options as well as plan and implement dam projects. Furthermore the WCD guidelines call for baseline ecosystem surveys for the effectiveness of mitigation, enhancement, compensation and monitoring measures.

The baseline surveys which aim at linking the hydrological regime of the river to its associated ecosystems, should compile – according to the guidelines – information on:

- the life cycle of important fish species (especially migratory species);
- the distribution of habitat for threatened or endangered species;
- important areas for biodiversity;
- and key natural resources for riverine communities.

However the WCD guidelines do not contain any mechanism beyond the baseline ecosystem surveys, which integrates biodiversity, i.e. monitoring processes.

Reviewing the biodiversity impacts of large dams, ALLISTER et al. (2001) recommended the following guiding key principles to minimise the negative impact of dam construction (see Table 17).

Table 17: Key Principles to Minimise Negative Impact of Dam Construction

Key principles to minimise negative impact of dam construction
Avoid the coincidence of environmental impacts of dams with areas rich in biodiversity — 'hotspots'
Avoid blocking migratory species
Maintain natural seasonal and daily river flow cycles
Maintain discharge volume as much as possible
Sustain water quality — temperature, oxygen, sediment & other levels
Avoid cumulative effects of dams — limit their number and proximity
Take into account the impacts of other human activities when planning dams
Apply high EIA standards
Involve environment staff early and at high levels in planning and construction
Enhance delivery and conservation in extant dams
Decommission ineffective dams & restore river ecosystems and species
Use landscape management to make dams more effective and to protect biodiversity
Establish protected areas to enhance the efficiency of dams and conservation of biodiversity
Improve needed knowledge bases through research
Explore and reduce the impacts of dams on terrestrial biodiversity

Source: ALLISTER et al. (2001)

ALLISTER et al. (2001) furthermore list the characteristics[33] of environmentally friendly versus environmentally threatening dam constructions from the viewpoint of species diversity (see Table 18). These aspects might support decision making processes prior to site selection or concrete planning.

[33] These will serve as underlying criteria for the decision sheet on hydropower as part of the toolkit related to this study.

Table 18: Environmentally Friendly and Environmentally Threatening Dam Constructions

'Environmentally friendly'	'Environmentally threatening'
No genetically distinct stocks or species extirpated or driven to extinction.	Several genetically distinct stock or species extirpated or driven to extinction.
Only small areas of ecosystems/habitats lost or converted.	Large areas of ecosystems/habitats lost or converted.
'Footprint' of dam avoids areas rich in species.	Endemic species, species at risk, or diverse habitats.
'Footprint' overlaps such areas.	Highly productive inland rivers, lakes and estuaries are retained in their natural state.
The ecological integrity of such areas is disturbed, hampering their biological productivity.	Overall 'footprint' of dam is small in area. Overall footprint of dam is large.
No exotic species or ecosystems introduced.	Several exotic species or ecosystems introduced.
Dam does not block routes of migratory freshwater species .	Dam blocks routes of migratory freshwater species.
Seasonal flow patterns of discharge maintained.	Seasonal flow patterns of discharge disrupted.
Discharge volume is little diminished. Water never ceases flowing.	Discharge volume is greatly reduced. Zero discharges frequent or prolonged.
Water quality natural. No methyl mercury generated.	Temperature, oxygen, turbidity, sediment, and acidity levels changed. Methyl mercury is generated.
Unique habitats conserved	Unique habitats lost.
Excellent EIA conducted and impacts avoided or mitigated.	No EIA carried out, or a poor one hastily conducted with serious impacts neither avoided nor mitigated.
Environmental staff are an important part of the dam planning and construction team from project start.	Environment staff called in late in the project after key decisions irrevocably made, and their input is given low priority.
Landscape and airscape planning and management are included in the process to enhance dam performance and lower water demand.	Landscape and airscape planning and management not included in the process.
Water volume stored is relatively small, but efficiency is high.	Water volume stored is high and wastefully used.
Protected land and freshwater areas created to enhance dam performance and conserve biodiversity.	No protected areas established.
Dam and irrigation canals leak-proof and evaporation minimised.	Dam and irrigation canals leak, evaporation rates high.
Dam reservoir sedimentation rate low.	Dam reservoir sedimentation rate high.
Pumped storage units, hydrogen conversion or other techniques used to store power instead of storing high water volumes, fostering more normal seasonal water flow patterns and volumes.	No such power storage devices used.

Source: ALLISTER et al. (2001)

BLÜMER et al. (1999) developed a method for quantitative biodiversity impact assessment, both for the application to existing hydropower sites as well as a planning tool for site-selection. Further surveys are planned to assess whether this method is also suitable for bio-energy (forest residues and energy crops) and wind power. The method is built upon a four-step process:

1. Definition of the baseline and the present situation. This step includes mapping of the total impact area with regards to land use. Necessary information is aerial photographs, new and old maps, etc.
2. Classification of the affected area into biotopes.
3. Characterisation of the biotopes (baseline and present situation) by using indicators.
4. Calculation of areas, presentation of results.

The Energy and Biodiversity Initiative (EBI)[34] launched a report in 2003, which contains recommendations and tools for integrating biodiversity conservation into oil and gas development. The report should further serve as a practical manual for integrating biodiversity into the entire life cycle of the operations.

Although the report refers to oil and gas development some lessons can be drawn for hydropower such as the whole approach on the development and generation of biodiversity indicators (see Chapter on indicators). However this partnership also serves as a good example for collaboration between business and conservation with the result of the integration of biodiversity concerns into all phases of the operations.

Another existing guideline is the Operational Policy 4.37 Safety of Dams of the World Bank. This OP however, does not contain any detailed statement as to dam projects and how biodiversity aspects are to be considered. An interrelation only exists in the context of a dam that does not function properly or fails, which can also have significant environmental relevance. Nevertheless, the policy strongly request that projects involving dams should make use of e.g. OP/BP 4.01 *Environmental Assessment*, OP/BP 7.50 *Projects on International Waterways,* and OP/BP 4.04 *Natural Habits* (see Chapter 5.3).

4.4.5 Conclusions and Recommendations

Guidelines are an internationally widespread approach for bearing in mind ecological consequences of management measures (e.g. ecological land use like sustainable forest or grassland management) or other activities (e.g. energy projects like dam construction). In these areas they have been applied and proved to be generally effective to meet many different requirements (social, ecological or economical). Furthermore, as soon as they have been drawn up e.g. by means of a wide stakeholder consultation they can easily be applied. The various guidelines are partly founded on a legal basis most of them however on a voluntary basis.

Another benefit of guidelines is that they can be adjusted to many different levels and specifically developed for certain types of projects, policies, or circumstances. That is to say, they can be drawn up for different levels in order to meet the respective specifications (guidelines mirror the preferences of authoring institutions, e.g. governments) and the required extend of consideration of biodiversity aspects; they can also be adjusted in detail to the respective ecosystem. Guidelines for climate change mitigation activities in the Kyoto context start with unbinding general principles (e.g. ecosystem approach, IPCC guidelines, UN Forest Declaration, etc.) and continue with more detailed and very precise guidelines like some sustainable forest management guidelines, certification-systems (see below), or the GS CDM-PDD.

A disadvantage of using guidelines as an instrument in climate change mitigation projects is that for some activities or ecosystems suitable guidelines do not exist to sufficiently consider biodiversity aspects.

Nevertheless some guidelines are very useful already today. In the forestry sector for example, international guidelines like ATO/ITTO, Asia Dry Forest, or Montreal Process (see Chapter 4.4.3) should be the minimum component used for CDM projects (e.g. included in the PDD).

[34] The EBI is a partnership of four energy companies and five conservation organisations: BP, Chevron Texaco, Conservation International, Flora &Fauna International, IUCN, Shell, Smithsonian Institution, Statoil, and The Nature Conservancy.

Guidelines in the Forestry Sector

The positive result to be concluded from this study is that biological diversity is an aspect in all guidelines for SFM. The SFM processes are similar in objectives and approach, but differ somewhat in content and structure. They have all developed criteria and indicators for use at the national level. The criteria identified by the processes correspond fairly closely, all incorporating, in some fashion, the following fundamental elements of SFM:

- extent of forest resources and global carbon cycle;
- forest ecosystem health and vitality;
- biological diversity in forest ecosystems;
- productive functions of forests;
- protective functions of forests;
- socio-economic functions and conditions;
- political, legal and institutional frameworks.

But even if the topic of biological diversity is an aspect in all guidelines for SFM, they differ somewhat in content and structure. Nevertheless that the intensity and quality which is set on biodiversity aspect differs, the SFM guidelines with their indicator sets are a useful instrument by the accomplishment of climate change mitigation activities already today. Because that international guidelines cannot go into much detail in order to be acceptable as a wide range international agreement, we recommend to use regional guidelines if exist. The advantage of this is that the requirements are adapted to different climates and types of landscape.

A better quality of being intense to biodiversity aspects, are the various certification systems in the forest sector. The degree of their specification makes the certification systems to an instrument which can very well take into consideration biodiversity aspects in the utilisation of forests. Therefore it would be desirable to introduce internationally accepted forest certification systems (the authors recommend FSC) as a prerequisite for forest management activities in the context of the KP, as well as for afforestation, reforestation and deforestation activities. Considering that in developing countries project developers can face the difficulties of a certification scheme with

additional costs[35], for the moment this prerequisite could be a must only for funding organisations. A good example for this practise is the Operational Policies 4.36, Forests of the World Bank. “To be eligible for Bank financing, commercial harvesting operations must also be certified under an independent forest certification system”.

Nevertheless also a minimum outline, e.g. in the way of an international accepted guideline, should be set which is binding for all forestry activities in the context of the KP.

4.5 Indicators for Biological Diversity

Currently, different definitions of the term indicator are used international level (see Table 19). For an easier comparison in this study we will list the different definitions of indicators.

Table 19. Definitions of the Term “Indicator”

Source	Indicator
MONTRÉAL PROCESS WORKING GROUP (1998)	A measure (measurement) of an aspect of the criterion. A quantitative or qualitative variable which can be measured or described and which when observed periodically demonstrates trends.
HEROLD et al. (2001)	Indicators have been defined as quantitative measures, which imply a metric (i.e. distance from a goal, target, threshold, benchmark, etc.) against which some aspects of policy performance can be measured. The use of reference points (as targets or benchmarks) distinguishes indicators from statistics. In this way, indicators build a bridge between the fields of policy-making and science. Policy makers set the targets and measurable objectives, while scientists determine relevant variables of that measure compliance with targets.
Global Environment Division	Indicators can be quantitative or qualitative variables which can be measured or described and which, when observed periodically, demonstrate trends in biodiversity characteristics.

[35] Certification can increase the credibility of a project and therefore support the sale of credits.

Generally indicators are an instrument to describe the state or condition of something valued, as well as its change of quality or value (DUMANSKI & PIERI 1997). Thus indicators provide information on certain phenomena, monitor changes and allow comparing trends over a certain period of time (SHYAMSUNDAR 2002). Several attempts have been made in the meantime to combine a number of indicators and aggregate them to indices.

Both indicator and indices development face the challenge of the "adequate" selection in order to meet the issue off political concern and to be sufficiently substantive and at the same time easy to understand. Furthermore the success of indicators depends on their applicability. Therefore many scientists repeatingly stress that indicators generally should be **s**pecific, **m**easurable, **a**chievable, **r**elevant and **t**ime-bound (SMART) (SNEL & BOT 2002).

In the context of climate mitigation projects indicators serve for site-selection, problem analysis and for the verification whether the set project objectives have been achieved (evaluation and monitoring).

4.5.1 Scope and Objective

Within the context of this survey the matter to be observed and valued is biodiversity and its ancillary resources which allow biodiversity growth and development such as land, water and soil. The interrelationship of different resources within an ecosystem is not the matter of discussion and will not be reflected in detail. They will only be pointed out as far as it seems to be necessary for the discussion of biodiversity indicators.

Furthermore the discussion of biodiversity indicators will be narrowed down to those aspects which relate to carbon mitigation activities (see Table 2). These comprise activities in the fields of forestry, land management and energy.

Since biodiversity requirements can be considered at different stages, the design, development and implementation of carbon mitigation projects, different kind of information might be adequate to consider. This will be supported by the Driving Forces/Pressure/State/Impact/Response (DPSIR) framework which describes the links between the pressures on land and biodiversity induced by human activities-in this

case carbon mitigation activities, the change in the quality of biodiversity and the response to these changes in order to halt or reverse trends. The European Environment Agency (EEA) i.e. uses this indicator model for its ongoing work on indicator development. Figure 8 further describes the application of the indicators of the DPSIR framework.

Figure 8: DPSIR Framework

Driving forces
Indicators in this group include those activities that may (in)directly cause the problem.

Pressure indicators
Indicators in this group include those activities that may (in)directly result in an increased pressure on the natural resource.

State indicators
State indicators reflect the conditions of the land as well as its resilience to withstand change.

Impact indicators
Impact indicators describe the effect and impacts of the increased or reduced pressure on the natural resource. Impact indicators or change indicators measure change in either positive or negative direction (degradation or improvement). They are needed by land users to guide them in their decisions on the management of their land and water resources and inputs.

Response indicators
Response indicators include those mechanisms which are normally achieved through direct actions by the land users themselves to release the pressure from the land. In rare instances environmental regulations may be necessary to effect proper control of land degradation.

Source: SNEL & BOT 2002

This model builds upon the so-called PSR model, which the Organization for Economic Cooperation and Development (OECD) has been elaborated, covering pressure, state and response indicators (OECD 1997, WETTERICH & KÖPPKE 2003). Some organisations and initiatives favour the PSR model, such as the OECD itself, as well as the expert meeting on indicators of biological diversity (UNEP/CBD/SBSTTA 2003).

4.5.2 Processes of Biodiversity Indicator Development – An Overview

The importance of indicators relevant to biodiversity and its monitoring and reporting has increasingly been stressed at global, European and national levels. Furthermore indicators are not only developed on but also applied at different political levels.

Therefore an overview will be given on the institutions involved in indicator development, thereby highlighting concrete results, actual efforts undertaken and identified gaps. Furthermore cooperation between institutions aiming at indicator harmonisation will be stressed. In many cases various institutions came up with concrete indicator sets, in others indicator development is currently processing and has to be considered at a later stage. Current work on indicator development has to be kept in mind and strategies on carbon mitigation have to be updated subsequently.

Indicators might apply at different levels and different steps of the project development cycle. At the national level, i.e. biodiversity relevant aspects might relate to land management and tenure and certain obligations on how to integrate biodiversity requirements into other policies. At the local and farmers levels aspects for biodiversity conservation obviously become more operational and concrete.

The discussion of indicators in the following chapters follows a two-string approach:

- Since different scales and levels of reflection have different implications on how biodiversity will be assessed and on how biodiversity requirements will best be integrated into other policies the first string provides an overview on the development of biodiversity indicators at global, European and national levels.
- The second string structures indicator sets and approaches according to different thematic areas which offer the possibility to design climate mitigation projects under the provisions of the KP and the MA. These comprise land management including cropland management and grassland management and the restoration of degraded areas, and energy including hydropower and dams and biomass production.

4.5.2.1 At Global Level

At global level biodiversity indicator development related to climate change is first of all being advanced and emphasised by (UNEP/CBD/SBSTTA 2003). In order to monitor and report on progress towards the 2010 biodiversity target the following list of global indicators has been compiled (UNEP/CBD/COP/7/20/Add.3):

- Trends in extent of selected biomes, ecosystems and habitats;

- Trends in abundance and distribution of selected species;
- Change in status of threatened species;
- Trends in genetic diversity of domestic animals, cultivated plants, and fish species of major socio-economic importance;
- Coverage of protected areas;
- Criteria and indicators for sustainable management of ecosystems;
- Biodiversity used in food and medicine;
- Water quality in aquatic ecosystems;
- Trophic integrity of ecosystems;
- Nitrogen deposition;
- Numbers and cost of alien invasions.

Additionally to its use for assessing the progress towards the 2010 target, these indicators will also serve as headline indicators for communicating the results. Furthermore they represent indicators which are scientifically valid and have been tested already. They rely on data sources that are available at global level and represent the three objectives of the CBD.

Furthermore the Millennium Ecosystem Assessment (MEA) currently works at a study on linkages between the world's ecosystems and human well-being, which also includes the development of biodiversity indicators. In the field of forest biodiversity, several regional and international processes have been developed criteria and indicators (see Chapter 4.4.3). The UN Food and Agricultural Organisation (FAO) is responsible for the international coordination, further development and implementation of these processes concerning forest biodiversity. The OECD undertakes substantial work to measure the environmental performance of agriculture and thus provides guidance in the field of agri-environmental policy. Both FAO and IPGRI lead on indicator development and coordination for genetic resources. CBD and the Global International Water Assessment are currently developing a joint work plan including

indicators on marine and coastal biodiversity, in particular the degradation of coral reefs and coral bleaching (DELBAERE 2002).[36]

Indicators are a priority issue of a joint work programme of the Secretariats of the CBD and the UNCCD on dry and sub-humid lands. Furthermore the Global Taxonomy Initiative plans to contribute to a menu of indicators in different thematic areas. Several international NGOs, initiatives and networks have initiated indicator development, monitoring programmes and reporting activities in their specific field of expertise, such as BirdLife International, IUCN, Wetlands International, the World Resources Institute, the World Conservation Union or the WWF (DELBAERE 2002). Table 20 provides an overview of international initiatives on biodiversity indicators.

Table 20: International Initiatives on Biodiversity Indicator Development

Area	Organisation(s)	Relevant document/source	Activity
Biodiversity in general	UNEP/CBD/ SBSTTA	Global indicators to measure progress towards 2010 target UNEP/CBD/SBSTTA/9/INF/18[37] UNEP/CBD/SBSTTA/9/INF/7 (indicators for rapid assessment of inland water ecosystems)	Indicator testing and development Indicator development
Biodiversity and Ecosystems	Millennium Ecosystem Assessment	MEA (2003a)	Ecosystem Assessment at global level, indicator development
Forest	FAO		International coordination, further development and implementation of indicators
Agriculture	OECD	OECD Environmental Indicators for Agriculture, Volume 3	Coordination of development of agri-environmental indicators
	FAO/IPCRI		Coordination of genetic resources indicators
Marine and coastal biodiversity	CBD/Global International Water Assessment		Joint work plan including indicators on marine and coastal biodiversity
Dry- and sub-humid lands	CBD/UNCCD		Joint work programme on dry and sub-humid lands

[36] The International Global Waters Assessment will be based on assessments of 66 international waters and nine mega-regions focusing on the ecological status and the causes of environmental problems of these regions. The regions comprise marine, coastal and freshwater areas, and surface waters as well as groundwater. http://www.giwa.net/areas/regions_and_network.phtml.

[37] "Proposals for further development and refinement of the guidelines for incorporating biodiversity-related issues into environmental impact assessment legislation or procedures and in strategic impact assessment".

Area	Organisation(s)	Relevant document/source	Activity
Global Taxonomy Initiative	CBD	Under development	Indicator development in different thematic areas
Specific species or ecosystems	BirdLife International, IUCN, WWF		Monitoring, reporting (See Table 9)
Wildlife	OECD Wildlife		Wildlife and habitats questionnaire in order to streamline data flows between EIONET, EEA, OECD

Indicator development by the CBD

The COP of the CBD has repeatedly emphasised the importance of developing *national* biodiversity indicators. CBD/SBSTTA provides guidance to the Parties to produce a national set of indicators, and supported an expert meeting which was convened in February 2003 with participants from numerous governments, NGOs, intergovernmental organisations UN organisations and other relevant bodies to further elaborate (UNEP/CBD/SBSTTA 2003):

- Principles for developing indicators and monitoring programmes at national level;
- A set of standard questions for developing national-level indicators; and
- A list of available and potential indicators based on a conceptual framework that comprises both the qualitative and quantitative approach.

A seven-step-approach provides guidance from identifying policy issues and goals to developing a comprehensive set of indicators including a suitable monitoring programme. Indicator selection and generation involves the following steps:

- The definition of issues and goals;
- The establishment of the terms of reference (purpose of indicators);
- Determination of indicator requirements;
- Development and selection of suitable indicators;
- Technical design of indicators;

- Development of a monitoring programme;
- Implementation and maintenance of the monitoring programme.

Indicator Development by the Millennium Ecosystem Assessment

In a comprehensive study the MEA will assess conditions and trends of ecosystems, services provided by ecosystems, causes of changes to the ecosystems, and the consequences of this change for human well-being (MEA 2003a).

The study will further develop and provide indicators of ecosystems condition and services as well as global biodiversity change (MEA 2003b).

Indicator development by OECD

Under the auspices of the OECD the Joint Working Party (JWP) developed a set of agri-environmental indicators. Particular progress was made at the OECD Expert Meeting on Agri-biodiversity Indicators (OECD 2001). According to the work of the OECD agriculture affects 13 environmentally relevant issues including biodiversity (OECD 2001). For the qualitative assessment of the environmental impact the OECD proposed indicators for each issue which vary in depth and concreteness (SIEBER 2003). Given the interacting environmental functions of an ecosystem, not only biodiversity indicators but also other relevant indicator sets, namely in the fields of water quality, soil quality, and natural habitats, have to be considered in climate mitigation projects (see Chapter 4.5.3.1).

The JWP identified the following criteria, which agri-environmental indicators have to meet:

- **Policy relevance** in addressing the key environmental issues faced by governments and other stakeholders;
- **Analytical soundness** being based on sound science, but recognising that their development is an evolving process;
- **Measurability** in terms of data availability and cost effectiveness of data collection;

- **Interpretation** of indicators in a way that is clear and understandable for policy makers and the wider public.

These criteria partially vary from the SMART criteria mainly showing a difference in their prioritisation and approach. This is probably due to the different scale which is targeted. Whereas the OECD-criteria are policy-oriented, the SMART criteria are more project–oriented. In all, these criteria might complement rather than contradict each other.

Biodiversity in the CBD and the OECD Approach

Biodiversity as defined by the CBD, on the one hand, covers genetic diversity, species diversity and ecosystem diversity. On the other hand the OECD distinguishes between biodiversity and habitats, with biodiversity including invasive species, genetic biodiversity concerning crops and livestock and wild species. Thus the OECD neglects particular aspects such as crop species and is not fully compatible with the CBD approach.

Criticism concerning OECD Indicators

The OECD Core Set of Agri-environmental Indicators is internationally agreed upon and reflects a compromise of the OECD Member States. Thus this indicator set cannot consider the specific natural, cultural and agricultural differences of a Member State, moreover specific political and economic interests of the OECD Member States were taken into account. From the German perspective, the OECD approach shows a number of deficits for the application at national level (WETTERICH & KÖPPKE 2003, SIEBER 2003):

- Some indicators have to be more concrete or modified (biodiversity of wild species and habitats);
- The OECD indicator system does not consider crop biodiversity;
- The SRP-model is not reflected in the OECD indicator set. In particular pressure, response and cause-effect indicators are lacking.

WETTERICH & KÖPPKE (2003) furthermore recognise that some indicators such as invasive species or natural forests are not relevant in Germany.

Indicator Development by Other Organisations

Several organisations have monitored and reported information on species, habitats or sites of high biodiversity relevance. The priorities set out by these organisation often are in line with their special area of expertise and may not always be mutually complementary or covering the pre-selected site of the climate mitigation project. However the information obtained and analysed by these organisations provides a huge stock of data and indicators which support decision making processes.

Concerning species approaches, birds are often promoted as indicator species in various ecosystem types, in particular by BirdLife International. Regarding the criteria for indicator selection and application birds are likely to serve as indicators due to several qualities (DELBAERE 2002). They occur in broad range of habitats, and sometimes even use several habitats, i.e. for both nesting and feeding. Furthermore good data exists or are realistic to collect. Birds are responsive to change and easily settle down in new living areas. This characteristic however also represents the difficulty to assess causalities. Therefore other animal species with less mobility might be more suitable. WETTERICH & KÖPPKE (2003) propose i.e. grasshoppers for grassland biotopes, because they are dependent on certain vegetation structures and humidity conditions.

In general the use of key species has often been criticised, because individual species or groups of species do not necessarily reflect species richness and trends in other occurring species (LANE & BUNNING 2003).

4.5.2.2 At the Regional Level – Example Europe

At the European level many initiatives related to the development of biodiversity indicators and the monitoring of biodiversity already exist. However Europe-wide reporting on the state and trends of European biodiversity is lacking. In order to close this gap the framework of the Pan-European Biological and Landscape Strategy and the process of Biodiversity in Europe enhance coordination and synergy in biodiversity

indicator development[38] although there is no mandate to create a binding reporting mechanism (DELBAERE 2002).

The Eurostat Task Force on Sustainable Development Indicators currently builds up a framework as a basis for a list of indicators, which evaluate the implementation and effectiveness of the EU Sustainable Development Strategy (SDS). The strategy focuses on six core themes, one of which is dedicated to "managing natural resources more responsibly." The thematic approach of the SDS has also been adopted by the indicator framework. One theme addresses the management of natural resources and consists of several sub-themes, namely biodiversity, marine ecosystems, fresh water resources and land use. Annex 11 outlines the indicators for the management of natural resources at three different levels, whereas level 1 indicators are an aggregation of level 2 indicators and level 2 indicators are an aggregation of level 3 indicators. Level 1 comprises the Biodiversity Index, population trends of woodland, farmland and wetland wild birds, and the percentage of fish catches taken from stocks that are taken from outside safe biological limits. The sub-theme freshwater resources i.e. includes water abstraction as a level 2 indicator, which builds upon indicators such as, among others, N surpluses in vulnerable zones and an index of pesticide risk to the aquatic environment as a level.

The EEA developed a "Core Set of Indicators" for comprising indicators related to different environmental issues and sector-environment indicators. The first group includes, among others, indicators on biodiversity. These can be categorised into three different groups (EEA 2003) relating to the

- State and trends in Europe's biodiversity;
- Conservation and restoration of Europe's biodiversity;
- Integration of biodiversity issues into other sectoral policies.

The EEA developed indicator sets to respond to major policy questions, some of which relate to different aspects concerning climate mitigation projects.

In Annex 2 indicators that provide evidence to the major policy questions "What are the causes of the loss of biodiversity?" and "What is the state and trends of biodiversity?"

[38] This was emphasised in the conclusions of the 2nd Intergovernmental Conference 'Biodiversity in Europe' (Budapest, 2002).

are listed, outlining the type of indicator underlying the DPSIR model, the quality of the description and the relation to other issues. The indicators as well as the underlying data can be used in relation to similar questions which might arise in the context of carbon mitigation projects.

The second group of the EEA indicator set mainly describes what measures are taken to conserve or restore biodiversity and how these instruments have been implemented and are not considered to be relevant in this context.

The third group of indicators defined in the EEA Core Set of Indicators addresses sectoral integration of biodiversity requirements and includes, among others, indicators which describe the integration of biodiversity into agriculture and forestry. The trends of agricultural intensification and marginalisation of farmland as well as forest management practices affect diverse areas causing major change, decline and loss of biodiversity. As agricultural and forest management practices play a significant role in carbon mitigation projects, indicators related to integration of biodiversity issues into sectoral policies should be considered (see Annex 3).

Eurostat is the predominant institution at the European level which conducts work on pressure indicators. Eurostat proposes the following indicators for biodiversity (EUROSTAT 1999):

- Protected area loss, damage and fragmentation;
- Wetland loss through drainage;
- Agricultural intensity;
- Fragmentation of forests, landscape and roads;
- Clearance of natural and semi-natural forested area;
- Change in traditional land use practices.

These indicators are quite broad and might serve for political decision-making processes and site selection.

The EUROPEAN COMMISSION (2000) also made proposals for the integration of biodiversity concerns into the agricultural policy.

The EC Biodiversity Strategy (EUROPEAN COMMISSION 1998) and its accompanying Action Plans (EUROPEAN COMMISSION 2001a) stress the importance to monitor the progress of implementation of the European biodiversity policy. The EEA is currently working on indicators for the implementation of the Action Plans (DELBAERE 2002).

Furthermore the EU Strategy for Sustainable Development calls for the establishment of a set of biodiversity indicators, which has to be delivered by the European Commission by 2003 (see Chapter 4.5.3.1). This includes both headline performance indicators as well as aggregated indicators.

For the success of climate mitigation projects it is worthwhile to consider ongoing policies and set the project into the overall political context.

European initiatives engaging in the development of biodiversity indicators are indicatively listed in the table below.

Table 21: Biodiversity Indicator Development at the European Level

Area	Organisations/ Processes	Relevant document/source	Activity
Biodiversity in general	Pan-European Biological and Landscape Strategy		Enhancing coordination and synergy in biodiversity indicator development
	Biodiversity in Europe		See above
State and trends in Europe's biodiversity; Integration of biodiversity into other sectors.	EEA	Core Set of Indicators	Indicator development and Europe-wide coordination
Integration of biodiversity into the agricultural policy	European Commission (2000)		Proposal of indicators
Implementation of EU biodiversity policy	EEA	Stressed by EC Biodiversity Strategy (European Commission 1998) and its accompanying Action Plans (European Commission 2001)	Indicator Development for measuring implementation of Action Plan ongoing
Biodiversity in general	European Commission	Required by EU Strategy for Sustainable Development	Proposal of indicators ongoing

4.5.2.3 At the National Level

Most countries carry out regular biodiversity reporting which are mostly in compliance to international conventions and other legal instruments. Often reporting is not based on a fixed set of indicators. However, in some countries good examples of operational indicator sets are available, which might serve as best practice examples for other countries. Many countries indeed, develop their indicators or monitoring programmes isolated from other indicator systems, which prevents national reporting from being used for regional and global aggregation and for comparison. The satisfactory provision of data, which is a precondition for the use of indicators is often not fulfilled. Furthermore national indicators are often too focused on specific instruments or initiatives and lack general policy relevance.

There are only few examples for aggregated indices such as the Natural Capital Index (NCI)[39] as developed by the Netherlands. This indicator combines quality and quantity parameters and is scale-independent, but does not allow for direct comparison of countries or aggregations at regional or other levels directly. In general most indicators applied are state indicators (DELBAERE 2002).

The following sections stress two initiatives to draw lessons for biodiversity indicator application and development at national level – the Biodiversity Indicators in National Use (BINU) project and the Biodiversity Strategy for England.

The BINU project[40] contributes to the development of operational national level biodiversity indicators to support planning and decision-making. Therefore several indicator frameworks are being tested for a focal ecosystem in four participating countries. Within these projects existing data which are available in the countries will be used. The BINU project carries out the following activities:

- Ecuador - The Ministry of Environment and EcoCiencia will focus on forest ecosystems;
- Kenya - The Kenya Wildlife Service will focus on wetland ecosystems;

[39] Natural Capital = ecosystem quantity (% area of the country) * ecosystem quality (% of baseline). Several initial exercises have been carried out on a variety of spatial scales: globally in UNEP's Global Environmental Outlook, continentally in Europe (pressure-based), and nationally in the Netherlands. Some case studies in developing countries are in preparation.

- Philippines - The Protected Areas and Wildlife Bureau and the Bureau of Fisheries and Aquatic Resources will focus on coastal and marine ecosystems;
- Ukraine – Ukrainian Land and Resource Management Centre (ULRMC) will focus on agrobiodiversity.

It is planned that the indicator portfolio for each ecosystem will be exchanged among the participating countries. This will support, that the final outputs will be replicable by other countries.

The BINU project in Ukraine brought forward a list of major key questions proposed for agro-biodiversity indicators[41]:

- What is the current state of agro-biodiversity in Ukraine?
- What are the main factors causing loss or increase of agro-biodiversity, and how do changes in the land use practices impact loss or increase of agro-biodiversity?
- What lands could be returned to a natural state in the near future?
- To what extent are national biodiversity indicators linked with the international ones, and how could the existing national statistics help build nationally and internationally applicable indices for decision-making?
- How can scenarios of agro-biodiversity changes be built, and how can biodiversity loss be stopped in the near future?

A list of selected indicators corresponds to each question, the progress of work will be reported in the respective matrix (see Annex 4).

The Biodiversity Strategy for England[42] sets out a number of policies and objectives for the protection of biodiversity as well as the integration of biodiversity requirements into other sectors.[43] Furthermore the UK launched a Biodiversity Action Plan as well as specific species (392) and habitat (45) action plans. This includes i.e. the sustainable

[40] Coordinated by UNEP-WCMC.
[41] http://www.ulrmc.org.ua/services/binu/keyquest_prop.html.
[42] Working with the Grain of Nature: a Biodiversity Strategy for England was launched on 24 October 2002. http://www.defra.gov.uk/wildlife-countryside/ewd/biostrat.
[43] The coasts and seas, Agriculture, Local and regional action, Water and wetlands, The economics and funding of biodiversity, Woodlands and forestry, The engagement of business, Towns, cities and development, Education and public understanding.

management of acid grasslands in the UK. Local biodiversity action plans now become increasingly important in implementation. In order to meet the objectives and targets, a steering group, responsible for the development of the action plans, drew up a set of guidelines for implementation of the action plans at local level.

The strategy includes headline indicators as well as sectoral indicators both covering indicators on the state of biodiversity. The indicators for each sector build upon the same structure and cover the condition of protected sites, the progress towards targets of the Biodiversity Action Plan in England, population trends in species/extent of habitats, policy response and public participation/awareness (see Annex 5 for complete list of indicators).

The indicators are all presented in a standardised format including the objective of the strategy corresponding to the indicator, the assessment of the indicator progress concerning the defined objective, the relevance of the indicator to enhancing biodiversity in England, any formal target that has been set for this indicator, trends and additional background information. In all, the strategy provides a suitable tool for safeguarding and enhancing biodiversity in England.

4.5.3 Indicators in Different Sectors

The following chapters provide an overview of indicator development related to different thematic areas – land management including cropland management and livestock, and energy comprising biomass production and hydropower and dams.

4.5.3.1 Agricultural Land Management

There are indicators which directly address land as a whole as well as indicator sets which concentrate on a certain aspect of land. These general approaches as well as indicator sets focusing on cropland management and livestock as well as specific grassland management indicators relate to climate mitigation projects and are presented in the following sections. The structure and classification of the indicator sets

have more systematic reasons, in some cases these areas overlap and cannot be separated from each other.

Several international organisations including the World Bank, FAO, UNDP, UNEP & Consultative Group on International Agricultural Research (CGIAR) launched the **Land Quality Indicator (LQI) program[44],** which is an international initiative to monitor *changes* having an impact on the sustainability of land resources in managed ecosystems. The program aims at developing land quality indicators at sub-national, national and global scales and harmonizing the combined objectives of production and environmental management, and thus to ensure more sustainable use of land, water and biological resources. In all, the program intended to develop indicators for project development, EIA and monitoring progress towards sustainable land management (see Chapter 4.4.4.1, Management of Grazing Land and Grassland).

The results and outcome of this program aimed at the following policy applications:

1. Assisting policy makers, planners and project managers to incorporate land quality considerations in their national and sub-national development programmes.

2. Strengthening human and institutional capacity to monitor, evaluate and manage land quality (i.e. condition of soil, water, forest and biological resources) based upon organised sets of geo referenced data and information collected at national and sub-national levels (community and district).

3. Contributing to global assessment of land quality as a function of major land cover and land use systems, and farmer practices.

A panel of internationally nominated scientists and representatives from administrations achieved international agreement on the following sets of land quality indicators:

- Five sets of indicators that can be developed in the short term, i.e., nutrient balance, yield trends and variability, land use intensity, land use diversity and land cover;
- Three sets of indicators, requiring longer-term research, on the themes soil quality, land degradation (erosion, salinisation, compaction, organic matter loss) and agro-biodiversity;

[44] See http://www-esd.worldbank.org/html/lqi/intro.htm.

- Four sets of indicators that are being developed by other working groups, i.e., water quality, forest land quality, rangeland quality and land contamination/pollution.

These land quality components of SLM and still must be complemented with indicators of the other pillars – economic viability, system resilience, and social equity and acceptability. One of the next major challenges is how to effectively implement sustainable land management in the field (DUMANSKI 1997).

FAO carried out a case study of Costa Rica to change concepts concerning soil erosion and conservation and in this case practically applies land change indicators. In this project farmers play a significant role in commenting and reporting on changed characteristics and qualities of their soils. The project finally set up a list of indicators on the state of land conditions in line with the farmers' comments, observations and indicators (BENITES et al. 1997).

Farming is one of the predominant land uses in many countries and occupies a large share of the total land areas in the countries, involving a broad spectrum of habitats. As management practices in agriculture might play a significant role in climate mitigation in the future, the following sections discuss cropland and grassland management.

Cropland management

In general the degree of biodiversity in crop-based agro-ecosystems depends on the following main characteristics (LANE & BUNNING 2003):

- The diversity of vegetation within and around the ecosystems;
- The permanence of the various crops;
- The intensity of management; and
- The extent of isolation from natural vegetation.

In livestock and range systems the main characteristics include:

- The diversity of animal species and animals on farmed land;
- The vegetation composition of pasture related habitats;

- The management of the farming system.

Furthermore the different agricultural systems, such as pastoralism, mixed farming, rain fed agriculture, irrigated agriculture, and agro forestry have to be taken into account. All the agricultural systems might influence biodiversity, mainly due to the following pressures:

- Clearing, fragmentation and habitat conversion;
- Intensification and appropriate land use;
- Alien invasive species;
- Over-exploitation and unsustainable harvesting of natural resources.

These characteristics and pressures outlined above reflect the complexity of the development of agri-environmental indicators, a challenging task which was taken up by various initiatives.

The **OECD agri-environmental indicators**[45] form a source of information on the status and trends in the environment due to agricultural impact. They are not only applicably to the OECD countries but also to non-Member countries.

These indicators are supposed to serve as a tool for policy monitoring, evaluation and in predictive scenarios to improve policy effectiveness in promoting sustainable agriculture and management of natural resources. Thus these indicators should also be considered as a tool to assess carbon mitigation activities related to land management.

The OECD agri-environmental indicators relevant for biodiversity are subsumed under the agri-biodiversity framework (ABF). The ABF recognises the following aspects (OECD 2001):

- The diversity of elements in an agro-ecosystem, which consists of plant and animal communities (domesticated crops and livestock, and wild species) and their environmental functioning as an ecological unit, strongly influenced,

[45] The need for such indicators was stressed by a number of international organisations such as EEA, FAO, Ramsar, UNEP, World Bank, the International Federation of Agricultural Producers, BirdLife International, ECNC, IUCN, Wetlands International and the World Seed Organisation.

created and/or maintained by agricultural management activities within which are a diversity of different habitats.

- The interaction between agro-ecosystems and other ecosystems, both terrestrial (e.g. forests) and aquatic (e.g. wetlands), especially in terms of the effects of farming practices on other ecosystems (e.g. off-farm impacts from nutrient/pesticide run-off into aquatic ecosystems) and land use changes from agricultural land to other land uses (and vice versa).[46]
- The hierarchical structure of different layers within the agro-ecosystem, including the current state and changes in the: agro-ecosystem base, including production species and production supporting species and the land use stock and changes between agriculture and other ecosystems; structure of habitats within the agro-ecosystem; management of the habitats in agro-ecosystems; wild species in the agro-ecosystem; and the use and requirements by wild species of the habitats within the agro-ecosystem (e.g. breeding and feeding).
- The tangible and quantifiable specification of biodiversity (i.e. genetic resources, habitats and wild species) across the whole agro-ecosystem and the spatial distribution of habitats and wild species related to agriculture.

The ABF can thus be used to:

- Assess the risk of genetic erosion of domestic crop varieties and livestock breeds;
- Assess the impact of a specific policy measure aimed at reducing wetlands to agriculture;
- Monitor the progress of a policy measure aimed at increasing the population size of rare and endangered wild species associated with agriculture;
- Combine indicators to measure current or future trends concerning the impact on wild species of changes in agricultural land use and cover patterns, habitat structure and farm management practices.

[46] This can have both beneficial and harmful effects on biodiversity depending on the nature of the change in land use, such as a change from semi-natural grassland to commercial forest or a change from a tropical forest to cultivated cropland.

The ABF comprises four groups of indicators, namely the agricultural genetic resources, habitat quantity, habitat quality and one group which express the overall loss (gain) of biodiversity by combining habitat quantity and quality. An overview of the indicators of the ABF is given in the Annex 6.

Generally the combination of habitat and species indicators is emphasised by various institutions and research projects (DELBAERE 2002). For habitats both quality and quantity (measured by species) is assessed.

WETTERICH & KÖPPKE (2003) identify the lack of crop and livestock species as a major gap in the OECD indicator system. They propose the following set of biodiversity indicators of crops and livestock species for national monitoring (see Table 22):

Table 22. Biodiversity Indicators of Crops and Livestock Species for National Monitoring

Crops	Livestock	Indicator type
Number of agricultural crops[47]		state
Share of agricultural crops	Development of stocks of agricultural livestock	state
Number of approved breeds	Number of livestock	state
Share of approved breeds	Development of population and threat of local stock	state
Breed-specific potential of diversity	Highly selective breeding methods	state/driving force
Number of breeding firms	Number of livestock breeding organisations	driving force
Governmental support of the cultivation of rare crop species and breeds	Governmental support of breeding of threatened livestock species	response

As these indicators directly relate to agricultural action they are also relevant for climate mitigation projects related to land use and land use change. However the usefulness of the single indicators has to be assessed case by case. WETTERICH & KÖPPKE (2003) discuss the importance of these indicators and also consider the respective data availability in Germany. They further stress the importance of both indicators and data availability. The following areas face a lack of adequate data in Germany:

[47] WETTERICH & KÖPPKE (2003) stress the importance to consider species with national responsibility. In an quantitative assessment an introduced species cannot replace a species threatened by extinction.

- Grassland; this could be tackled, however, within the area of wild species;
- Rare livestock and crop species;
- Breed specific amount of cultivation for some crops;
- Genetic diversity within and between stocks and breeds.

Additionally to the ABF mentioned above water and soil quality indicators of the OECD indicator set might be particularly relevant in the context of carbon mitigation projects related to land management. The OECD proposes key indicators for the area of water quality. Furthermore water and wind erosion belong to the key indicators in the area of soil quality. Further indicators in this field comprise soil compaction, soil fertility, soil degradation through chemical input, acidification and salinisation (SIEBER 2003). These indicators might support the assessment of the biodiversity quality and the biodiversity composition.

The EEA developed sector-environmental indicators, including, among others, indicators for integrating environmental concerns into agriculture. The key policy question in this context relates to the progress in management integration and whether the impact of agriculture on environment is improving. The policy questions and indicators are listed in Annex 7.

The agri-environmental indicators developed by OECD are not fully compatible with those brought forward by the EEA concerning the type of indicators and the scope. However concerning natural resources and biodiversity a close match has been achieved.

Another initiative on agri-environmental indicators was launched by FAO with the Handbook on the Collection of Data and Compilation of Agri-environmental Indicators (FAO 2002). This book presents a suggestive list of indicators which still have to be tested at the country-level and sub-country level. However the indicative list includes as well indicators, which closely relate to climate mitigation activities, and comprise indicators on land use change, the intensification of agriculture and the change in land condition. Even if biodiversity is not directly targeted, these indicators might deliver ancillary effects on natural resources which again influence the quality of biodiversity.

The European Commission presented 35 indicators grouped within different areas where indicators are needed (COM (2000) 20 and COM (2001) 144). These indicators however, vary regarding their level of development and applicability. For the further development of indicator application the International Renewable Energy Agency (IRENA)[48] operation was created, which aims at: a) data sets for the 35 indicators, b) an indicator report on the indicators listed in the Communications, and c) an indicator based assessment on the integration of environmental concerns into agricultural policy.

Annex 8 outlines the areas, indicators, the data sources and requirements and action for further development.

The European Community Biodiversity Action Plan for Agriculture (2001) stresses the relationship between agriculture and biodiversity and points out both the mutual benefits but also the pressure on biodiversity from farming. This analysis resulted in the following priorities for the action plan:

- Keeping intensive farming at a level which is not harmful to biodiversity. This can be achieved by the application of the good agricultural practice, and establishing sustainable resource management;
- Ensuring that farming activities are economically viable, socially acceptable and safeguard biodiversity;
- Implementing agri-environmental measures for the sustainable use of biodiversity;
- Ensuring that the necessary ecological infrastructure exists;
- Supporting measures related to maintaining local breeds and varieties and the diversity of varieties used in agriculture;
- Preventing the spreading of non-native species.

The European Community Biodiversity Action Plan for Agriculture lists tentative monitoring and evaluation indicators (see Annex 9).

[48] The IRENA operation is an outcome of a Memorandum of Understanding of five partners: the Directorates General Agriculture, Environment, Eurostat, Joint Research Centre of the European Commission and the EEA.

Grazing Land Management and Grassland

According to the definition of the MA, “grazing land comprises grassland, pastures, rangeland, shrubland, savannah and arid grassland”. Depending on the type and location of grazing land, management has to be very specific and generalisation is difficult to assess.

Among OECD countries there are remarkable differences concerning the categorisation of grassland. One point of discussion is that in the US and Canada a distinction is made between natural grassland and cultivated grassland whereas in Europe semi-natural grasslands are predominant.

Semi-natural grasslands are most valuable habitats and the richest habitat in terms of biodiversity on European farmland. Regarding the threats and decline of semi-natural grasslands, monitoring of their status and trends is required. It is therefore proposed to include respective indicators in the OECD habitat system (WETTERICH 2003). Thus the concentration of species on semi-natural grassland with more or less common habitat requirements could be taken into account at one glance. However additional indicators might be needed to monitor their quality (such as insect species and sensitive plants).

Additionally semi-natural grassland might serve as an indicator by itself, regarding the fact that semi-natural grassland is destroyed by the intensification of agriculture and land abandonment and this loss is often irreversible.

For rain fed agricultural systems in arid, semi-arid and sub-humid agro-environments in Africa the 2nd International Workshop on the Development of Land Quality Indicators brought forward indicators sets at different states of elaboration (BENITES et al. 1997). Indicators for arid lands cover mainly grazing indicators. A distinction is made between short-return indicators for grazing lands and long-term indicators (>2 years). Long-term indicators include vegetation indicators as well as soil indicators. Finally some indicators address the deterioration of cropland. For semi-arid lands the results were less concrete and include a list of brought categories of issues covering the mismatch between resource availability and management, the policy environment, infrastructure etc. For sub-humid lands indicators were compiled for different categories covering the diversity of land use, land quality and soil fertility.

Numerous approaches of grassland management and respective indicators exist at the regional and local level world-wide. In many countries guidelines are being developed on the basis of habitats. Therefore a systematic overview on grassland management guidelines and indicators is difficult to assess and cannot be achieved within the scope of this study.

Revegetation

The major causes of land degradation are inappropriate land use and poor management including both intensive tillage and cropping, poor water management, and over-grazing resulting in the degradation of soil, water and vegetation cover and loss of both soil and biodiversity. The reverse of these phenomena at the same time increases carbon storage. The indicators listed for the assessment of land management within the LADA framework (see Chapter 4.4.4.1) might therefore directly feed into the activities for carbon mitigation projects.

LANE & BUNNING (2003) conducted a survey resulting in a compilation of dryland biodiversity issues in the context of the Land degradation Assessment of Drylands and an overview on potential indicators and methods for assessing biodiversity and land condition. The survey provides key biodiversity and land condition indicators for use at local, ecosystem/agro-ecological zone and national levels (see Annex 10). Furthermore, the work stresses the constraints of indicators and assessment methods in reflecting and valuing biodiversity. The critical role of human management practices in maintaining biodiversity and land condition is recognised and discussed. The report finally provides general guidelines on selecting indicators, monitoring sites and sampling strategies.

In line with the work of the CBD Expert Group on indicator development, Lane & BUNNING (2003) propose this approach in the context of degraded land to be applied at national, Agro-Ecological-Zoning (AEZ) - and local levels.

Cultivation of Energy Crops

At the current stage recommendations for biomass production are given through guidelines. The Bioenergy Primer i.e. lists detailed indicators for monitoring environmental impacts related to the measurement of soil quality but just generally refers to biodiversity under alternate and prior land uses. However for the assessment of biodiversity the indicators for cropland management can be applied.

4.5.3.2 The Energy sector

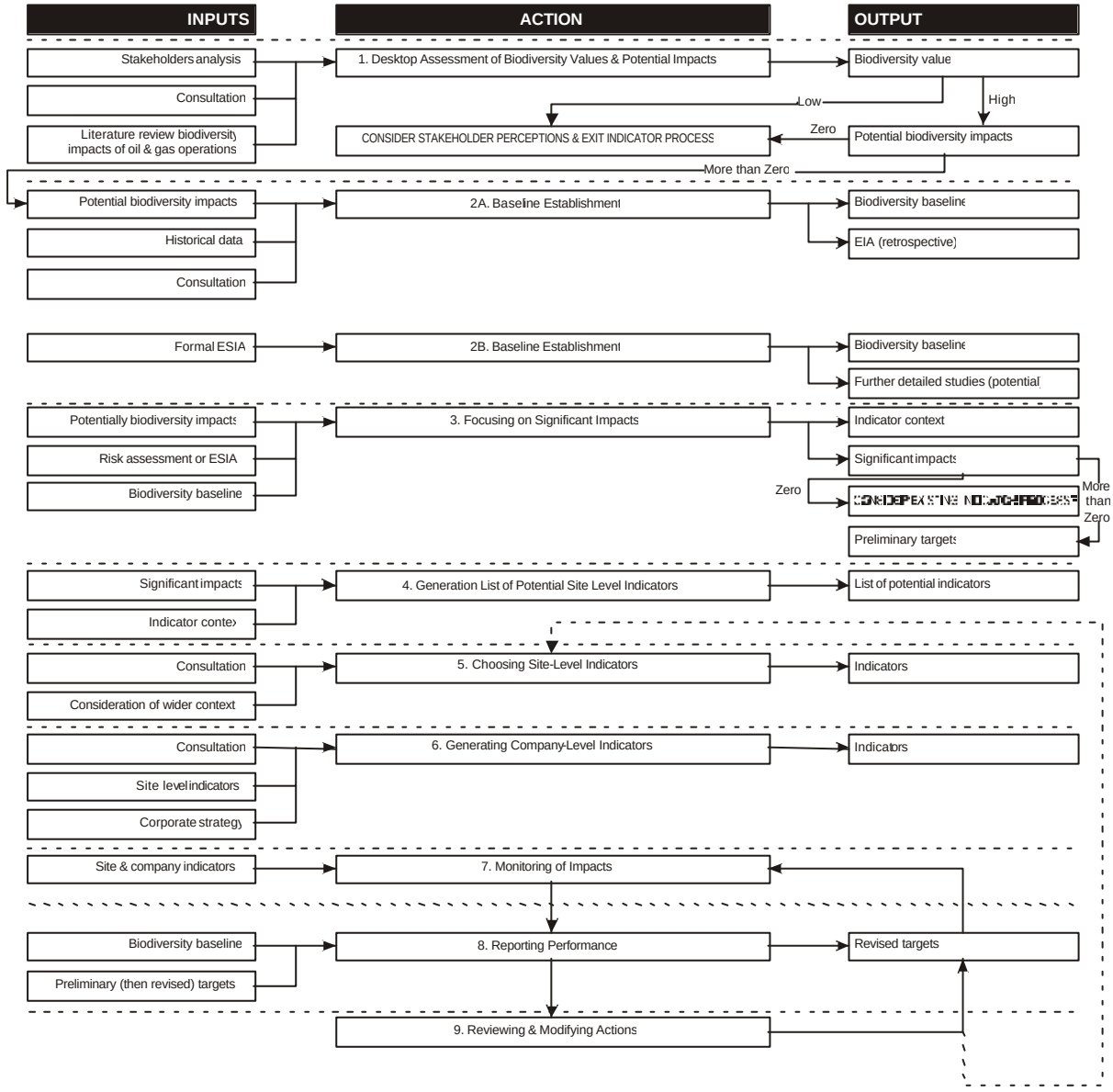
Few indicator sets have been developed specifically to measure biodiversity within the context of the energy sector.

Under the auspices of Helio International, THORNE & LA ROVERE (1999) proposed a set of eligibility criteria and indicators for the appraisal and evaluation of CDM project proposals with the overall aim to contribute to sustainable development. The report recognises, among others, the impact on biodiversity and the use of natural resources as potential negative effects of CDM projects. The proposed indicators should support monitoring during the project cycle and comprise indicators to determine the net change from baseline as well as sustainable development indicators. The sustainable development indicators include an indicator on the contribution to the sustainable use of natural resources but do not make reference to biodiversity.

Hydropower and Dams

The Energy and Biodiversity Initiative (EBI) developed a guide on the generation of biodiversity indicators within the oil and gas sector. The results comprise a methodology for indicator generation as well as a catalogue of indicators, outlining the application level and the strengths and weaknesses of each indicator. The EBI stresses that the indicators are representing examples only and do not serve as indicators “off-the-shelf”. Figure 9 provides an overview of the necessary steps of indicator development.

Figure 9: EBI Indicator Development and Monitoring



Source: EBI (2003)

The whole process starts with the assessment of the biodiversity values of a predicted site and the potential impacts. In a second step a baseline will be developed as a reference for future change. The potential impacts will be narrowed down to the significant impacts in a next step. In the case of significant impacts appropriate indicators are needed to ensure that these impacts are managed effectively. At this point the development of indicators can be initiated. This includes the generation of

site-level indicators and company-level indicators. The impacts which are then monitored are set against the baseline which was developed at the beginning.

This approach takes note of fundamental understanding of the site in question, the stakeholders' knowledge and perception and the stakeholders' interests. Furthermore it can be closely linked to environmental management systems (EMS) and takes all stages of the lifecycle of the energy operation into account. Therefore a stringent consideration of biodiversity throughout the operation can be fulfilled. However the methodology of indicator development case-by-case requires adequate financial resources and a sound knowledge of indicator development and implementation.

4.5.4 Conclusions and Recommendations

The use and development of indicators face the following constraints:

Despite the intensive work of many organisations and initiatives on the development of biodiversity indicators DELBAERE (2002) stated a big discrepancy between scientific indicator development and policy requirements.

There is a further incompatibility concerning the technical requirements of indicator sets and the data availability. WETTERICH & KÖPPKE (2003) came to the conclusion that the majority of the OECD indicators cannot be applied for national monitoring because the available data do not meet the technical requirements. In order to develop suitable state indicators an appropriate data base has to be provided. In the UK or Switzerland i.e. the data availability is given due to respective programmes for the assessment of the state of biodiversity in these countries. Some regions lack the political or scientific framework for additional research. In other regions, i.e. drylands, comprehensive data collection is difficult to achieve due variable climate and diversity of responses to rainfall (LANE & BUNNING 2003).

LANE & BUNNING (2003) concluded that slow progress has been made to date in developing practicable indicators for biodiversity and land degradation. The reasons, that are generally valid for indicator development related to biodiversity, can be attributed to:

- Scientific uncertainty and poor understanding of ecosystem processes and the complexity of ecological systems;
- The wide range of policy-relevant issues that fall under the roof of biodiversity and coupled with the variety of projects types for climate mitigation;
- The variety of biodiversity impacts and the risk of a complex, time consuming and costly assessment process.

Furthermore there are numerous specific national, regional and local policies as well as local and site-specific conditions which require a profound selection or generation of indicators for the integration of biodiversity concerns.

To date, a number of state indicators have already been developed as well as pressure indicators. Impact and cause-effect indicators should complement the indicator sets in the future. The level of indicator applicability should be clearly indicated like i.e. outlined in the preliminary list of sustainable development indicators by Eurostat (European Commission 2004).

Harmonisation and coordination of ongoing indicator developments or existing indicator set have already started in some areas, i.e. agro-biodiversity indicators, and should become one of the premises in indicator development.

Recommendations for the development and use of indicators for the integration of biodiversity requirements into climate change policies and activities:

<u>Future research should address the following aspects:</u>

- Case studies on political integration of biodiversity requirements in the context of climate mitigation projects;
- Identification and analysis of best practices in practical indicator application;
- Transfer of results and information obtained by the means of a database.

<u>National/Regional action should focus on:</u>

- Further coordination and harmonisation of indicator development in the different areas relevant to climate mitigation;
- The nomination of a biodiversity contact person/organisation/focal point for project developers in each country.

International negotiation processes should aim at:

- Including relevant work under the UNCCD in the ongoing CBD process, and
- in turn facilitating the information flow of recent developments concerning biodiversity indicator development and application to the UNCCD.

5 Conclusion and Evaluation of Selected Instruments

One objective of the UNFCCC is the promotion of reducing or preventing anthropogenic emissions of GHG, including LULUCF as well as the promotion of renewable energy such as biomass production or hydropower (UNFCCC Art. 4.1.c). Apart from this objective under the UNFCCC there are respective provisions under the CBD, mainly brought forward by decisions of CBD COP 5, which call for the enhancement of synergies. These provisions urge parties and governments to explore how climate change mitigation activities under UNFCCC and its KP can support CBD objectives.

Therefore the target of the present study was to compile and evaluate relevant instruments for integrating biodiversity aspects into climate change mitigation activities in the LULUCF sector, and in the energy sector. The further need for adaptation and development of these instruments for the integration of biodiversity considerations into climate mitigation activities was identified. The instruments that are finally analysed in this document are: EIA, SEA, guidelines, and indicators. They all incorporate aspects how to consider biodiversity in climate projects. Table 23 shows their advantages and disadvantages within this context.

Table 23: Advantages and Disadvantages of Different Instruments in Integrating Biodiversity Aspects

Instrument	Advantages	Disadvantages
EIA	EIA is widespread and commonly used in many countries. EIA often is founded on a legal basis. A large set of proven methods and procedures as well as best-practice from many sectors is available. EIA has political backing in the international climate and biodiversity policy process.	In many countries, the consideration of biodiversity aspects is not explicitly required in EIA legislation. Many climate project types would not be subject to an EIA because the agriculture and forestry sector are not included in EIA legislation in some countries. In practice, EIA often fails to include biodiversity aspects adequately into EIA due to lack of time, funding and expertise - especially if biodiversity is not mentioned explicitly in the terms of reference.

Instrument	Advantages	Disadvantages
SEA	SEA overcomes an important weakness of project-based EIA in that it can be used to assess a wider range of possible alternatives. Different mitigation options, e.g. including or excluding LULUCF sector activities, could be tested against each other. If SEA is carried out early, certain activities, project types or areas could be excluded from the very beginning before the planning stage. SEA is currently gaining importance worldwide, especially in organisations like the World Bank that are working in the field of carbon funding. SEA has political backing in the international climate and biodiversity policy process.	Not many countries have established binding regulations on SEA, especially developing countries lack legislation on this instrument. There are no standard methods that could be applied internationally. The costs for a SEA are usually not borne by the project proponent, as in EIA, but by the public. This could be a disincentive for developing countries to apply the instrument, as they would have to bear the additional costs. The inclusion of biodiversity aspects is not well-established in SEA practice.
Guidelines	Guidelines are an internationally widespread approach for bearing in mind ecological consequences of management measures (e.g. forestry, grassland, etc.) or other activities (e.g. dams). Guidelines have been applied for a long time and proved to be effective e.g. in sustainable land management. Guidelines can be drawn up for different levels in order to meet the respective (government) specifications and the required extend of consideration of biodiversity aspects; they can also be adjusted in detail to the respective ecosystem.	Worldwide many guidelines exist already for some areas of land use activities. However when applied, the extent of consideration for biodiversity differs considerably (e.g. the different forest guidelines). Some approaches only state the requirement: “Biodiversity is to be considered respectively to be protected”. The use of such guidelines does not guarantee optimum realisation of all requirements in the context of the CBD. For some project types or ecosystems suitable guidelines do not exist to sufficiently consider biodiversity aspects. Additionally, in order to use guidelines indicators are often needed for monitoring. If these indicators are missing (see above), the adequate realisation is hard to control.
Indicators	Indicators support detailed analysis of driving force, pressure, state impact, and response as well as cause-effect relationship. Suitable means for monitoring and reporting and sit-selection. Indicators might directly flow into political decision making processes. Reliable statements for projects involving land uses which do not require EIA or SEA.	Discrepancy between scientific indicator development and policy requirements. Data availability does not always meet technical requirements. Specific indicator set required for variety of project types, ecosystems and land management. Indicator generation time-consuming and costly. <u>General Constraints:</u> Indicator development and research relies upon adequate political and scientific framework. Data collection might be difficult due to external factors (i.e. climate variability).

Instrument	Advantages	Disadvantages
		Scientific uncertainty and poor understanding of ecosystem processes.

The instruments analysed have reached a good level of development; they can already form the basis for preventing significant adverse impacts on biodiversity when designing and realising climate projects e.g. according to the CDM. Some of these instruments and guidelines have already been implemented, i.e. in the context for sustainable forest or grazing land management. As these activities are also quoted under the MA, they represent suitable instruments for future climate change mitigation projects.

The EIA is an internationally widespread approach for considering ecological consequences of measures and actions, in many countries EIA is already founded on a legal basis. As described in Chapter 4.2, the requirements for making an EIA can vary considerably. These requirements could sometimes be more specific or explicit especially as to considering biodiversity aspects when carrying out a measure. At the same time, there are already promising approaches for an improved integration of biodiversity-related issues into EIA legislation (e.g. CBD COP Dec. VI/7). For this reason, the minimum requirements for EIA set up by SBSTTA should generally be taken into account for climate projects in order to assure sufficient protection for biodiversity.

SEA is not well-established in comparison to project-based EIAs. Chapter 4.3 shows that SEA can be interpreted in many different ways. SEA is less suitable for the implementation of biodiversity aspects in specific project types. Nevertheless it is a good instrument at the level of plans and programmes. It can be used e.g. for large-scale planning which project type can be carried out in which regions without negative impacts on biodiversity. Moreover SEA can be used for analysing climate policies of individual countries in order to take into consideration biodiversity aspects for all climate change mitigation activities and for improving the integration of adaptation measures.

For some activities EIA is obligatory due to the respective legislation; in other cases however, the authors agree EIA is not necessary to assess impacts on biodiversity. Concerning activities such as grazing land, cropland, and forest management, we can

stipulate (i) that there are either no significant adverse impacts on biodiversity; or (ii) that well developed other adequate instruments exist which can guarantee a sufficient consideration of biodiversity aspects. In any case, project planning should include scoping the possible effects on biodiversity as well as the existing gaps in data and information about the project area in order to propose measures for closing the data gaps.

For hydropower activities (run-off river and storage dams) however, an EIA should be obligatory because particularly dam projects always cause a significant adverse impact on biodiversity. In use of biomass, and revegetation activities it must be observed individually if the project activity will result in significant environmental impacts.

Table 24 provides an indicative overview on instruments especially suitable for the different project types. A clear distinction between the different instruments, however, is not possible as they are sometimes linked. In many cases, for example, guidelines are complemented by indicators. For EIA and SEA indicators are used e.g. in the baseline description or for monitoring (see Chapter 7.2.5.9). SEA is not listed in the table since it is not practicable to assign it to individual project types respectively on project level.

Table 24: Recommended Instruments for Chosen Activities [(+)= restricted recommended; += recommended; ++= highly recommended and =obligatory]

Instrument / Activity	EIA	Guidelines	Indicators
Grazing Land Management		+	+
Forest Management		+	+
Cropland Management		+	+
Hydropower		+	+
Afforestation & Reforestation	+	++	+
Biomass	(+)	+	+
Revegetation	(+)	+	+

Indicators are used on many different political levels (see Chapter 4.5.2). They can be used as an independent instrument (monitoring and reporting) but also as an important

supplement for EIA and guidelines in order to integrate biodiversity concerns into climate projects.

Numerous indicator sets already exist in the areas of cropland and grazing land management. However for project developers they are neither systematised nor made available. Furthermore there is hardly any guidance yet on practical application.

On the one hand, indicators are important for consideration and assessment of biodiversity with regard to state, trends, and impacts. On the other hand, indicators also play an important part for the assessment of political integration of biodiversity in other political areas. The EEA and the European Commission are intensively working in this field and published respective indicators. However this is not discussed on a global scale yet.

Generally the DPSIR framework is often quoted but still there are predominantly state indicators, a limited number of impact indicators and very few approaches to assess cause - effect relationship, and responses. This is in many cases accompanied by gaps in data availability.

There are numerous specific regional, national and local policies as well as local and site-specific conditions which require a profound selection or generation of indicators for the integration of biodiversity concerns. This requires a time-consuming and costly process.

For site selection, decision making processes, monitoring and reporting functions in climate mitigation project indicators are a fundamental means. To date their application is, however, limited in practice due to the lack of suitable data in any regions of the world. For this reason the further development of indicators should be intensified (see Chapter 4.5.4).

Guidelines differ considerably in quality and intensity as to integrating biodiversity aspects not only within the same project type (e.g. forest management) but also on the different project levels and between the different project types. International regulations such as the ecosystem approach are not sufficiently precise yet in order to make sure a specific project considers biodiversity aspects, they nevertheless form the basis for regulations to be drawn up later e.g. on a national level.

In the forestry sector, many different regional guidelines already today form a good basis (which can of course be optimised as to considering biodiversity aspects). In other projects, suitable project guidelines still need to be evaluated.

We can conclude that all discussed instruments need more or less optimisation in order to take biodiversity aspects more or more detailed into account for the project types mentioned.

Apart from this discussion, particularly the realisation of sink projects should not cause additional significant negative impacts on biodiversity.

The study also shows that in consistently implementing the existing instruments it is already possible to contribute considerably to maintaining biodiversity during carrying out climate mitigation activities. It is therefore important to persistently use these instruments when implementing climate change activities in the context of CDM or JI or on a voluntary basis[49] in the context of domestic actions and all other activities to cope with climate change while working on their improvement to include biodiversity aspects. This means that existing knowledge gaps (e.g. data for indicators) need to be closed.

Toolkit

To provide practical information on suitable instruments and decision support, the toolkit (handbook) “Integration of Biodiversity Concerns in Climate Change Mitigation Activities” was produced in addition to this study[50]. The objective of this toolkit is to provide practical guidance on designing climate mitigation projects or activities in a way that will also benefit biodiversity. It is designed for experts who plan, implement or evaluate climate change mitigation activities. It is also a useful tool for stakeholders that are involved in a project cycle for CDM (see also Chapter 2.1.2) or JI (see Chapter 2.1.1) project activities.

The first part of the toolkit provides an overview of possible climate mitigation activities, especially in the LULUCF and energy sector, and their possible benefits and negative

[49] Particularly funding organisations should on a voluntary basis use existing instruments which can guarantee a minimum of consider biodiversity aspects in climate change mitigation projects. These instruments are e.g. guidelines (e.g. forest certification systems, GS), EIA, etc.
[50] The toolkit is published separately by the Federal Environmental Agency of Germany.

impacts on biodiversity (see Chapter 3). The second part introduces selected instruments that could be applied for the integration of biodiversity aspects into climate change mitigation activities (see Chapter 4).

The advantages and disadvantages of these instruments for the indicated purpose are discussed and additional literature for practical work with these instruments is presented. The third part of the toolkit is intended to help project planners or evaluators (e.g. DOE, Independent Entity or DNA) to apply these instruments and the relevant biodiversity aspects on an activity-specific basis. This section contains a series of decision trees and checklists for the most common project types.

6 Literature

ADHIYA, J. & CHISHOLM, S.W. (2001): *Is Ocean Fertilization a Good Carbon Sequestration Option? A critical review of ocean fertilization methods proposed for addressing the problem of anthropogenic CO_2 emissions in the atmosphere*. White Paper prepared for the Center for Environmental Initiatives at MIT.

ALLISTER, D. E.; CRAIG, J.F.; DAVIDSON, N.; DALANY, S. & SEDDON, M. (2001): *Biodiversity of large dams.* Background paper No. 1 prepared for IUCN, UNEP and WCD.

BAGRI, A. & VORHIES, F. (1997): *Biodiversity Impact Assessment*. Draft Discussion Paper for SBSTTA3 in Montreal, Canada. http://economics.iucn.org.

BAKER, J & DOBOS, R. (2002): *Environmental Assessment Follow-Up: A Framework for Environment Canada*. Proceedings of the IA Follow-Up Workshop of IAIA at The Hague, 2002

BENITES, J.R.; SHAXON, F. & VIEIRA, M. (1997): *Land Condition Change Indicators for Sustainable Resource Management* in: FAO, UNDP, UNEP and World Bank (1997): *Land Quality Indicators and Their Use in Sustainable Agriculture and Rural Development*. Proceedings of the Workshop 25-26 January 1996 in Rome. Rome: FAO.

BEWINGA, E.E. & VAN DER BJIL, G. (1996): *Sustainability of Energy Crops in Europe*. Utrecht: Centre for Agriculture and Environment.

BIBBY, C.J. & ALDER, C. (2003): *The Conservation Manual*. Cambridge: BP Conservation Programme and BirdLife International. http://conservation.bp.com.

BFN – BUNDESAMT FÜR NATURSCHUTZ (FEDERAL AGENCY FOR NATURE CONSERVATION) (2000): *Empfehlungen des BfN zu naturschutzverträglichen Windkraftanlagen*. Bonn.

BLÜMER, M.; KYKLÄKORPI, L. & RYDGREN, B. (1999): *Quantitative Biodiversity Impact Assessment: Introducing the Biotope Method*. Prepared for IAIA Annual meeting Glasgow 15-19 June 1999. http://biodiversityeconomics.org/pdf/990616-02.pdf.

CAN – CLIMATE ACTION NETWORK (2003): Clean Development Mechanism & Joint Implementation Mechanism. http://www.climnet.org/EUenergy/CDM.htm.

CIFOR – CENTER FOR INTERNATIONAL FORESTRY Research (2003): *Guidelines to monitor reduced impact logging in the Amazon* http://www.cifor.cgiar.org/docs/_ref/publications/newsonline/30/monitoring.htm

CPPI – CENTER FOR PREPARATION AND IMPLEMENTATION OF INTERNATIONAL PROJECTS ON TECHNICAL ASSISTANCE (2001): *Strategic Environmental Assessment – Ratification of Kyoto Protocol by Russian Federation*. Moscow.

DELBAERE, B. (2002): *Biodiversity indicators and monitoring. Moving towards implementation*. Proceedings of a side event held at the 6th Conference of the

Parties of the Convention on Biological Diversity, 10 April 2002, The Hague, The Netherlands. ECNC.

DUMANSKI, J. (1997): *Criteria and Indicators for Land Quality and Sustainable Land Management*. ITC Journal 1997. Pages 3-4.

DUMANSKI & PIERI (1997) in: SNEL & BOT (2002): *Some suggested indicators for Land Degradation Assessment of Drylands*. Draft paper. Rome: FAO.

DUSIK, J.; SADLER, B. & MICULIC, N. (2001): *Developments in Strategic Environmental Assessment in Central and Eastern Europe* in: Public Participation and Health Aspects in Strategic Environmental Assessment, 49-55.

EBI - Energy and Biodiversity Initiative (2003): *Energy and Biodiversity: Integrating Biodiversity Conservation into Oil and Gas Development*.

EUROPEAN COMMISSION (1998): *Communication of the European Commission to the Council and to the Parliament on a European Community Biodiversity Strategy*. COM (98)42. Brussels.

http://europa.eu.int/comm/environment/docum/9842sm.htm.

EUROPEAN COMMISSION (2000): *Indicators for the Integration of Environmental Concerns into the Common Agricultural Policy*. COM (2000) 20 final. Brussels. http://europa.eu.int/comm/agriculture/envir/index_en.htm.

EUROPEAN COMMISSION (2001a): *Biodiversity Action Plans in the Areas of Conservation of Natural Resources, Agriculture, Fisheries, and Development and Economic Cooperation*. Commission Communication of 27 March 2001 to the Council and the European Parliament. Brussels. http://europa.eu.int/eur-lex/en/com/pdf/2001/com2001_0162en.html.

EUROPEAN COMMISSION (2001b): Commission Communication of 27 March 2001 to the Council and the European Parliament: *Biodiversity Action Plan for Agriculture* (Volume III).

EUROPEAN COMMISSION (2004): *Prelimnary list of Sustainable Development Indicators Revision 2 (30/01/2004).* DOC. SDI/TF/44/04BREV. 2(2004), 7th Meeting of the ESS Task Force on Methodological Issues for Sustainable Development Indicators. SDI Workshop, 9-11th February 2004, Stockholm.

EEA - EUROPEAN ENVIRONMENT AGENCY (2003): *EEA Core Set of Indicators*. Revised Version April 2003. Copenhagen.

EUROSTAT (1999): "Towards Environmental Pressure Indicators for the EU". Office for Official Publications of the European Communities, Luxemburg in: SCHULZ, N.B., HABERL, H., PLUTZAR, C., ERB, K.-H. & KRAUSMANN, F. (2001): *Pressure Indicators for Biodiversity Loss.* Paper to the Conference "Predicting Biodiversity in European Landscapes: Mapping, Patterns, Indicators, Monitoring". Vienna 18 - 20 December 2001.

FAO (2000): *Development of National-Level Criteria and Indicators for the Sustainable Management of Dry Forests in Asia*. Background Papers of the

FAO/UNEP/ITTO/IIFM/USFS Workshop on the Development of National-Level Criteria and Indicators for the Sustainable Management of Dry Forests in Asia. Bhopal, India; 30 November - 3 December 1999. FAO-Regional Office for Asia and the Pacific, Bangkok, Thailand. FAO-RAP Publication 2000/08. June 2000.

FAO (2001): "Criteria and Indicators for Sustainable Forest Management: A Compendium," Forest Management Working Paper 5, in: *Use of Criteria and Indicators for Monitoring, Assessment and Reporting on Progress toward Sustainable Forest Management in the United Nations Forum on Forests (2001)* Rome: Forest Resources Division.

FAO (2002): *Handbook on the Collection of Data and Compilation of Agri-Environmental Indicators. A Step-by-Step Guide*. Rome: FAO.

FISCHER, G. & SCHRATTENHOLZER, L. (2001): *Global bioenergy potentials through 2050*. Biomass and Bioenergy 20, 151 – 159.

GLOBAL ENVIRONMENT DIVISION (1998): *Guidelines for Monitoring and Evaluation for Biodiversity Projects* http://lnweb18.worldbank.org/ESSD/envext.nsf/45ByDocName/MEGuidelinesforBiodiversityProjects1998/$FILE/M&EGuidelinesforBiodiversity.pdf

HÄUSLER & SCHERER-LORENZEN (2001). *Sustainable Forest Management in Germany: The Ecosystem Approach of the Biodiversity Convention Reconsidered.* Bonn.

HEROLD, A.; EBERLE, U.; PLOETZ, C. & SCHOLZ, S. (2001): *Requirements of climate protection with regard to the quality of ecosystems: Use of synergies between the UNFCCC and the CBD*. Federal Environmental Agency (Berlin, Germany).

IAIA – INTERNATIONAL ASSOCIATION FOR IMPACT ASSESSMENT & IEA – INTERNATIONAL ENERGY AGENCY (1999): *Principles of Environmental Impact Assessment Best Practice*. http://www.iaia.org.

IPCC – INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (2000): *Special Report Land Use, Land-Use Change, and Forestry.* Cambridge, New York: Cambridge University Press.

IPCC – INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (2001): *Climate Change 2001: Mitigation*. Contribution of Working Group III to the Third Assessment Report (TAR) of the IPCC. Cambridge, New York: Cambridge University Press.

IUCN (2001): *Indicators and Environmental Impact Assessment*. Recommendations for the Seventh Meeting of the Subsidiary Body on Scientific, Technical, and Technological Advice (SBSTTA) to the Convention on Biological Diversity.

JENKINS, M. & KAPOS, V. (n.d.): *Biodiversity Indicators for Monitoring GEF Programme Implementation.* Final Report. World Conservation Monitoring Centre.

KALTSCHMITT, M. & HARTMANN, H. (2001): *Energie aus Biomasse. Grundlagen, Techniken und Verfahren.* Springer, Berlin, Heidelberg, New York.

KHADKA, R.; MCEACHERN, J.; RAUTIAINEN, O. & SHRESTA, U.S. (1996): "SEA of the Bara Forest Management Plan, Nepal" in: THÉRIVEL, R. & PARTIDÁRIO, M.R.:

The Practice of Strategic Environmental Assessment. Earthscan, London, 95 - 111.

KARTHA, S. & LARSON, E.D. (2000): *Bioenergy Primer. Modernised Bioenergy for Sustainable Development*. New York: UNDP.

KJORVEN, O. & LINDHEJM, H. (2002): *Strategic Environmental Assessment in World Bank Operations: Experience to Date – Future Potential*. Background Paper, The World Bank Group, Washington. http://www.worldbank.org.

LANE, A. & S. BUNNING 2003: *Stocktaking of Dryland Biodiversity Issues in the Context of the Land Degradation Assessment of Drylands (LADA): Selection and Use of Indicators and Methods for Assessing Biodiversity and Land Condition*. Draft 28 July 2003. Rome: FAO.

MCNEELY, J.A. & MILLER, K. (eds., 1984): *National Park Conservation and Development: the Role of Protected Areas in Sustaining Society*. Washington, D.C.: Smithsonian Institution.

MEA – MILLENNIUM ECOSYSTEM ASSESSMENT (2003a): *Ecosystems and Human Well-Being. Millennium Ecosystem Assessment*. Island Press.

MEA – MILLENNIUM ECOSYSTEM ASSESSMENT (2003b): Condition Working Group Assessment Report Outline. Draft, October 2003. http://www.millenniumassessment.org/viewdocument.aspx?ID=64.

MONTRÉAL PROCESS WORKING GROUP (1998): *Montréal Process – Criteria & Indicators*. http://www.mpci.org/criteria_e.html

MYERS et al. (2000): "Nature 403" in: JENKINS, M. & KAPOS, V. (n.d.): *Biodiversity Indicators for Monitoring GEF Programme Implementation*. Final Report. World Conservation Monitoring Centre.

NBF – NATIONAL BIOFUELS ROUNDTABLE (1994): *Principles and Guidelines for the Development of Biomass Energy Systems*. A report from the National Biofuels Roundtable. May, 1994. Draft Final Report.

OECD – ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT (2001): *Environmental Indicators for Agriculture, Methods and Results*, Volume 3. Paris, France.

OLADE – LATIN AMERICAN ENERGY ORGANISATION & IDB – INTER-AMERICAN DEVELOPMENT BANK (1994): *Guide for Assessing the Environmental Impact of Biomass Development for Energy Purposes*. Quito: IDB.

OTA – OFFICE OF TECHNOLOGY ASSESSMENT OF THE CONGRESS OF THE UNITED STATES (1993): *Potential Environmental Impacts of Bioenergy Crop Production – Background Paper*. OTA-BP-E-118. Washington D.C. Government Printing Office.

PARTIDÁRIO, M.R. (1996): "SEA Regulations and Guidelines Worldwide" in: THÉRIVEL, R. & PARTIDÁRIO, M.R.: *The Practice of Strategic Environmental Assessment*. Earthscan, London, 15 – 29.

RAVEN, J.A. & FALKOWSKI, P.G. (1999). *Oceanic Sinks for Atmospheric. CO2. Plant*, Cell and Environment 22, 741-755

SADLER, B. (1996): *Environmental Assessment in a Changing World: Evaluating Practice to Improve Performance. International Study of the Effectiveness of Environmental Assessment.* Canada, Ministry of Supply and Services.

SAEFL – SWISS AGENCY FOR THE ENVIRONMENTAL, FORESTS AND LANDSCAPE (2004): http://www.umwelt-schweiz.ch/buwal/de/fachgebiete/fg_swissflex/index.html

SEIBEL, B.A. & WALSH, P.J. (2001): *"Potential Impacts of CO_2 Injection on Deep-Sea Biota*". *Science* 294, 319-320.

SHYAMSUNDAR (2002): *Poverty-Environment Indicators*. The World Bank Environmental Department, World Bank, Washington DC in: SNEL & BOT (2002): *Some suggested indicators for Land Degradation Assessment of Drylands*. Draft paper. Rome: FAO.

SIEBER, S. (2003): *Indicators for a national monitoring of the environmental impacts of agriculture,* Volume 1. Report of the Institute for Agricultural Policy, University of Bonn. Federal Environmental Agency (Berlin, Germany).

SIST, P.; DYKSTRA, D.; & FIMBEL R. (1998): *Reduced-Impact Logging Guidelines for Lowland and Hill Dipterocarp Forests in Indonesia.* – CIFOR Occasional Paper No. 15. – Indonesia

SNEL & BOT (2002): *Some suggested indicators for Land Degradation Assessment of Drylands*. Draft paper. Rome: FAO.

THÉRIVEL, R.; WILSON, E.; THOMPSON, S.; HEANEY, D. & PRITCHARD, D. (1992): *Strategic Environmental Impact Assessment*. Earthscan, London.

THÉRIVEL, R. & PARTIDÁRIO, M.R. (1996): *The Practice of Strategic Environmental Assessment*. Earthscan, London.

THÉRIVEL, R. (1996): "SEA Methodology in Practice" in: THÉRIVEL, R. & PARTIDÁRIO, M.R.: *The Practice of Strategic Environmental Assessment*. Earthscan, London, 30-46.

THORNE, S. & LA ROVERE, E.L. (1999): *Criteria and Indicators for Appraising Clean Development Mechanism (CDM) Projects.* Energy Transformations, Cape Town, South Africa and Federal University of Rio de Janeiro, Brazil.

TRAEGER, H.; STEINER, K. & HERRING, A. (1997): "*Indicators of Sustainable Land Management. A Literature Review.*" GTZ, Farming Systems Research, Eschborn, Germany. in: Dumanski, J. (1997): *Criteria and Indicators for Land Quality and Sustainable Land Management*. ITC Journal 1997 – 3/4.

TREWEEK, J. (2001): *Integrating Biodiversity WITH National Environmental Assessment Processes. A review of Experiences and Methods*. UNEP/UNDP Biodiversity Planning Support Programme. Bristol, U.K.

TREWEEK, J. (n.d.): *Biodiversity and EIA for Development Cooperation*: Workshop Conclusions. EC/EU Tropical Biodiversity Advisors Group (TBAG). http://www.wcmc.org.uk/biodev/reports.

UNEP/CBD/SBSTTA (2003): *Interlinkages between biological diversity and climate change - Advice on the integration of biodiversity considerations into the implementation of the United Nations Framework Convention on Climate Change and its Kyoto Protocol.* CBD Technical Series no. 10. http://www.biodiv.org/doc/publications/cbd-ts-10.pdf.

UCS – UNION OF CONCERNED SCIENTISTS (2001): *Policy Context for Marine Carbon Sequestration*. Cambridge, Massachussetts, USA. www.-document. www.ucsusa.org/environment/br_marcarseq.pdf

UN – UNITED NATIONS (1992): *United Nations Framework Convention on Climate Change*. http://unfccc.int/resource/docs/convkp/conveng.pdf.

UN – UNITED NATIONS (1992a): *Convention on Biological Diversity*. http://www.biodiv.org/convention/articles.asp

UN – UNITED NATIONS *(1997): Kyoto Protocol to the United Nations Framework Convention on Climate Change. http://unfccc.int/resource/docs/convkp/kpeng.pdf.*

UN – UNITED NATIONS (2000): *Decision V/6: Ecosystem Approach*. http://www.biodiv.org/decisions/default.aspx

UN – UNITED NATIONS (2002): *WSSD Plan of Implementation.* http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIChapter 1.htm.

UN – UNITED NATIONS (2002a): *The Marrakesh Accords*. in: UNFCCC/CP/2001/13/Add.1 and 13/Add.2.

WBGU – WISSENSCHAFTLICHER BEIRAT DER BUNDESREGIERUNG GLOBALE UMWELTVERÄNDERUNGEN (2001): *Welt im Wandel – Erhaltung und nachhaltige Nutzung der Biosphäre*. Jahresgutachten 1999. Springer Berlin-Heidelberg.

WBGU – WISSENSCHAFTLICHER BEIRAT DER BUNDESREGIERUNG GLOBALE UMWELTVERÄNDERUNGEN (2003a): *Welt im Wandel – Energiewende zur Nachhaltigkeit*. Springer-Verlag Berlin-Heidelberg.

WBGU – WISSENSCHAFTLICHER BEIRAT DER BUNDESREGIERUNG GLOBALE UMWELTVERÄNDERUNGEN (2003b): *Über Kyoto hinaus denken – Klimaschutzstrategien für das 21. Jahrhundert*. Springer-Verlag Berlin-Heidelberg.

WERNER, G. (1992): "Environmental Impact Assessment in Asia: Lessons from the past Decade" in: BISWAS, A.K. & AGARWAL, S.B.C.: *Environmental Impact Assessment for Developing Countries*. Butterworth-Heinemann, Oxford, 16-21.

WETTERICH, F. & KÖPKE, U. (2003): *Indikatoren für ein nationales Monitoring der Umwelteffekte landwirtschaftlicher Produktion – Testphase*. Band 2: Biologische Vielfalt und Landschaftsästhetik. Berlin: Umweltbundesamt.

WORLD BANK (1997): *Environmental Assessment Sourcebook Update: Biodiversity and Environmental Assessment*. Washington DC: World Bank.

WORLD BANK (2001): *Making sustainable commitments - an environment strategy for the World Bank*. Washington D.C: World Bank.

WORLD BANK (2002): *Operational Policy on Forests - Definitions* (OP 4.36 - Annex A). Washington, D.C.

WORLD COMMISSION ON DAMS (2000): *Dams and development - a new framework for decision-making.* Earthscan Publications, London, United Kingdom.

WWF – World Wildlife Fund (2003): *The Gold Standard - Quality Assurance for CDM and JI Projects*. http://www.panda.org/about_wwf/what_we_do/climate_change/what_we_do/business_industry/gold_standard.cfm

7 Appendix(es)

Annex 1: Major International SFM Guideline Processes

Process and Year Initiated	Region/ Forest Types	Number of C&I	C&I considering biodiversity aspects
International Tropical Timber Organization (ITTO) 1992	Humid tropical forests	7 criteria and 66 indicators	Principle 3: The main ecological functions of the forest are maintained. Criterion 3.1 The sustainable management of the forest resources is based on a dynamic acquisition of knowledge on ecology. Indicator 3.1.1 Available knowledge allows an ecological assessment and diagnosis of the forest ecosystems. Indicator 3.1.2 Impact studies are carried out, in relation to the scale of harvesting, in accordance with the level and extent of scarcity of any resources of concern. Indicator 3.1.3 New scientific and technical data are synthesized periodically. Indicator 3.1.4 The results of monitoring and new scientific findings or technical data are taken into account to improve forest management and harvesting practices. Criterion 3.2 The impact of harvesting activities on the structure of the forest is minimized. Indicator 3.2.1 Reduced impact logging techniques are defined at the national level and implemented. Indicator 3.2.2 The harvesting methods do not impair the original structure and diversity of the forest. Criterion 3.3 The impact of harvesting activities on biodiversity is minimized. Indicator 3.3.1 At the forest concession level, decisions concerning forests with high conservation value are taken within the context of the precautionary principle. Indicator 3.3.2 Adequate procedures and guidelines exist and are implemented to identify and protect, in a manner which is representative of the diversity of habitats and at a scale adapted to the subject to be preserved: • endangered, rare or threatened species of fauna and flora; and • other biological components of the forest of particular interest, such as reproduction sites, rare habitats and key species. Indicator 3.3.3 The diversity and relative abundance of fauna species do not change significantly. Indicator 3.3.4 The diversity and density of flora species are not significantly modified by harvesting. Criterion 3.4 The natural regeneration capacity of the forests is ensured. Indicator 3.4.1 The conditions for natural regeneration are fulfilled and regeneration Indicator 3.4.2 Measures are taken to promote natural regeneration whenever necessary. Criterion 3.5 The impact of harvesting activities on water, soils and slopes is minimized. Indicator 3.5.1 The flow rate and quality of water are maintained. Indicator 3.5.2 The impact of harvesting activities on the biological, physical and chemical

Process and Year Initiated	Region/ Forest Types	Number of C&I	C&I considering biodiversity aspects
			Indicator 3.5.3 Water and soil restoration programs are implemented whenever necessary.
African Timber Organization (ATO) 1993 revised in collaboration with ITTO 2003	West and Central Africa African natural tropical forests	4 principles, 20 criteria and associated indicators and sub-indicators	Principle 3: The main ecological functions of the forest are maintained. Criterion 3.1 The sustainable management of the forest resources is based on a dynamic acquisition of knowledge on ecology. Indicator 3.1.1 Available knowledge allows an ecological assessment and diagnosis of the forest ecosystems. Indicator 3.1.2 Impact studies are carried out, in relation to the scale of harvesting, in accordance with the level and extent of scarcity of any resources of concern. Indicator 3.1.3 New scientific and technical data are synthesized periodically. Indicator 3.1.4 The results of monitoring and new scientific findings or technical data are taken into account to improve forest management and harvesting practices. Criterion 3.2 The impact of harvesting activities on the structure of the forest is minimised. Indicator 3.2.1 Reduced impact logging techniques are defined at the national level and implemented. Indicator 3.2.2 The harvesting methods do not impair the original structure and diversity of the forest. Criterion 3.3 The impact of harvesting activities on biodiversity is minimized. Indicator 3.3.1 At the forest concession level, decisions concerning forests with high conservation value are taken within the context of the precautionary principle. Indicator 3.3.2 Adequate procedures and guidelines exist and are implemented to identify and protect, in a manner which is representative of the diversity of habitats and at a scale adapted to the subject to be preserved: • endangered, rare or threatened species of fauna and flora; and • other biological components of the forest of particular interest, such as reproduction sites, rare habitats and key species. Indicator 3.3.3 The diversity and relative abundance of fauna species do not change significantly. Indicator 3.3.4 The diversity and density of flora species are not significantly modified by harvesting. Criterion 3.4 The natural regeneration capacity of the forests is ensured. Indicator 3.4.1 The conditions for natural regeneration are fulfilled and regeneration Indicator 3.4.2 Measures are taken to promote natural regeneration whenever necessary. Criterion 3.5 The impact of harvesting activities on water, soils and slopes is minimised. Indicator 3.5.1 The flow rate and quality of water are maintained. Indicator 3.5.2 The impact of harvesting activities on the biological, physical and chemical Indicator 3.5.3 Water and soil restoration programs are implemented whenever necessary.

Process and Year Initiated	Region/ Forest Types	Number of C&I	C&I considering biodiversity aspects
Pan-European Forest Process or Helsinki process 1993	European forests	4 general guidelines, 6 criteria and associated indicators	Resolution H2: General guidelines for the conservation of the biodiversity of European forests General guidelines: 1. The conservation and appropriate enhancement of biodiversity should be an essential operational element in sustainable forest management and should be adequately addressed, together with other objectives set for forests, in forestry policies and legislation. 2. The conservation and appropriate enhancement of biodiversity in forests should be based both on specific, practical, cost-effective and efficient biodiversity appraisal systems, and on methods for evaluating the impact on biodiversity of chosen forest development and management techniques. 3. Where possible, the size and degree of utilisation of forest compartments and other basic management units should take account of the scale of variation of the site, in order to better conserve and manage the diversity of habitats. Management should aim at increasing the diversity of forest habitats. 4. Where possible the establishment of taxa, which are naturally associated with those, that occur most frequently in the forest should be encouraged, and a variety of structure within stands should be favoured, where the natural dynamics of such associations permit. Criterion 4: Maintenance, Conservation and Appropriate Enhancement Of Biological Diversity in Forest Ecosystems Indicators: 4.1 Tree species composition 4.2 Regeneration 4.3 Naturalness 4.4 Introduced tree species 4.5 Deadwood 4.6 Genetic resources 4.7 Landscape pattern 4.8 Threatened forest species 4.9 Protected forests
Dry Zone Africa 1995	North, East and Southern Africa	7 criteria and 47 indicators	Criterion 2: Conservation and enhancement of biological diversity in forest eco systems Ecosystem Indicators: 1. Areas by types of vegetation (natural and man-made) 2. Extent of protected areas 3. Fragmentation of forests 4. Area cleared annually of forest ecosystems containing endemic species Species Indicators: 5. Number of forest dependent species (and its changes over time) 6. Number of forest dependent species at risk 7. Resources exploitation systems used Genetic Indicators (fauna, flora): 8. Average number of provenances (and their change over time)

Process and Year Initiated	Region/ Forest Types	Number of C&I	C&I considering biodiversity aspects
			9. Number of forest dependent species with reduced range 10. Population levels of key species across their range 11. Management of genetic resources
Montreal Process 1995	Temperate and boreal forests	7 national-level criteria and 67 indicators	Criterion 1: Conservation of biological diversity Biological diversity includes the elements of the diversity of ecosystems, the diversity between species, and genetic diversity in species. Indicators: Ecosystem diversity a. Extent of area by forest type relative to total forest area-(a); b. Extent of area by forest type and by age class or successional stage-(b); c. Extent of area by forest type in protected area categories as defined by IUCN or other classification systems-(a); d. Extent of areas by forest type in protected areas defined by age class or successional stage-(b); e. Fragmentation of forest types-(b). Species diversity f. The number of forest dependent species-(b); g. The status (threatened, rare, vulnerable, endangered, or extinct) of forest dependent species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment-(a). Genetic diversity h. Number of forest dependent species that occupy a small portion of their former range-(b); Population levels of representative species from diverse habitats monitored across their range-(b).
Tarapoto Proposal 1995	Amazon Forest	12 criteria and 77 indicators	<u>Criterion No. 4:</u> Conservation of the forest cover and of biological diversity. Indicators a. Extent of areas by type of forest in categories of conservation area, in relation to total forest area. b. Measures for in situ conservation of endangered species. c. Measures for the conservation of genetic resources. d. Area and percentage of forests affected by various agents or processes (pests, diseases, fire and flood, among other things). e. Rates of natural regeneration, composition of species and survival. f. Rate of change-over of the forest cover to other purposes. g. Areas and percentage of forest land with fundamental ecological changes. h. Impact of activities of other sectors on the conservation of forest ecosystems (mining, agriculture/stock farming, energy, infrastructure, etc.).

Process and Year Initiated	Region/ Forest Types	Number of C&I	C&I considering biodiversity aspects
Near East Process 1996	Near East	7 criteria and 66 indicators	Criterion 2: Conservation of biological diversity in forest areas. Ecosystem Indicators: 1. Distribution of forest ecosystems (area by type of vegetation, natural or man-made). 2. Areas of forest reserves and protected areas. 3. Spatial fragmentation of forest resources. 4. Excisions affecting rare ecosystems by area. Species Indicators: 5. Number of forest dependent species (fauna, flora). 6. Area and number of species at risk in forest areas. 7. Extent of mixed stands. 8. Reliance on natural regeneration. Genetic Indicators: 9. Existence of the number of seed provenance. 10. Number of forest dependent species with reduced range. 11. Population levels of key species across their range.
Central America Process or Lepaterique Process 1997	Central America	7 principles, 8 criteria and 40 indicators	Principle No. 4: Maintenance of biological diversity: Central American biological diversity has the potential to be converted into an ecological platform of political importance in globalisation and the context of economic integration. Criterion 5: Biological diversity in forest systems
Dry Forest Asia 1999	South and Central Asia	8 criteria and 48 indicators	Criterion No. 3: Maintenance and Enhancement of Bio-diversity 3.1 Extent of protected areas 3.2 Number of threatened, keystone, flagship and endemic species of plants and animals 3.3 List of flora and fauna 3.4 Degree of non-destructive harvest 3.5 Percentage of cover by forest type and/or species 3.6 Existence of mechanisms for the conservation of genetic resources
Forest Stewardship Council (FSC) 1993 revised February 2000	Worldwide all kind of forests	10 principles and 46 criteria	Principle No. 6: Environmental Impact Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest. 6.1 Assessment of environmental impacts shall be completed -- appropriate to the scale, intensity of forest management and the uniqueness of the affected resources -- and adequately integrated into management systems. Assessments shall include landscape level considerations as well as the impacts of on-site processing facilities. Environmental impacts shall be assessed prior to commencement of site-disturbing operations. 6.2 Safeguards shall exist which protect rare, threatened and endangered species and their habitats (e.g. nesting and feeding areas). Conservation zones and protection areas shall be established, appropriate to the scale and intensity of forest

Process and Year Initiated	Region/ Forest Types	Number of C&I	C&I considering biodiversity aspects
			management and the uniqueness of the affected resources. Inappropriate hunting, fishing, trapping and collecting shall be controlled. 6.3 Ecological functions and values shall be maintained intact, enhanced, or restored, including: a) Forest regeneration and succession. b) Genetic, species, and ecosystem diversity. c) Natural cycles that affect the productivity of the forest ecosystem. 6.4 Representative samples of existing ecosystems within the landscape shall be protected in their natural state and recorded on maps, appropriate to the scale and intensity of operations and the uniqueness of the affected resources. 6.5 Written guidelines shall be prepared and implemented to: control erosion; minimize forest damage during harvesting, road construction, and all other mechanical disturbances; and protect water resources. 6.6 Management systems shall promote the development and adoption of environmentally friendly non-chemical methods of pest management and strive to avoid the use of chemical pesticides. World Health Organization Type 1A and 1B and chlorinated hydrocarbon pesticides; pesticides that are persistent, toxic or whose derivatives remain biologically active and accumulate in the food chain beyond their intended use; as well as any pesticides banned by international agreement, shall be prohibited. If chemicals are used, proper equipment and training shall be provided to minimize health and environmental risks. 6.7 Chemicals, containers, liquid and solid non-organic wastes including fuel and oil shall be disposed of in an environmentally appropriate manner at off-site locations. 6.8 Use of biological control agents shall be documented, minimised, monitored and strictly controlled in accordance with national laws and internationally accepted scientific protocols. Use of genetically modified organisms shall be prohibited. 6.9 The use of exotic species shall be carefully controlled and actively monitored to avoid adverse ecological impacts. 6.10 Forest conversion to plantations or non-forest land uses shall not occur, except in circumstances where conversion: a) entails a very limited portion of the forest management unit; and b) does not occur on high conservation value forest areas; and c) will enable clear, substantial, additional, secure, long term conservation benefits across the forest management unit.
Pan European Forest Certification Council (PEFC) 1999	Europe	6 criteria pursuant the Pan-European Forest Process	<u>Criterion No. 4:</u> Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems. <u>4.1 Guidelines for Forest Management Planning</u> a. Forest management planning should aim to maintain, conserve and enhance biodiversity on ecosystem, species and genetic level and, where appropriate, diversity at landscape level. b. Forest management planning and terrestrial inventory and mapping of forest resources should include ecologically important forest biotopes, taking into account protected, rare, sensitive or representative forest ecosystems such as riparian areas and wetland biotopes, areas containing endemic species

Process and Year Initiated	Region/ Forest Types	Number of C&I	C&I considering biodiversity aspects
			and habitats of threatened species, as defined in recognised reference lists, as well as endangered or protected genetic in situ resources. 4.2 Guidelines for Forest Management Practices a. Natural regeneration should be preferred, provided that the conditions are adequate to ensure the quantity and quality of the forests resources and that the existing provenance is of sufficient quality for the site. b. For reforestation and afforestation, origins of native species and local provenances that are well adapted to site conditions should be preferred, where appropriate. Only those introduced species, provenances or varieties should be used whose impacts on the ecosystem and on the genetic integrity of native species and local provenances have been evaluated, and if negative impacts can be avoided or minimised. c. Forest management practices should, where appropriate, promote a diversity of both horizontal and vertical structures such as uneven-aged stands and the diversity of species such as mixed stands. Where appropriate, the practices should also aim to maintain and restore landscape diversity. d. Traditional management systems that have created valuable ecosystems, such as coppice, on appropriate sites should be supported, when economically feasible. e. Tending and harvesting operations should be conducted in a way that does not cause lasting damage to ecosystems. Wherever possible, practical measures should be taken to improve or maintain biological diversity. f. Infrastructure should be planned and constructed in a way that minimises damage to ecosystems, especially to rare, sensitive or representative ecosystems and genetic reserves, and that takes threatened or other key species - in particular their migration patterns - into consideration. g. With due regard to management objectives, measures should be taken to balance the pressure of animal populations and grazing on forest regeneration and growth as well as on biodiversity. h. Standing and fallen dead wood, hollow trees, old groves and special rare tree species should be left in quantities and distribution necessary to safeguard biological diversity, taking into account the potential effect on health and stability of forests and on surrounding ecosystems. i. Special key biotopes in the forest such as water sources, wetlands, rocky outcrops and ravines should be protected or, where appropriate, restored when damaged by forest practices.

Annex 2: EEA - Indicators Related to the State and Trends of Europe's Biodiversity

Policy question	Indicator title & sub indicators	DPSIR	S/M/L	Other issues
What is the state and trends of biodiversity? Will the loss of biodiversity be halted 2010?	BDIV1 Habitat diversity BDIV1a State of 10 main EUNIS habitats types per biogeographic region and per country BDIV1b Change of 10 main EUNIS habitats types per biogeographic region and per country (including agro-ecosystems) BDIV1c Percentage and trends in wilderness areas by country, biogeographic region, Europe BDIV1d Naturalness of Forests	S	ST MT MT ST	MCPFE 4.3
	BDIV2 Species diversity BDIV2a Species richness in proportion to surface area of the countries BDIV2b Species richness in proportion to surface area of biogeographic regions BDIV2c Species richness by main 10 main EUNIS habitats types BDIV2d Tree species composition in forests BDIV2e Changes in species composition in wetlands BDIV2f Endemic Species richness in proportion to surface area of biogeographic regions BDIV2g Trends of species groups (carnivores, raptors, geese, species of economic interest…) BDIV2h Trends of representative selection of species associated with different ecosystems (including agro-ecosystems)	S	ST ST MT ST ST MT ST/MT ST/MT	Agriculture MCPFE 4.1 Agriculture
	BDIV3 Threatened species BDIV3a Number of threatened taxa occurring at different geographical levels BDIV3b Number of globally threatened species endemic to Europe BDIV3c Percentage of globally threatened species per biogeographic region BDIV3d Percentage of European threatened species per biogeographic region BDIV3e Threatened forest species	I	ST ST ST MT ST	MCPFE 4.8
	BDIV4 Genetic diversity BDIV4a Forest Genetic resources BDIV4b Wild relatives of cultivated plants BDIV4c Crops and breed genetic diversity	S	ST ST ST	MCPFE 4.6 Agriculture
What are the causes of the loss of biodiversity?	BDIV5 Threats to ecosystems BDIV5a Threats in and around wetland sites	I	ST/MT	
	BDIV6 Landscape changes BDIV6a Landscape-level spatial pattern of forest cover BDIV6b Diversity of linear features and diversity of crops in farmlands		LT LT	MCPFE 4.7 Agriculture
	BDIV7 Introduced and invasive species BDIV7a Percentage of introduced species that have become invasive per biogeographic region BDIV7b Spread of invasive species over time BDIV7c Introduced tree species BDIV7d Introduced species in fresh surface waters WEC8b Introduced species in marine waters	I	MT MT MT ST ST	Agriculture

Annex 3: Indicators Related to Integration of Biodiversity Issues into Sectoral Policies

Policy area/sector	Indicator title & subindicators	DPSIR	S/M/L	Other issues/ sectors
Agriculture	BDIV1a State of 10 main EUNIS habitats types per biogeographic region and per country BDIV1b Change of 10 main EUNIS habitats types per biogeographic region and per country (including agro-ecosystems) BDIV2h Trends of representative selection of species associated with different ecosystems (including agro-ecosystems) BDIV4b Wild relatives of cultivated plants BDIV4c Crops and breed genetic diversity BDIV13b Agricultural land in designated areas			Agriculture
Forestry	BDIV14 Deadwood	S	LT	MCFPE 4.5
	BDIV1d Naturalness of Forests BDIV2d Tree species composition in forests BDIV2e Changes in species composition BDIV3e Threatened forest species BDIV4a Forest Genetic resources BDIV6a Landscape-level spatial pattern of forest cover BDIV7c Introduced tree species			

Annex 4: Agrobiodiversity in the Ukraine

Wild Biodiversity
KQ 1: What is the current state of agrobiodiversity in Ukraine?
LPI Species richness NCI Status of rare species Alien species Types/Areas of ag land Analysis and inventory of natural fragments Water availability and quality
KQ 2: What are the main factors causing decrease or increase of agrobiodiversity, and how do changes in the land use practice impact decrease or increase of agrobiodiversity?
Human population distribution and trends Land use changes Alien species Fragmentation Tillage frequency Ag land management (soil & water) Ag inputs (fertilizers, pesticides, herbicides) Abiotic environment quality (soil, water, air) Global climate change and population (provided by GLOBIO)
KQ 3: What lands could be returned to nature in the near future?
Spatial integrity index Marginal ag lands (lands with low ag value) Areas of high diversity with threatened species Ag lands with long fallow periods Low agricultural inputs Human population Land to be privatised Economic pressures Lands planed for conversion to a natural state
KQ 4: To what extent are national bio-indicators linked with international ones?
LPI on migratory spp. Ag lands best for migratory spp. Participation in international agreements processes (FAO, CBD, CMS) Evaluation of government policy on international agreements

KQ 5: How can scenarios of agrobiodiversity changes be built, and how can biodiversity loss be stopped in the near future?
Calculate the magnitude of the problem (LPI, NCI) Forecast pressures from KQ2 Future government policy Evaluate species risks and develop action plan
Genetics
What is the status of crop race diversity in Ukraine, and to what extend is Ukraine susceptible to monoculture effects?
Consumption patterns Total number of crop genotypes Number of genotypes that are commonly grown Distribution and abundance of wild relatives crops Effects of high production crops on wild biodiversity

Annex 5: England Biodiversity Strategy Indicators

Indicators in *italics* are presented complete in this document, those in black are not yet fully developed.

H. Headline
H1: Populations of wild birds in England (including farmland and woodland birds)
H2: Condition of Sites of Special Scientific Interest (SSSI) in England
H3: Progress with Biodiversity Action Plans in England
H4: Area of land under agri-environment agreement in England (interim to be replaced by 'Area of BAP land under agri-environment agreement')
H5: Biological quality of rivers in England (interim)
H6: UK fish stocks fished within safe limits
H7: Progress with Local Biodiversity Action Plans
H8: Public attitudes to biodiversity

A. Agriculture
A1: Progress towards farmland HAP/SAP targets in England
A2: Condition of farmland SSSI's in England
A3: Extent and condition of farmland habitat features
A4: Trends in plant diversity in fields and field margins
A5: No. of farms with LEAF Audit

W. Water and wetlands
W1: Progress towards water and wetland SAP/HAP targets in England
W2: Condition of water and wetland SSSIs in England
W3: Populations of water and wetland birds in England
W4: Trends in riverine plant diversity in England
W5: Phosphorus levels in rivers and lakes (interim to ultimately be replaced by 'Nutrient levels in rivers and lakes')
W6: Percentage of rivers meeting conservation targets for salmon

F. Woodland and forestry management
F1: Progress towards woodland SAP/HAP targets in England
F2: Condition of woodland SSSIs in England
F3: Trends in woodland plant diversity
F4: Area of ancient woodland (interim to be replaced by 'Area of ancient woodland under an approved management regime')
F5: Public enjoyment of woodland

T. Towns, cities and development
T1: Impact of the urban sector on Biodiversity Action Plans
T2: Condition of SSSI's in urban areas
T3: Populations of birds in towns and gardens
T4: Ease of access to local green space and countryside
T5: Proportion of households in England undertaking wildlife gardening
T6: Unitary Development/Structure Plans with biodiversity policies and targets

M. Coasts and seas
M1: Progress towards coastal and marine SAP/HAP targets
M2: Populations of coastal and seabirds
M3: Marine biodiversity
M4: Number and size of coastal and inshore marine Natura 2000 sites; Number of sites with management plans; Condition of coastal SSSIs in England

M5: Marine inputs: cessation of discharges, emissions and losses of hazardous substances by 2020
M6: Levels of cetacean by-catch in UK waters

L. Local and regional
L1: Condition of SSSIs in local authority ownership
L2: Community Strategies with biodiversity elements
L3: Incorporation of biodiversity objectives in regional strategies

E. Economics and funding
E1: Economic contribution of tourism
E2: Numbers of visits to nature reserves in England
E3: Sustainable tourism

B. Engagement of business
B1: Condition of SSSIs in company ownership
B2: Proportion of expenditure by business on biodiversity
B3: No of companies for whom biodiversity is a material issue which report on their biodiversity performance in annual reports
B4: Coverage of company BAPs as a contribution to LBAPs

U. Public understanding
U1: Volunteer time spent in conservation activity
The following theme and indicator has been added since the publication of the England Biodiversity Strategy.

C. Climate change

C1: Changes in abundance of climate sensitive species at Environmental Change Network sites in England

Annex 6: Agri-biodiversity Framework of the OECD

Indicator Group	Indicators
Agricultural Crop and Livestock Genetic Resources	• Total number of crop varieties/livestock breeds for the main crop/livestock categories (e.g. wheat, rice, cattle, pigs) that have been registered and certified for marketing, including native and non-native species and landraces. • Share of crop varieties in total production for individual crops (e.g. wheat, rice). • Share of livestock breeds in total livestock numbers for respective categories of livestock (e.g. cattle, pigs, poultry, sheep). • Number and share of national crop varieties/livestock breeds used in agricultural production that are endangered.[51] • Number of available species and accessions (samples) conserved in situ and ex situ in national programmes.
Habitat Quantity[52]	• The current area and share (stock) of different habitat types across all agricultural land, including intensively or extensively farmed land (e.g. arable crops, rangeland, rice paddies), semi-natural areas (e.g. certain grasslands, heather moorland) and uncultivated land (e.g. fallow, areas of remnant native vegetation, ponds). • Changes in the area and shares of habitats (flows) both within agriculture (e.g. less arable land, more pasture) and between different land uses (e.g. from agricultural use to forestry or change from wetlands to agricultural use).
Habitat Quality	**Habitat Structure Indicator** to describe trends in quality and quantity of habitat features and their spatial composition across agricultural land. • patch size: the size of habitat patches is important for some species; • fragmentation: the extent to which a given habitat type is divided into separate patches; • linear features and networks: for example, the length, age, quality and connectivity of • hedges; • vertical structures: habitat structures in terms of vertical layers (e.g. bushes and trees), • which are especially important to bird and invertebrate communities; • mosaic of different habitats in an agro-ecosystem: for example, habitat diversity, location, juxtaposition and heterogeneity of land cover, and linkages to indicators of agricultural landscape in countries where this is important. **Habitat Management Indicator**: Trends in farm management practices and systems which affect biodiversity. Habitat management indicators, which provide an indirect measure of habitat quality, are included under the OECD overall core set of agri-environmental indicators concerning farm management covering the effects on biodiversity from farming practices (e.g. timing of grass cutting, nutrient and pesticide management, stocking densities), and different farm management systems (e.g. integrated land management systems,

[51] This indicator cannot be used i.e. in Germany as there are no criteria for the classification of rare or endangered.

[52] At present two types of agricultural categorisation are used in OECD countries: 1) agricultural land use and cover types, mainly drawing on data collected through regularly updated agricultural census, for example, arable land, permanent crops and managed pasture; 2) biological and ecological characteristics, for example, mires and heathland, semi-natural grasslands, wild prairies, rangelands, and broader ecozones.

Indicator Group	Indicators
	organic farming). **Wild Species Indicator** to describe trends in the abundance, richness and ecologically indicative value of wild species using agricultural habitats or affected by farming activities. They provide a direct measure of habitat quality, they are also useful indicators in their own right to reveal the current stock and trends in wild species, including wild relatives of domesticated crop and livestock species, and widespread, rare and endangered species. Trends in alien invasive species are also of importance to a number of OECD countries, but are currently not part of the OECD work on agri-biodiversity indicators.
Habitat Quantity and Quality	**Habitat-Species Matrix**: Changes in the area and management of all agricultural habitat types and the identification, explicitly (i.e. direct observations) or implicitly (i.e. indirect information such as expert knowledge), of the impact of these changes on wild species (flora and fauna). **Natural Capital Index**: The product of the quantity of agricultural habitat types and their quality in terms of wild species abundance, richness, habitat structure and management, measured between the current state of the agro-ecosystem and a baseline state.

Annex 7: EEA Agricultural Indicators in Relation to Policy Questions

Generic question	Policy question	Indicator title	DPSIR	S/M/L	Other sectors/sectors
Is the environmental impact of agriculture improving?	How are emissions from agriculture developing? What is the impact of agriculture on key environmental resources? What is the link of agriculture to landscapes and biodiversity?	APE7b Agriculture ammonia emissions		ST	Air pollution
		AGRI1Surface nutrient balance		ST	(Water Terrestrial)
		CC5i Agriculture GHG emissions		ST	Climate change
		TES1a Soil erosion		LT	Terrestrial
		WQ3a Ground water levels		MT	Water
		TES2 Loss of organic matter content of soils		MT	Terrestrial
		WEU1/WEU2/WHS1/WHS2 Nitrates/pesticides in water		ST	Water
		TELC5 landscape diversity		MT	Terrestrial
		BDIV2c Species richness		MT	Biodiversity
		BDIV1 Habitats and biodiversity		MT	Biodiversity
		AGRI4 High nature value farming areas		MT	Biodiversity

[…]

What is the progress in management integration?	How widespread is the use of environmental policy measures and farm management knowledge?	AGRI16 Farm management practices		LT	
		BDIV13b Agricultural land in designated areas		MT	Biodiversity
		AGRI17 Nitrate Directive Implementation		ST	Water
		AGRI11 Use of cross-compliance instrument		MT	

Annex 8: Indicators in the Field of Agriculture Compiled by the European Commission

DPSIR reference	Group	No.	Indicator	Data Sources	Requirements	Action
Public policy	b	1	Area under agri-environment support	Administrative	Access to administrative data	R
	b	2	Good farming practice	Administrative	Access to method, MS survey Further research	M, R, S
	d	3	Environmental targets	*	Further studies and research	M
	b	4	Nature protection	Information in Member States	Access to information	P, M, R
Market signals	a	5.1	Organic producer prices	Agricultural price statistics	Extension of coverage	P, E, S
	A	5.2	Agricultural income of organic farmers	FADN	Implementation	E
Technology and skills	a/c	6	Holders' training levels	FSS Rural Development data	New characteristics, access to administrative data	E,MR
Attitudes	a/b	7	Organic farming	Administrative data; Ad hoc questionnaire	Access to data New questions	R,E
Input use	a	8	Fertiliser consumption	FADN and other sources Ad hoc survey	New characteristics Set up	P,E
	a/c		Pesticide consumption	Administrative data; Results of TAPAS actions	Research on aquatic risk indicator; Data access	P,S,R
	a		Water use	FADN, specific surveys	New characteristics, set up	E
	a	11	Energy use	FADN	New characteristics	E
Land use	b	12	Topological change	National administrative records	Access to data	P,M,R
	a/c	13	Cropping/livestock patterns	National studies	Access to information; Encouraging harmonisation	R,M S,M
Management	d	14	Management practices	No proposals	Further study and research	S
Trends	a/c	15	Intensification/extensification	FSS and FADN data	Fully exploitation of existing sources	P,S
	a	16	Diversification	FSS, GIS	New characteristics and relocation of FSS data	E,S
	a/c	17	Marginalisation	FSS, national data	Relocation of data, new characteristics, availability	P,R,E,M
Pollution	a	18	Surface nutrient balance	FSS and administrative data	Methodological development	S,M,R
	a	19	CH4 emissions	Inventories (EEA, MS), FSS	Access to existing inventories; New characteristics	M E
	c	20	Pesticide soil contamination	*	Further work needed	En
	c	21	Water contamination	*	Further work needed	En
Resource	a/c	22	Ground water	Survey	cf. Indicator 10	R,M

DPSIR reference	Group	No.	Indicator	Data Sources	Requirements	Action
depletion			abstraction/water stress	Source of water	Availability from MS	
	a/b/c	23	Soil erosion	Existing studies and GIS	Methodological development	S En
	a	24	Land cover change	LUCAS	Successful deployment	L
	B	25	Genetic diversity	Administrative data	Supplementary survey	R,S
Benefits	B	26	High nature value areas	NATURA 2000, CORINE land cover (CLC) and FSS	CLC update Integration of the sources	E S
	A	27	Renewable energy sources	Administrative data, FSS	Access to data, New characteristics	R,E
Biodiversity	D	28	Species richness	National data?	Further work needed	M
Natural resources	C	29	Soil quality	CLC and existing data	Identifying the most useful sources	P,M En
	D	30	Nitrates/pesticides in water	National data?	Further study and research	M En
	D	31	Ground water levels	National data?	Further study and research	M En
Landscape	B	32	Land use matrix	LUCAS	Successful deployment	L
Habitats and biodiversity	C	33	Habitat and biodiversity	LUCAS FSS/CLC	Successful deployment Studies on spatial relocation	L S
Natural resources	B	34.1	GHG emissions	Existing data	Modelling	S
	B	34.2	Nitrate contamination	National data	Modelling and national data	M, S
	B	34.3	Water use	Water questionnaire	Add items to questionnaire	E
Landscape diversity	C	35	Agricultural and global diversity	LUCAS, CLC	Successful deployment update	L E

Action: R = Regulation for statistical use of administrative data and their integration with statistical sources where necessary, E = Based on existing surveys, M = use of data/methods from Member states, S = study / development, L = LUCAS survey, P = pilot study En = Environmental data bases such as CORINE Land Cover, soil, climate, etc.

Annex 9: Indicators included in the EC Biodiversity Action Plan for Agriculture

Annex III - Monitoring indicators These indicators were presented by the Commission in the context of the Rural Development Regulation.
Less-favoured areas and areas with environmental restrictions
Breakdown by type of compensatory payment associated to different areas (Mountain areas, other less-favoured areas, areas affected by specific handicaps, areas with environmental restrictions) and by type of area (Natura 2000 etc) of the following figures: - Number of beneficiaries of compensatory allowances - Number of hectares enjoying compensatory allowances - Average amount of payment (per holding and per ha) - Total public expenditure (of which: EAGGF contribution)
Breakdown by areas with environmental restrictions of compensatory allowances: - Classified agricultural surfaces (ha) - % of those surfaces enjoying compensatory allowances (of which: mountain areas, other less-favoured areas, areas affected by specific handicaps, areas with environmental restrictions * Agri-environment
Environmental indicators. Breakdown by action and by type of land use of: - Codification of undertakings - Objective of the action (Protection of natural resources, biodiversity, and/or landscapes) - Mineral fertilisation level (of which N, P, K): level fixed by the undertaking (Kg/ha) / reference level - Organic fertilisation: level fixed by the undertaking (t/ha) / reference level - Livestock density: level fixed by the undertaking (LU/ha) / reference level
Uptake indicators. Breakdown by type of land use (annual crops, permanent crops, other land uses) / action / objective (biodiversity, landscape, natural resources), of the following figures: - Number of beneficiaries - Number of units [50] eligible to the engagements/achieved [50] The «reference unit» used in respect of agri-environmental undertakings mainly refers to concerned Ha, but it can also be LU (actions relating to endangered breeds) or km (creation of hedgerows etc). - Average premium per unit of payment - Premium linked to non-remunerative investment (%) - Total public expenditure (of which EAGGF contribution)
Other indicators: - Areas environmentally sensitive: ha of classified surfaces (of which: surfaces (%) covered by an agri-environmental contract) - Plant varieties under threat of genetic erosion: ha of cultivated areas (of which surface (%) covered by an agri-environmental contract) - Endangered breeds: number in the region (of which: number covered by an agri-environmental contract)
Annex IV - Indicators for evaluation These indicators are currently discussed with the Member States in the context of the Rural Development Regulation.

Annex 10: Key Biodiversity, Land Condition and Socio-economic Indicators and Levels of Assessment (local, ecosystem or national)

State of biodiversity, natural resources and socio-economics	Local (plot, F-H, catchment)	Farming system/agro-ecological zone	National
I Ecosystem level			
Diversity of ecosystems/habitats			
Change in vegetation cover, composition and structure [B, H, N, P]		X	X
Degree of fragmentation by ecosystem (e.g. forest type) [P]		X	X
Rate of conversion of forest cover [B, H, N, P]		X	X
Land use change [B, H, N, P]		X	X*
Proportion of agricultural ecosystem types [B, H, N, P]		X	X
Change in surface water area [H, P]		X	X
Proportion of threatened habitats and species protected		X	X
Arable and permanent crop land [P]		X	X*
Human demographics			
Human Population growth		X	X
Poverty	F-H	X	X
Urban/rural area		X	X
Urban/Rural population		X	X
Rural exodus			X
Management practices			
Water management [H]	F-H	X	
Tillage and sowing methods [B, H, N, P]	P	X*	
Nutrient and OM management [B, H, N, P]	P	X*	
Crop rotation [B, H, N, P]	P		
Intercrops and cover crops [B, H, N, P]	P		
Fallow period, over sowing [B, H, N, P]	P		
Weed, pest and disease management [B, H, N, P]	P	X*	
Grazing regime [B, H, N, P]	P	X*	
Fire management [N, H, P]	P, C	X	X
2 Species and genetic diversity (plant, animal microbe)			
Loss of key species (economic, cultural, eco-services) [B, N]	X	X	X*
Changes in species composition and abundance [P]	X	X	
Rate of harvesting of certain wild target species [P]		X	X
Policies and plans in place for harvesting of wild target species		X	X
No. of threatened species protected		X	X
Plant			
Species and taxa diversity [B, H, N, P]	X		
No. and amount of wild food species consumed	F-H		
Structural diversity (vertical and horizontal) [B, H, N, P]	P, C	X	X*
Proportion of alien or invasive species [B, N]	P, C	X	X*
Share of crop varieties in total production for individual crops [1 B, N]	P	X	X*
No. and share of national crop varieties used that are endangered[1]			
No. of species cultivated by local smallholders [B, N]	P	X	X*
Contribution to HH food needs [P]			
Key plant species (high ecological, conservation, financial, cultural value) [B, H, N, P]	P		
	F-H	X	X*
	P	X	X*
Animal			
No. of breeds used by livestock categories including native and non-native species [B, N]			
No. and share of livestock breeds used in agricultural production that are endangered[1]	F-H	X*	X*
Contribution to HH food needs [P]	F-H	X	X*
Key animal species (high ecological, conservation, financial, cultural value) [B, H, N, P]	F-H	X	X*
	P	X	X*
Microbial			
Incidence and spread of pests and diseases (plant & soil borne) [B]			
Impacts on crop and livestock productivity [P]	P, C	X	X*
Impacts of pests and diseases on income levels	P, C	X	X*
	F-H	X	X*

State of biodiversity, natural resources and socio-economics	Local (plot, F-H, catchment)	Farming system/agro-ecological zone	National
3. Soil			
Soil Biodiversity			
Presence and abundance of selected macro-fauna (see Table 2) [B, H, N]	P		
Microbial activity (respiration rate) [B, H, N, P]			
Soil organic biomass [B, H, N, P]	P		
	P		
Soil Physical degradation			
Soil surface condition [H, N, P]	P		
Ponding (indicating compaction) [H, N, P]	P, C	X	
Erosion [H, N, P]	P, C	X	
Vegetation cover, composition; structure; health [B, H, N, P]	P, C	X*	
Soil moisture (e.g. day after rainfall) [H, P]	P	X	
Soil Chemical degradation/contamination			
Area of salinity, sodicity, acidity [H, N, P]	C	X	X*
Vegetation cover, productivity, composition, health [P]	P, C	X*	
Soil nutrient deficiencies (NPK) [H, N, P]	P	X*	
Soil micronutrient deficiencies (e.g. Mb) [H, N, P]	P		
4. Water			
Water Quality – contamination			
Flora and fauna bio-indicators [B, N, P]	C	X	
Chemical characteristics [B, N]	C	X	
Turbidity [B, N]	C	X	
Nutrient load [B, N, P]	C	X	
Sedimentation [N]	C	X	
Algal blooms [N]	C	X	
Proportion of population with access to good quality water	C	X	X*
Incidence or deaths from water-related human diseases	C	X	X*
Water Quantity – loss of habitat			
Flora and fauna bio-indicators (sensitive to depth changes) [H, P]	C		
Withdrawal volume or proportion [H, P]	C	X	X*
Depth to water table [H]	C	X	
Water flow (duration, volume) [H]	C	X	X*
Time taken to collect water [H]	F-H	X	
5. Food and livelihood security (see FIVIMS methods)			
Farm size	F-H	X	X*
Area under cultivation	F-H	X	X*
Household income	F-H	X*	X*
Income per capita	F-H	X*	X*
Farm profits	F-H	X*	X*
Proportion of income from livestock	F-H	X*	X*
Proportion of income from crops (differentiate food and fodder)	F-H	X*	X*
Land tenure	F-H	X	X
Crop and livestock productivity	F-H	X	X*
Food security of households (over year)	F-H	X	X*
Nutritional status and deficiencies of households	F-H	X	X*
Number in HH by gender and age groups	F-H	X	X*
Number of HH member able to work (dependency ratio)	F-H	X	X*
Education (highest level in HH and schooling of children (quality and quantity)	F-H	X	X*
Time to reach nearest market	F-H	X	
Natural disasters (e.g. drought, flood frequency and severity)		X	X

Source: LANE & BUNNING (2003)

National level assessments often collate information collected at local and ecosystem levels. These national indicators are indicated as X*. [1] = OECD (2001a) agricultural biodiversity indicator

Ecosystem processes: B=bio control H=hydrological cycle N=nutrient cycling P=productivity

Annex 11: Eurostat: Preliminary List of SDI, Revision 2 (Version of 26 January 2004), Sub-theme: Management of Natural Resources

Level I	Sub-themes	Level II	Level III	Headline Objectives
MANAGEMENT OF NATURAL RESOURCES AND WASTE				
1. *Biodiversity index* **1a. Population trends of woodland, farmland and wetland wild birds** **2. Percentage of fish catches taken from stocks that are outside safe biological limits**	**BIODIVERSITY**	**1.** Percentage of protected area (either under the Birds and Habitats Directive, or, by IUCN category)	*Sufficiency of protected areas*	Protect and restore habitats and natural systems and halt the loss of biodiversity by 2010. 6EAP: Conservation of species and habitats with a special concern of preventing habitat fragmentation. PoI2002: Achieve by 2010 a significant reduction in the current rate of loss of biological diversity.
	MARINE ECOSYSTEMS	**2.** *Effective fishing capacity vs. quotas, by specific fisheries* **2a.** Size of fishing fleet (in tonnes)	*Structural support to fisheries and % allocated to promote env. friendly fishing practices* *Trends for spawning stocks of selected species*	EC Gothenburg2001: The review of the CFP should address the overall fishing pressure by daapting the EU fishing effort to the level of available resources, taking into account the social impact and the need to avoid over-fishing. 6EAP: Conservation, appropriate restoration and sustainable use of marine environment, coasts and wetlands. PoI2002: On an urgent basis, and where possible by 2015, maintain or restore depleted fish stocks to levels that can produce the maximum sustainable yield.
	FRESH WATER RESOURCES	**3.** Water abstraction (surface and groundwater) / available resources	*Water use vs. replenishment rate* (% of households connected to waste water treatment systems) *BOD loading of rivers (or oxygen content in rivers)* *N surpluses in vulnerable zones (as defined in Nitrates Directive)* *Index of pesticide risk to aquatic environment*	6EAP: Ensure that the rates of extraction from water resources are sustainable over the long term. PoI2002: Develop integrated water resources management and water-efficiency plans by 2005.

	LAND USE	**4**. Land use change (natural-agriculture- built-up land) **5**. *Exceedance of critical loads of acidifying substances and N in sensitive natural areas*	Growth of built-upland *Total area at risk from soil degradation, by category of degradation (erosion, heavy metal contamination, etc.)* % of forest showing severe forest defoliation	6EAP: Conserve and restore areas of significant landscape value including cultivated and sensitive areas. Promotion of sustainable use of the soil, with particular attention to preventing erosion, deterioration, contamination and desertification. PoI2002: Accelerate the implementation of the IPF/IFF proposals for action and by the Collaborative Partnership on Forests, and intensify efforts on reporting to the UN Forum of Forests so as to contribute to an assessment of progress in 2005.