Practical Guidance and Recommendations for Integrating Climate Change and Biodiversity into Strategic Environmental Assessment (SEA) Procedures

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FOREWORD

[To be added by DG Environment at their discretion]

Contents

Glossary

Term	Definition
Adaptation	The term used to describe responses to the effects of climate change. The IPCC defines adaptation as "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities." Adaptation can also be thought of as the ongoing process of managing changing climate risks.
Baseline	A description of the present and future state, in the absence of any plan or programme, taking into account changes resulting from natural events and from other human activities.
Biodiversity	The variability among living organisms and the ecological complexes of which they are part. This includes diversity within species, between species and of ecosystems.
Biodiversity offsets	Measures taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimised and/or rehabilitated or restored, in order to achieve no net loss or a net gain of biodiversity. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, protecting areas where there is imminent or projected loss of biodiversity.
Climate	Usually defined as the 'average weather', or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time. These quantities are most often surface variables such as temperature, precipitation, and wind. The conventional period of time over which weather is averaged to calculate climate is 30 years, as defined by the World Meteorological Organization (WMO). (Modified from IPCC.)
Climate change	The IPCC defines this generally as "...any change in climate over time, whether due to natural variability or as a result of human activity." This usage differs from that in the United Nations Framework Convention on Climate Change (UNFCCC), which defines 'climate change' specifically in relation to human influence as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'.
Cumulative effect	Cumulative effects can be defined as incremental effects of an action when added to other past, present, and reasonably foreseeable future actions. These effects can result from individually minor but collectively significant actions taking place over a period of time.
Direct effect	An environmental effect caused directly by the implementation of a plan or programme.
EIA Directive	Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, as amended by Directives 97/11/EC, 2003/35/EC and 2009/31/EC
Environmental assessment	A tool for integrating environmental considerations into decision-making by ensuring that significant environmental effects of the decision are taken into account. In terms of the SEA Directive, environmental assessment is defined as the preparation of an environmental report, the carrying out of consultations, the taking into account of the environmental report and the results of the consultations in decision-making and the provision of information on the decision in accordance with Articles 4 to 9
Environmental Impact Assessment (EIA)	Generic term used internationally to describe environmental assessment as applied to projects.
Environmental Management Plan	The synthesis of all proposed mitigating and monitoring actions, set to a timeline with specific responsibility assigned and follow-up actions defined. The EMP is one of the most important outputs of the environmental assessment process. (World Bank)
Environmental report	Document required by the SEA Directive as part of an environmental assessment, which identifies, describes and evaluates the likely significant effects on the environment of implementing a plan or programme. The SEA Directive state that the environmental report shall mean the part of the plan or programme

Term	Definition
	documentation containing the information required in Article 5 and Annex I.
Fauna	The animals of a particular region or habitat.
Flora	The plants of a particular region or habitat.
Indicator	A measure of variables over time, often used to measure achievement of objectives.
Indirect effect / impact	An impact that occurs away from the immediate area affected by the implementation of a plan or programme, e.g. quarrying of aggregates elsewhere as a result of implementing new road proposals included in plan or programme.
Mitigation (climate change)	An anthropogenic intervention to reduce the anthropogenic forcing of the climate system; it includes strategies to reduce greenhouse gas emissions and enhancing greenhouse gas sinks.
Mitigation (SEA)	Measures to avoid, reduce or offset significant adverse effects.
Monitoring	A continuing assessment of conditions at and surrounding the action. This determines if effects occur as predicted or if operations remain within acceptable limits, and if mitigation measures are as effective as predicted.
Objective	A statement of what is intended, specifying the desired direction of change in trends.
Plan and programme	Plan - a set of co-ordinated and timed objectives for the implementation of policy. Programme - a set of projects in a particular area. In terms of the SEA Directive, plans and programmes shall mean plans and programmes, including those co-financed by the European Community, as well as any 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.
Precautionary principle	State that if an action or policy has suspected risk of causing harm to the public or to the environment, in the absence of a scientific consensus that harm would not ensue, the burden of proof falls on those who would advocate taking the action.
Public	One or more natural or legal persons, and, in accordance with national legislation or practice, their associations, organizations or group.
Public concerned	The public affected or likely to be affected by, or having an interest in, the environmental decision-making.
Residual effects	Effects that remain after mitigation has been applied.
Scoping	The process of determining the scope and level of detail of an SEA, including the environmental effects and alternatives which need to be considered, the assessment methods to be used, and the structure and contents of the Environmental Report.
Screening	The process of deciding whether a plan or programme requires SEA.
SEA Directive:	Directive 2001/42/EC 'on the assessment of the effects of certain plans and programmes on the environment'.
Secondary effect	Effect that occur as a consequence of a primary effect or as a result of a complex pathway.

Term	Definition
Short-term effects	Are typical of those that may occur during the early stages of the implementation of a plan or programme. For example, if a plan or programme will result in the development, short-term effects may occur during the construction phase, for example, the increased traffic going to and from the site during, say, a six months construction period.
Significant effect	Effects which are significant in the context of the plan or programme, a function of not just of magnitude, but of nature, sensitivity and scale of the receptor.
Strategic environmental assessment (SEA):	Generic term used internationally to describe environmental assessment as applied to policies, plans and programmes.
Synergistic effect	Effects that interact to produce a total effect greater (or less than) than the sum of the individual effects.
	[other terms may be added in final draft]

Acronyms and Abbreviations

BAP	Biodiversity Action Plans
BISE	Biodiversity Information System for Europe
CBD	Convention on Biological Diversity
CO_2	Carbon Dioxide
EEA	European Environment Agency
EIA	Environmental impact assessment
ETC/ACM	European Topic Centre for Air Pollution and Climate Change Mitigation
ETC/BC	European Topic Centre for Biological Diversity
ETS	Emission Trading Scheme
EU	European Union
EVDAB	European Database of Vulnerabilities for Urban Areas
GEO	Group on Earth Observatories
GHG	Greenhouse Gases
GIS	Geographical Information System
HFC	Hydro fluorocarbon
ICES	International Council for the Exploration of the Sea

IMS	Indicator Management System
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
JRC	Joint Research Centre
LCA	Life Cycle Assessment
NGOs	non-governmental organisation
SAC	Special Areas of Conservation
SDI	Sustainable Development Indicator
SDS	Sustainable Development Strategy
SEA	Strategic Environmental assessment
SPA	Special Protection Areas
TEEB	The Economics of Ecosystems and Biodiversity
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
	[other abbreviations may be added in final draft]

EXECUTIVE SUMMARY

Climate change and biodiversity loss have been recognised internationally and within Europe as two of the most important environmental policy areas for the future. The reality of climate change and the need to take action has permeated European political agendas in recent years, resulting in important legislative actions (for example the EU climate-energy legislation of 2009) and policy commitments (the White Paper on adapting to climate change). Similarly, ambitious targets aimed at halting biodiversity loss and ecosystem degradation across Europe are contained within the European Commission's biodiversity strategy. Moreover, the complex links between the causes of and capacities to cope with climate change and the status of biodiversity and ecosystems have been widely recognised, and it is clear that objectives in these two areas are co-dependent.

Progress towards combating and adapting to climate change, and halting the loss of biodiversity and damage to ecosystems requires sound consideration of these issues in projects implemented across the EU

The *Practical guidance and recommendations for integrating climate change and biodiversity into Strategic Environmental Assessment (SEA) procedures* serves as a tool to improve the inclusion and integration of climate change and biodiversity issues into SEA carried out across the EU Member States. This executive summary reviews the purpose of the guidance, and its key messages.

SEA at present offers the only formalised process for considering climate change and biodiversity concerns in proposed plans, and programmes across the EU. Required by EU law[1] for those plans and programmes likely to have significant effects on the environment, SEA has proven to be a critical tool for the implementation of EU environmental policy and the achievement of EU environmental objectives.

Yet experience and evidence has shown that SEAs carried out across the EU have so far struggled to effectively integrate climate change and biodiversity issues into practice, despite the recent prioritisation of these issues within the environmental policy agendas.[2] Part of the reason for this is these issues - and climate change in particular - are not yet fully incorporated into either formal requirements or typical SEA procedures and available guidance. Moreover, both climate change and biodiversity – particularly when considered in terms of ecosystems – are complex and cross-cutting issues that

[1] The SEA Directive: *on the assessment of the effects of certain plans and programmes on the environment* (2001/42/EC).

[2] The *Study on the application and effectiveness of the SEA Directive (2001/42/EC) (*COWI for the EC, 2009) has cited the need for improved consideration of both climate change and biodiversity into SEAs based on dialogue with officials in MS; this has also been cited by the EEB in *EEB input into stakeholder consultation on climate change and adaptation* and *Biodiversity in Strategic Environmental Assessment, Quality of national transposition and application of the Strategic Environmental Assessment (SEA) Directive,* both 2005. It has also been noted with reference to SEA and climate change in the upcoming report by the Interreg IVC project Regions for Sustainable Change, based on a survey of 11 EU regions.

do not lend themselves to simple or quick analysis. As legally required and specifically defined processes, SEA represents an opportunity to integrate climate change and biodiversity into all future policy and development directions in Europe; this is an opportunity that cannot be missed if Europe is to achieve its environment and development objectives.

The guidance, which aims to facilitate the effective integration of climate change and biodiversity into SEA, is based upon a number of key messages which are important for competent authorities and policymakers, planners, SEA practitioners and other stakeholders. These are summarised below.

Key messages for integrating climate change and biodiversity into SEA

Legal considerations. The SEA Directive recognises "climatic factors", "biodiversity" and "fauna and flora" in the list of factors to be assessed, meaning that these issues must be considered in order for assessments to be legally compliant. Moreover, the Directive sets out unambiguously to establish a high level of protection for the environment.

Policy drivers. Annex I of the Directive emphasizes the need to take into account the environmental objectives established at international, Community or Member State level, which are relevant to the plan or programme. As such, EU policy on climate change and biodiversity and the relevant national, regional and local targets policies and strategies in these areas must be integrated into plans and programmes and considered in SEAs.

Plan and programme benefits. SEA offers the opportunity not only to avoid negative impacts in terms of GHG emissions and loss of biodiversity, but also to build in positive benefits for climate change mitigation and adaptation, and the enhancement and restoration of biodiversity, while at the same time enabling plans and programmes to foster greater overall resilience to future environmental change.

Cost-effectiveness. SEAs should help bring to light the potential for cost-savings, and also positive economic and lifestyle opportunities to be gained from mitigation of climate change through energy efficiency and a shift away from fossil fuels.

Stakeholder engagement. Early and effective consideration of climate change and biodiversity in SEA will necessitate the involvement of a wide range of stakeholders, both for gathering information and consultation purposes. SEAs are important to help identify and bring together all the relevant stakeholders that need to be part of relevant decision-making.

The impact of a changing climate. SEAs need to consider not only the impact of the plan or programme on causes of climate change (e.g. greenhouse gas emissions), but also the projected impacts of the changing climate on the plan or programme

itself. To do so will require a shift in thinking from the concept of impacts on the environment to one of impacts from the environment on the plan or programme. SEAs will need to assess how to build resilience - the capacity of systems to cope with environmental change and recover from disturbance – into proposed plans and programmes.

Ecosystems services. Through its broad approach to assessment and emphasis on cumulative impacts, SEA can encourage an "ecosystems approach" to planning, recognising that biodiversity depends on the integrated management of ecosystems and processes, across administrative and other boundaries.

Impact on environmental limits. SEAs need to consider thresholds for sudden decline or collapse in biodiversity, even when unclear, based on the precautionary principle and "no regrets" solutions.

Long-term and cumulative nature of impacts. SEAs should consider the evolution of the environmental baseline, which will entail understanding recent trends and likely future trends in key issues.

Complexity. Climate change and biodiversity involved complex systems and interactions between the biophysical environment and the human environment. Efforts to mitigate one impact may adversely affect others.

Dealing with uncertainty. SEAs need to reflect the uncertainty inherent in climate change and help to develop climate resilient solutions based on "win-win" or "no regrets" approaches to planning. Scenarios, proxy indicators and risk management are all ways of dealing with uncertainty.

INTRODUCTION AND USER GUIDE

Objectives and purpose of the guidance

Climate change and biodiversity loss are among the most important environmental challenges the EU faces today. Both are complex and cross-cutting issues, which impact nearly all human activity. Progress towards combating and adapting to climate change, and halting the loss of biodiversity and damage to ecosystems requires sound consideration of these issues in plans, programmes and projects implemented across the EU. This in turn will require improved integration of these complex issues into the environmental assessment tools that exist to ensure the consideration of environmental impacts of decisions.

The *Practical guidance and recommendations for integrating climate change and biodiversity into Strategic Environmental Assessment (SEA) procedures* serves as a tool to improve the inclusion and integration of climate change and biodiversity issues into SEA carried out across the EU Member States. By reinforcing general good practice principles and techniques for SEA, as well as introducing the range of benefits that integration of climate change and biodiversity can bring to projects, this guidance document aims to improve the efficiency and effectiveness of SEA overall.

Climate change and biodiversity loss have been recognised internationally and within Europe as two of the most important environmental policy areas for the future. The reality of climate change and the need to take action has permeated European political agendas in recent years, resulting in important legislative actions (for example the EU climate-energy legislation of 2009) and policy commitments (the White Paper on adapting to climate change). Similarly, ambitious targets aimed at halting biodiversity loss and ecosystem degradation across Europe are contained within the European Commission's biodiversity strategy. Moreover, the complex links between the causes of and capacities to cope with climate change and the status of biodiversity and ecosystems have been widely recognised, and it is clear that objectives in these two areas are co-dependent.

SEA at present offers the only formalised process for considering climate change and biodiversity concerns in proposed plans and programmes across the EU. Required by EU law[3] for those plans and programmes likely to have significant effects on the environment, SEA has proven to be a critical tool for the implementation of EU environmental policy and the achievement of EU environmental objectives.

The purpose of the SEA Directive

The SEA Directive provides for a high level of protection of the environment and contributes to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development.

[3] The SEA Directive: *on the assessment of the effects of certain plans and programmes on the environment* (2001/42/EC).

Yet experience and evidence has shown that SEAs carried out across the EU have so far struggled to effectively integrate climate change and biodiversity issues into practice, despite the recent prioritisation of these issues within the environmental policy agendas.[4] Part of the reason for this is these issues - and climate change in particular - are not yet fully incorporated into either formal requirements or typical SEA procedures and available guidance. Moreover, both climate change and biodiversity – particularly when considered in terms of ecosystems – are complex and cross-cutting issues that do not lend themselves to simple or quick analysis. Nevertheless, these complexities represent the reality of environmental issues facing Europe today. As a legally required and specifically defined process, SEA represents an opportunity to integrate climate change and biodiversity into all future policy and development directions in Europe; this is an opportunity that cannot be missed if Europe is to achieve its environment and development objectives.

To address both climate change and biodiversity effectively means building them into the assessment process from the earliest stages

Nature of this guidance

This guidance addresses the specific issues and challenges that climate change and biodiversity bring to SEA; complementary guidance is being prepared on improving the integration of climate change and biodiversity into EIA procedures and practice. It is designed to be used by competent authorities and policymakers, planners, SEA practitioners and other stakeholders across the EU Member States and candidate countries. By focusing on climate change and biodiversity this guidance does not seek to prioritise these topics, rather it seeks to facilitate the effective integration of these issues within SEA, alongside and in support of the other topics laid down in the Directive.

This guidance is arranged in a thematic way that seeks to highlight what you need to know and to do to integrate climate change and biodiversity issues effectively into the SEA process. It deliberately does not simply follow the SEA process stages since there are many other factors to be considered in an SEA as well as climate change and biodiversity, and this guidance is not intended to be comprehensive guidance on undertaking SEA. This guidance does not seek to identify or provide advice on all of the climate change and biodiversity impacts and issues you may encounter in SEA – this would be impossible for all situations and all sectors in a usable and reader friendly format.

To address both climate change and biodiversity effectively means building them into the assessment process from the earliest stages – in that way you are more likely to follow them through the whole SEA process. But it is important that the

[4] The *Study on the application and effectiveness of the SEA Directive (2001/42/EC) (*COWI for the EC, 2009) has cited the need for improved consideration of both climate change and biodiversity into SEAs based on dialogue with officials in MS; this has also been cited by the EEB in *EEB input into stakeholder consultation on climate change and adaptation* and *Biodiversity in Strategic Environmental Assessment, Quality of national transposition and application of the Strategic Environmental Assessment (SEA) Directive,* both 2005. It has also been noted with reference to SEA and climate change in the upcoming report by the Interreg IVC project Regions for Sustainable Change, based on a survey of 11 EU regions.

consideration of biodiversity and climate change issues is tailored to the specific context in which you are working; it is not simply a set of checklists of issues to tick off having been completed. The guidance is arranged in a way that will encourage you to think about how important climate change and biodiversity – as assessment issues – are likely to be for your SEA:

- What is it about climate change and biodiversity that poses a challenge to the assessment process?
- How does that affect the information needs the assessment will have – what type of information, what sources and what stakeholders will hold information and specific knowledge in these areas?
- What are the key aspects to cover in the detailed assessment and how important will those issues be in decision-making?

The guidance section will cover these three assessment issues that are most important for considering climate change and biodiversity in SEA. A series of annexes then provides specific information sources, tools, guiding questions or "entry points" for assessment, and a set of case studies illustrating actual practice. Details on how to navigate the guidance are in the user guide section below.

How to use this guidance

This guidance has a very broad target audience and has therefore been structured with a flexible approach. Users can review the entire document at once, or skip directly to sections that interest them.

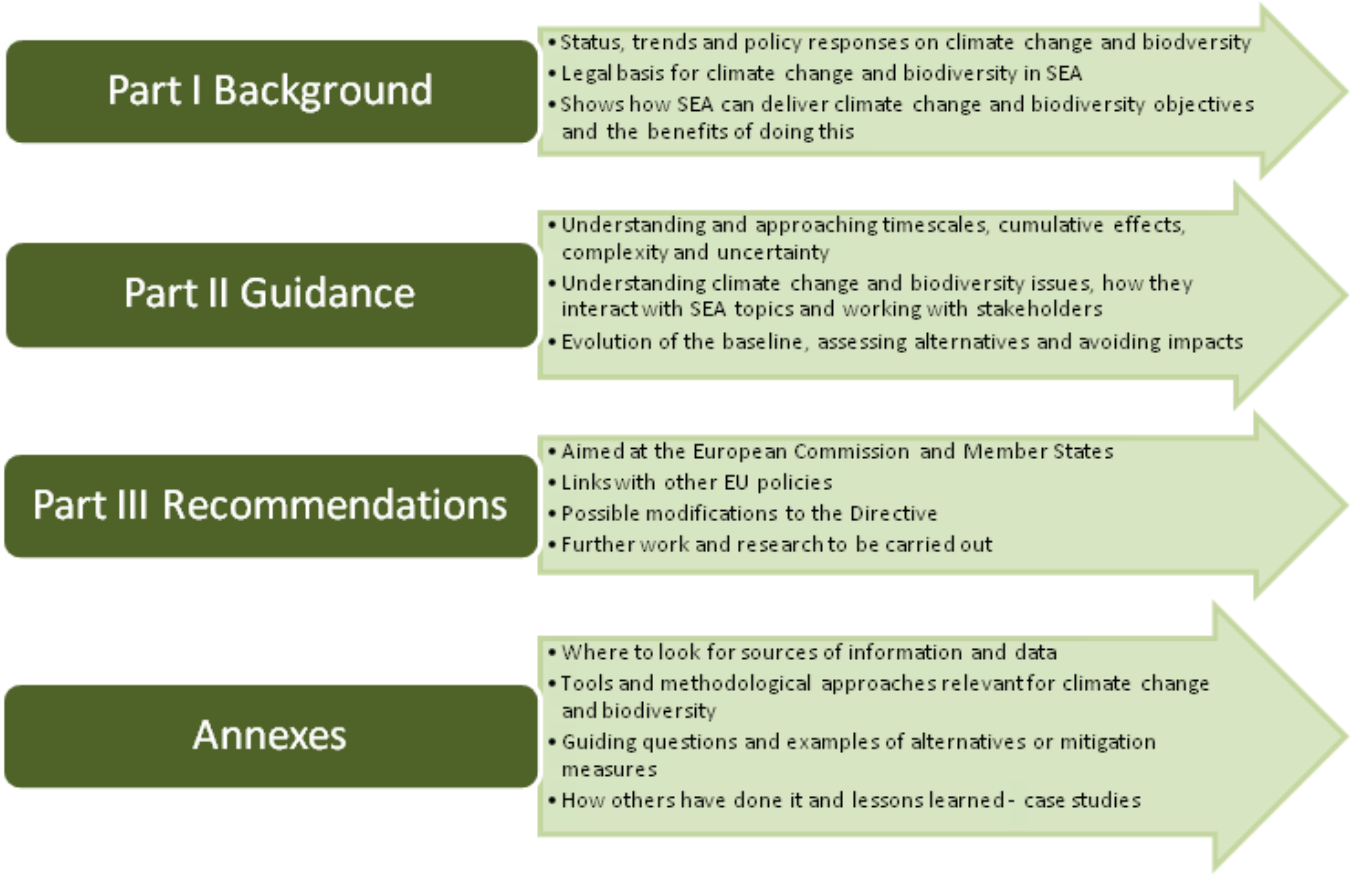
Part I Background provides background on the issues and their legal and practical relationship with SEA. It also points out the benefits of early consideration of climate change and biodiversity in SEA.

Part II Guidance covers the challenges, information needs and assessment approaches that are most important for consideration of climate change and biodiversity in SEA.

Part III Recommendations contains recommendations at the legal and policy levels, as well as ideas for further work and research projects that could support practitioners and stakeholders. It is aimed mainly at the European Commission and Member State levels.

It is possible that this section may be removed from the final guidance as the target audience is different.

Annexes contain more detailed information to assist in the actual practice of carrying out the SEA. This includes where to look for information and data, assessment tools and methodologies to assist in understanding and evaluating impacts and projections, and a breakdown of key questions to ask and examples of alternatives or mitigation measures to consider for some of the main climate change and biodiversity issues. Finally a set of case studies illustrates how SEAs have incorporated climate change and biodiversity from around the EU, as well as the consequences some have faced from failing to effectively consider these issues at an early stage.



The figure provides an overview of the guidance parts and sections and the contents of each section.

PART I: BACKGROUND

This part provides background information on the topics of climate change and biodiversity. It starts by introducing what is meant by the terms 'climate change' and 'biodiversity' and then provides an overview of the current status, trends and drivers relevant to them in the European context. It goes on to present the key policy context for climate change and biodiversity at the international and EU levels, and finally explores the key interactions between climate change and biodiversity.

The purpose of this part of the guidance is to highlight to those involved in SEA, whether as a competent authority, planner or programme developer, SEA practitioner, regulator or other stakeholder, the importance and complexity of climate change and biodiversity. It also provides an overview and starting point for some of the key information sources and issues, policy objectives and targets that need to be considered to best integrate climate change and biodiversity into SEA.

1. Background on Climate Change and Biodiversity

Introduction to climate change and biodiversity

Climate change has been described as humanity's biggest challenge and a threat to our civilisation. While there is truth to these statements, they also suggest that there is little that individual projects or environmental assessments can achieve. But this is not the case. In fact much of the potential for reducing the impacts of climate change lies in the actions of individuals and organisations and in particular our use and organisation of the natural and built environment. Environmental assessment is an important opportunity to influence these.

Climate change can be divided into two aspects:

- **Mitigation** - climate change mitigation is the process of reducing the emission of greenhouses gases (GHG) that are changing our climate. This may involve not releasing emission from a current carbon store such as a forest as well as reducing energy and material use as these are generally based on fossil fuel combustion. Scientists predict that to limit 'dangerous' climate change, global warming should be limited to 2^{o}C and that emissions need to peak in 2020 and reduce by around 50% by 2050.
- **Adaptation** - climate change adaptation is the process of responding to predicted and experienced climate change effects to moderate harm or exploit benefits.

These two aspects of climate change interact and have the potential for synergistic or conflicting relationship. This is an issue dealt with in Part II of the guidance.

Biological diversity - or biodiversity - is one of the key terms in conservation, encompassing the richness of life and the diverse patterns it forms. The Convention on Biological Diversity (CBD) defines biological diversity as '*the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems*' (Article 2).

Biodiversity is recognised as providing a wide range of services upon which the wellbeing of society and individuals is dependent, a number of authoritative and significant research projects have indicated the scale of this contribution and

"Healthy ecosystems are essential in any strategy for climate change adaptation. One can say that conservation of biodiversity is our life insurance for the future. The current threats of habitat loss and fragmentation and pollution need to be addressed."
Stavros Dimas, EU Environment Commissioner

shaped much of the current thinking around biodiversity[5]. As such protecting biodiversity is more than an ethical issue; there are also clear socio-economic benefits to doing so.

Climate change mitigation - overview of current status, trends and policy responses

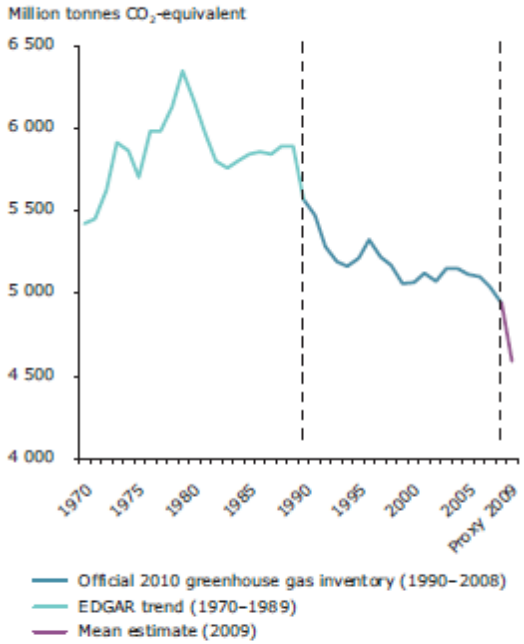
What are the current status, trends and key drivers?

The EU currently contributes around 12% of annual global direct GHG emissions. In recognition of this, the EU agreed in 2007 to an independent binding target to reduce its emissions by at least 20% by 2020 compared to 1990 levels. This commitment was to increase to 30% if major emitting countries outside Europe made similar challenging commitments under a global climate agreement. The historic trends of GHG emissions in the EU over the past 20 years are the result of two sets of opposing factors – those driving emissions upwards and those driving emissions downwards (see Table 1).[6]

Key GHG sources at the EU level are road transport (freight and passenger cars), international aviation and maritime transport - all of which have increased over the long term. Other GHG increases have been observed due to the consumption of halocarbons (HFCs) used in the production of cooling devices such as air conditioning systems and refrigerators – HFCs are powerful GHGs. For a more detailed analysis of the causes and drivers of GHG emission see the Key background documents on climate change mitigation presented in the box at the end of this sub-section.

Much of Europe's GHG emission reductions achieved in the last 20 years were achieved in the 1990s, largely as a result of the economic restructuring that occurred primarily in Eastern Europe. Beyond this reductions were achieved as a combined result of policies and measures implemented to reduce GHG emissions, such as the EU Emission Trading Scheme (EU ETS). Since 2008, the short-term effects of the global economic crisis have also contributed to emission reductions. Looking at sectors, CO_2 emissions from the residential and commercial sectors have fallen significantly since 1990. There have also been substantial reductions in GHG emissions from the waste sector due to improvements in recycling rates and the technical requirements of landfills.

Figure 1: Absolute GHG emissions in the EU-27, 1970–2009



Note: The 1970–1990 time series was calculated using the annual change in EDGAR (EC-JRC/PBL, 2009) emissions applied to 1990 UNFCCC (EEA, 2010a) emissions. The 2009 early GHG estimate for the EU-27 (EEA, 2010b) is based on publicly available verified EU ETS emissions for 2009 and published activity data, as of mid-July, at both national and European level disaggregated by major source categories in sectors reported under the UNFCCC and the Kyoto Protocol.

Source: EEA, 2010a, 2010b; EC-JRC/PBL, 2009.

Source: EEA (2010) Mitigating climate change - SOER 2010 thematic assessment

[5] For example the Millennium Ecosystem Assessment (2005), TEEB (2009) and Global Biodiversity Outlook: see the Further Reading section.

[6] Sources for this section are: EEA (2010) Mitigating climate change – SOER 2010 Thematic Assessment; EEA (2010) Understanding Climate Change SOER 2010 Thematic Assessment

Table 1: Opposing factors driving historic trends of GHG emissions in the EU over the past 20 years

Factors driving emissions upwards	Factors driving emissions downwards
• increases in the production of electricity and heat by thermal plants, which has increased both in absolute terms and in comparison with other sources • economic growth in manufacturing industries • increasing transport demand for passengers and freight • increasing share of road transport compared with other transport modes • increasing number of households • demographic changes over the past decades	• improvements in energy efficiency, in particular by industrial end users and the energy industries • fuel efficiency improvements in vehicles • better waste management and improved landfill gas recovery (the waste sector achieved the highest relative reductions) • decreases in emissions from agriculture (by more than 20% since 1990) • a shift from coal to less polluting fuels, particularly gas and biomass, for the production of electricity and heat • partly due to the economic restructuring in Eastern Europe

Source: EEA (2010) Mitigating Climate Change – SOER Thematic Assessment

Overall, the EU is making progress towards its 2020 target with emissions of its 27 Member States 11.3% below 1990 levels in 2008 and, according to preliminary EEA estimates, 17% below 1990 levels in 2009 - see Figure 2. Despite the general reduction trend, achieving Europe's mitigation targets will require accelerated reductions over the medium to long term and much of the work required to achieve them needs to start now. Global emissions continue to increase, with many developing countries showing significant rates of increase. The per capita emissions of these nations however are still significantly below those of Europeans, meaning that the obligation is still on developed countries to de-carbonise.[7]

[7] Sources for this section are: EEA (2010) Mitigating climate change – SOER 2010 Thematic Assessment

What's the policy response?

The global nature of climate change means that mitigating it requires a focus on delivering internationally binding emission reduction targets. The aim is to ensure that all nations operate within a level playing field and do not gain any benefits by not seeking to reduce GHGs.

- At the highest level the **United Nation Framework Convention on Climate Change (UNFCCC)** seeks to reduce international GHG emissions by setting national level targets based on the concept of 'equal but differentiated responsibility'. This means that nations which have emitted the majority of GHGs up to now, such as EU states, should seek to reduce GHGs at a greater rate.
- Under the **UNFCCC's Kyoto Protocol** European Commission are required to reduce their emissions relative to 1990 levels (Member State emission targets are differentiated under a burden-sharing EU accord). The Kyoto Protocol is still operational but ceases to be from 2012. Under the Kyoto Protocol, 15 Member States of the EU ('EU-15') are committed as a group to reduce their GHG emissions by 8 % compared to 1990 levels during the commitment period 2008–2012. The EU-15 is well on track to meeting its target; emissions in 2008 were 6.9 % lower than the base-year. Preliminary estimates of the EEA indicate that EU-15 emissions were further reduced in 2009 to 13 % below base-year levels. Of the EU-12 Member States, 10 have individual targets and are on track to meet these.
- The **EU's Climate and Energy Package** is a set of binding legislation that requires the 27 Member States to: 1) reduce their combined GHG emissions in 2020 by at least 20% compared to 1990 levels; 2) produce 20% of their combined energy from renewable sources; and 3) improve energy efficiency to reduce primary energy use by 20% compared with projected levels. The "effort sharing decision" establishes annual binding GHG emission targets for individual Member States for the period 2013-2020. This so called 20-20-20 target is supported by the long term (but as yet unlegislated) target of 80% reduction against 1990 levels by 2050.
- A **Roadmap for moving to a low-carbon economy in 2050** looks beyond these 2020 objectives and sets out a plan to meeting the long-term target of reducing EU emissions by 80-95% by 2050. The strategy takes a sectoral perspective, looking at the how heavy-emissions sectors such as power generation, transport, buildings and construction, industry and agriculture can make the transition to a low-carbon economy over the coming decades.
- Under the Europe 2020 Strategy, the **flagship initiative for a resource-efficient Europe** supports the shift towards a resource-efficient, low-carbon economy to achieve sustainable growth. It provides a long-term framework for

*the **EU's Climate and Energy Package** requires the 27 Member States to reduce their combined GHG emissions in 2020 by at least 20% compared to 1990*

Key background documents on climate change mitigation

- European Environment Agency (2010) Mitigating Climate Change
- European Commission (2011) Roadmap for moving to a competitive low-carbon economy in 2050
- European Commission – European Climate Change Programme (ECCP)

actions to factor in resource efficiency in a balanced manner in many policy areas including climate change, energy, transport, industry, agriculture, biodiversity and regional development.

For the latest research and policy developments relevant to climate change and the European Union visit the relevant web pages on DG Climate Action's website: http://ec.europa.eu/climateaction/

Climate change adaptation - overview of current status, trends and policy responses

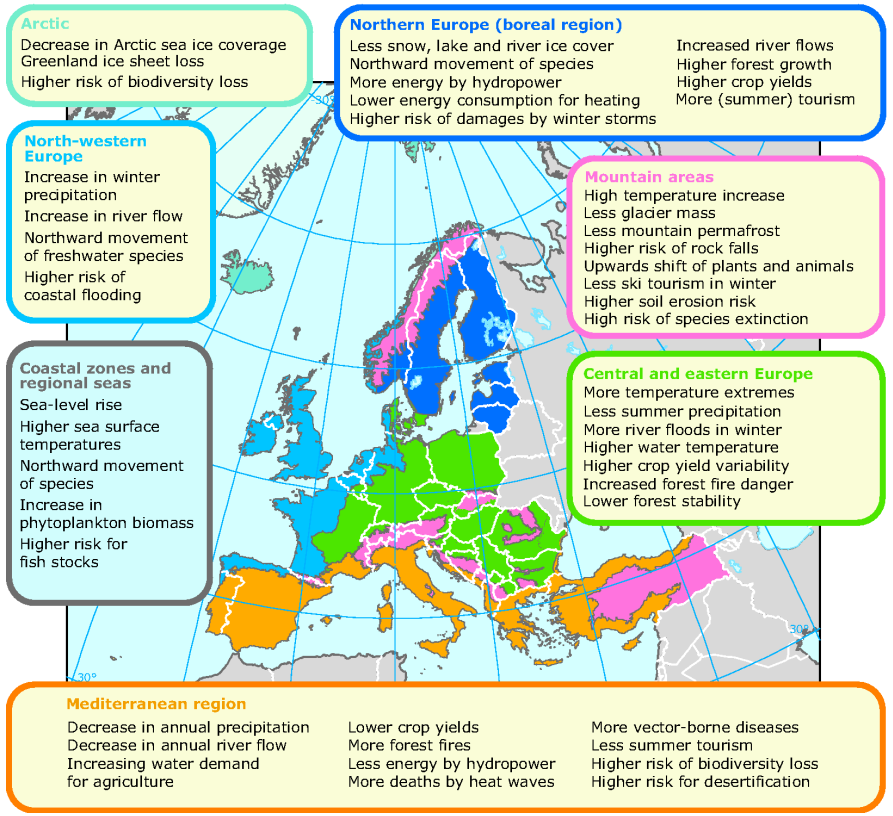
What are the current status, trends and key drivers?

Regardless of the success of mitigation efforts, some degree of climate change is already 'locked in' and we are feeling the effects of our changing climate already. The majority of projected climate change impacts and vulnerabilities are, or are expected to be, negative, and these often need to be addressed proactively. The focus is therefore on identifying and countering the adverse effects of climate change through adaptation.

Adaptation does not seek to detract from mitigation; rather it is a commonsense approach to increasing the resilience of European society and natural environment in response to unavoidable changes in the climate.

Vulnerability to climate change varies significantly across regions and sectors in Europe; adaptation is therefore a context- and location-specific challenge. Regions of particular vulnerability include the Mediterranean basin, north-western and central-eastern Europe and the Arctic. Other general areas of vulnerability include many coastal zones (due to sea level rise) and areas prone to river floods, such as mountainous areas and cities. Low-lying coastal areas across Europe could face major impacts due to sea level rise and a possible increased frequency of severe storm surges, particularly in north-western Europe. More intense winter and spring river floods are expected in this region. General projected climate impacts include:[8]

Figure 3: Key past and projected impacts of climate change and effects on sectors for the main bio-geographical regions of Europe



Source: EEA (2010) The European environment - State and outlook 2010. Adapting to Climate Change.

[8] Sources for this section are taken from EA (2010) The European environment - State and outlook 2010. Adapting to Climate Change.

- A northward movement of species is expected due to higher sea surface temperatures. Plant and animal species face the risk of extinction due to barriers prohibiting them from moving upwards or northwards to more suitable habitats.
- Temperature increase particularly in mountain areas, leading to glacier mass decrease and resulting melt water, reduced snow cover, thawing of permafrost and changing precipitation patterns.
- Cities and urban areas (where much of Europe's population live) continue to be vulnerable to heat waves, flooding and droughts. These impacts are expected to have knock-on effects on infrastructure, public health and the economy of Member States.
- The Mediterranean basin has experienced decreased precipitation and increased temperature over past decades, and this trend is projected to worsen as the climate changes. The availability of water and hence crop yields could decrease while droughts, biodiversity loss, forest fires and heat waves may increase.
- The Arctic faces a continued accelerating decrease in summer sea ice cover. This trend is expected to continue.
- Temperature extremes are projected to increase and are considered likely to have significant impacts in Central and Eastern Europe. During summer, reduced precipitation, increased risk of droughts and higher energy demand are also anticipated. In winter and spring the intensity and frequency of river floods may increase as precipitation patterns change.
- Climate change may offer certain short- and medium-term opportunities in this region, such as increased forest growth in the northern regions as temperatures increase. However changing precipitation patterns and higher temperatures are projected to cause less snow and lake and river ice cover in northern Europe. At the same time, winter and spring river flows are expected to increase and the damage of winter storms is expected to increase.

the costs of adaptation are likely to be far less than the costs of inaction

It has been calculated that the costs of adaptation are potentially very large (possibly billions of euro per year in the medium- and long-term). Therefore current assessments suggest that timely and proportionate adaptation makes economic, social and environmental sense, simply put the costs of adaptation are likely to be far less than the costs of inaction. GHG emissions and climate change are the ultimate drivers of these projected impacts, but other factors relate specifically to the capacity to adapt. For example ensuring sufficient understanding of potential climate change impacts and the wide range of potential adaptation actions that can be taken represents a major barrier to effective adaptation. Adaptation actions that

are carried out without sufficient understanding of impacts and options are often unnecessary, ineffective, and can contribute to greater GHG emissions.

What's the policy response?

The concepts that define adaptation such as preparedness, resilience and vulnerability are not easily quantifiable, making it difficult to set hard and fast targets as in the case of climate change mitigation. In the EU, the focus is on integrating the need to adapt into all relevant policies and instruments and facilitating effective, consistent adaptation actions at Member State, regional and local levels.

- The European Commission adopted a **White Paper on Adaptation to Climate Change** in 2009 and plans to publish a Communication on Mainstreaming Adaptation and Mitigation in 2011. The White Paper recognises the importance of EIA in climate proofing - this guidance seeks to support the White Paper. The intention is to develop the knowledge base and options for mainstreaming climate change into key policy areas, and then to prepare a comprehensive EU adaptation strategy to be implementing in 2013-2020.
- Work has begun on an EU '**climate change impacts vulnerability and adaptation clearinghouse**', which will make it easier to find information on impacts and different adaptation approaches. The clearing house is to be operational by 2012. The clearinghouse will be maintained by the EEA and will collect and coordinate EU and national level data, vulnerability information and good practices in adaptation action. It will also provide simple and easy to use tools to orient users to the database and help them better understand vulnerability.
- **The last EU Budget Review** considered climate change and its policy to be considered amongst the tasks that require significant public spending, as part of the core objectives of the Europe 2020 Strategy. As such it is an active area of policy development where the EU is adopting a phased approach.

At a national level, many European countries, as well as a few regions and cities, have adopted adaptation strategies. The EEA keeps an overview of national adaptation strategies in its 32 member countries.[9]

For the latest research and policy developments relevant to climate change and the European Union visit the relevant web pages on DG Climate Action's website: http://ec.europa.eu/climateaction/

Key background documents on climate change adaptation

- European Commission (2009) White Paper on Adapting to Climate Change
- European Environment Agency (2010) Adapting to Climate Change
- European Environment Agency (2005) Vulnerability and Adaptation to Climate Change in Europe

[9] Available from: http://www.eea.europa.eu/themes/climate/national- adaptation-strategies

Biodiversity - overview of current status, trends and policy responses

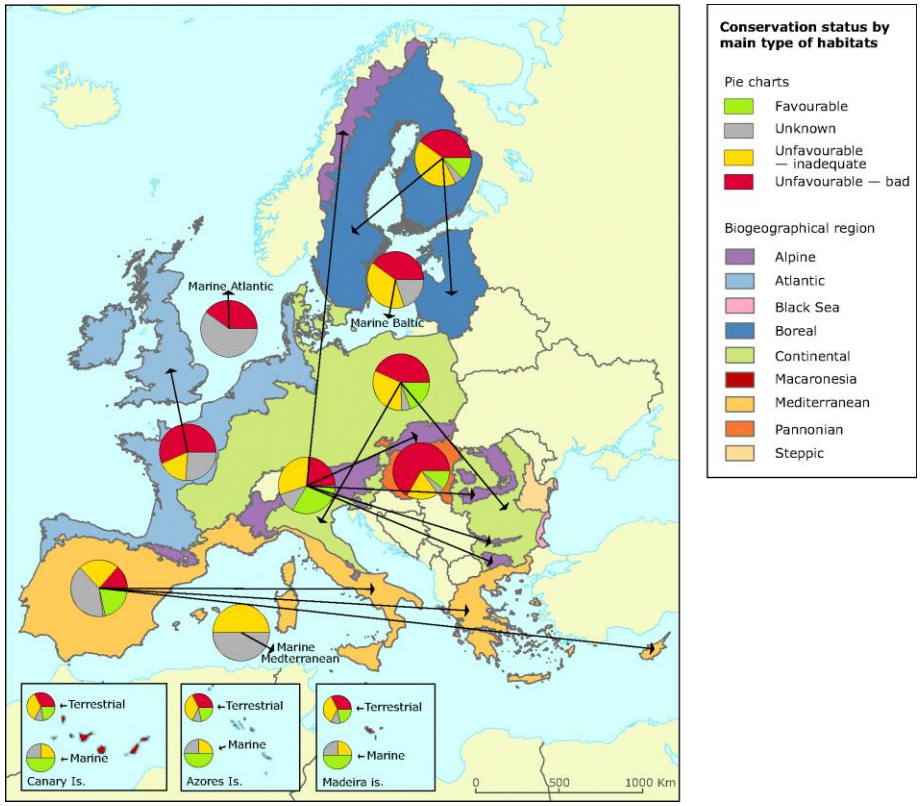
What are the current status, trends and key drivers?

Analyses have indicated that across the EU as a whole, despite some positive elements, the rate of biodiversity loss is still accelerating. This is illustrated in Figure 4 which shows the conservation status of habitats in the EU by biogeographical region. There are some positive elements within the Natura2000 network of designated sites, which has been credited with slowing the rate of biodiversity loss though protecting key species and habitats. However even many of these Natura2000 sites remain in an 'unfavourable' state and require improved management. It should also be noted that there is a great degree of uncertainty surrounding biodiversity and current trends, especially for individual populations of species within specific geographic areas, though there is no doubting the overall pattern is one of decline.

The main causes of biodiversity loss in Europe are:[10]

- **Habitat loss** – Europe experiences significant changes in land use but generally natural habitats are replaced by other systems such as intensive agricultural production systems and land abandonment and the construction of human developments and transport systems (causing fragmentation of habitats). These trends can be seen in Figure 5, where the continued loss of grassland and wetland habitats which are of particularly high biodiversity potential is of particular concern. Overall, it is considered that 70% of species are threatened by the loss of their habitat.
- **Overexploitation and unsustainable use of natural resources** - 30% of species are threatened by overexploitation. For instance: 88% of stocks are being fished beyond Maximum Sustainable Yields and 46% outside safe biological limits, which means that stocks may not replenish. Forestry as a sector is being managed more sustainably with general forest cover increasing, however its management is often focussed solely on yields, meaning many forests are increasingly homogenous and present few

Figure 4: Conservation status of assessed habitats in EU-25, by biogeographical region



Source: EEA (2010) Biodiversity Thematic Assessment

[10] The sources for this section are taken from: EEA (2010) Biodiversity Thematic Assessment; EEA (2010) Assessing Biodiversity in Europe; EEA (2010) Biodiversity: 10 Message for 2010; EEA (2010) Biodiversity Baseline Flyer

opportunities for species and biodiversity.

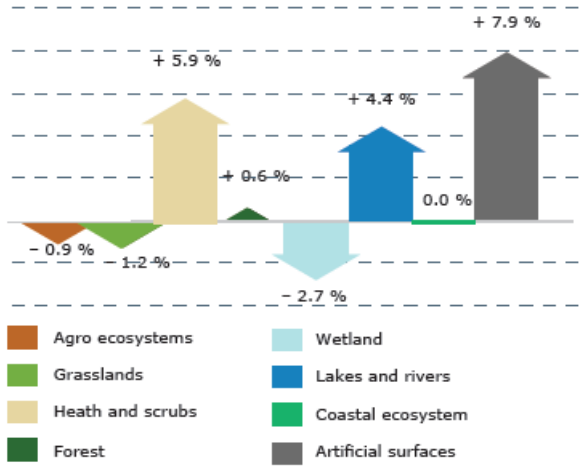
- **Pollution** - release of pollution and nutrient into the air, water and soil impacting on individual, population and ecosystem health. Despite some improvements in freshwater pollution (especially in rivers) there are still significant problems in coastal and lake environments, which are the final destinations for many of the pollutants we release. Moreover, 26% of species are threatened by pesticides, and fertilisers like nitrates and phosphates.
- **Invasive alien species** - this is an increasing phenomenon due in part to increased international trade and movement. More than 10,000 non-native species are now present in Europe – 10-15% of these are considered to have negative economic or ecological effects. It is considered that 22 % of species are threatened by invasive alien species.
- **Climate change** - shifts in habitats and species distribution are being observed as the climate changes, as are more severe climate impacts such as desertification (due to changing precipitation patterns). The impacts are predicted to be particularly severe in mountain environments. Climate change interacts and often exacerbates other threats to biodiversity (see below).

Increasingly European policy makers, scientists, business leaders and citizens are realising that these losses in biodiversity are contributing to significant decreases in the services we receive from the environment. Biodiversity provides a huge range of these services in aspects as varied as flood protection, agricultural pollination and the aesthetic and cultural value of being in nature. Recent analyses have suggested that the continued loss of biodiversity and the services it provides could have significant negative impacts on the economy and wellbeing of Europe[11].

What's the policy response?

Biodiversity has been a core part of EU policy for over 20 years. Nevertheless, the overall trends are still negative and current policy considered to be ineffective – as shown by the EU's failure to achieve the target of halting biodiversity loss by 2010. In response to this, policy is increasingly seeking to expand upon the partial successes of site conservation and take a broader approach to biodiversity across the landscape including integrating the importance of the services we receive from biodiversity into decision making. There are a number of relevant legislative and policy tools:

Figure 5: Changes in ecosystems between 1990 and 2006



Natural areas still being lost - the latest Corine Land Cover inventory (EEA, 2010) shows a continued expansion of artificial surfaces (e.g. urban sprawl, infrastructure) and abandoned land at the expense of agricultural land, grasslands and wetlands across Europe. Natural grasslands are still being turned into arable land and built-up areas. The loss of wetlands has slowed down (near 3 % lost in the last 16 years) but Europe had already lost more than half of its wetlands before 1990. Extensive agricultural land is being converted into forms of more intensive agriculture and is also being converted to into forests.
Source: EEA (2010) EU 2010 Biodiversity Baseline Flyer

[11] References for this section include the EU Biodiversity Strategy 2020, TEEB (2009) and the EEA (2010) Biodiversity Baseline.

- **The Habitat and Birds Directives** seek to protect sites of particular biodiversity importance – these sites form a network referred to as Natura 2000. Member States are required to designate and manage the Natura 2000 network sites on their territory. This includes ensuring that the status of the sites moves towards 'favourable' and reducing the impact of development. This is achieved in part through the use of Natura 2000 Assessments (see box).
- **The Convention on Biological Diversity (CBD)** is the major international agreement governing biodiversity policy. The EU and the Member States are all parties to this convention. Article 14 of the CBD on Impact Assessment and Minimizing Adverse Impacts requires that the adverse impacts on biological diversity of programmes and policies are duly taken into account (see Box).
- The main objective of the EU **Biodiversity Strategy 2020** '*Our life insurance, our natural capital: an EU biodiversity strategy to 2020*', is to '*halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss*'. There is also a target to protect, value and appropriately restore biodiversity and the ecosystem services it provides by 2050. Here the emphasis is on the essential contribution of biodiversity and ecosystem services to human wellbeing and economic prosperity, and avoiding catastrophic changes caused by the loss of biodiversity. These are positive intentions focussed on improving (restoring) biodiversity as a whole and ensuring non net loss of biodiversity. This represents a significant change in emphasis from reducing impacts to providing enhancement something that SEA can contribute to. The main targets of the Strategy include:
    - Full implementation of EU nature legislation to protect biodiversity
    - Better protection for ecosystems, and more use of green infrastructure
    - More sustainable agriculture and forestry
    - Better management of fish stocks
    - Tighter controls on invasive alien species
    - A bigger EU contribution to averting global biodiversity loss
- **Biodiversity Action Plans (BAPs)** detail how the Biodiversity Strategy is to be achieved. BAPs are present at the European level but also at the national and in some Member States local levels. These form the wider implementation framework for biodiversity beyond Natura 2000. BAPs at the Member State level include inventories of identified species and habitats, an assessment of the status of these species within the ecosystem, creation of targets for conservation and restoration and the establishment of budgets and timelines for achieving said targets.

Habitats and Birds Directive – Natura 2000 Assessments

Natura 2000 Assessment is required in accordance with Article 6(3) of the Habitats Directive. This form of assessment is a key process for assessing and regulating activities that may threaten habitats and species of Community interest within Natura 2000 sites.

Convention on Biological Diversity

Article 14(b) of the CBD states that *"Each Contracting Party, as far as possible and as appropriate, shall:*

*Introduce appropriate arrangements to ensure that the environmental consequences of its **programmes and policies** that are likely to have significant adverse impacts on biological diversity are duly taken into account".* (our emphasis)

Key background documents on biodiversity

- European Commission (2011) Our life insurance, our natural capital: an EU biodiversity strategy to 2020
- European Environment Agency (2010) Biodiversity
- European Environment Agency (2010) Assessing Biodiversity in Europe
- European Environment Agency (2010) EU 2010 Biodiversity Baseline

For the latest research and policy developments relevant to biodiversity and the European Union visit the relevant web pages Environment's website: http://ec.europa.eu/environment/nature/biodiversity/policy/

Interactions between climate change and biodiversity

The natural environment is intrinsically interlinked in ways that we are only starting to understand; these inter-relationships are particularly evident between climate change and biodiversity. This section does not attempt to fully describe the relationship between these two aspects, but there are a few key interactions that are directly relevant to SEA. To do this it is helpful to outline a basic framework within which these interactions operate– such as framework is provided by the concept of ecosystem services though other related concepts, such as resilience and environmental limits, are also relevant.

Ecosystem services as a framework for biodiversity – climate change interactions

The natural environment delivers a range of goods and services to society and individuals which directly contribute to our wellbeing by, for instance, cleaning our water, providing us with recreation and cultural spaces, protecting us from floods or other natural hazards. Biodiversity can be thought of as a central part of the system which provides these services that we are all dependent upon. If this system is damaged or removed then the services we receive decrease and at some point will irreversibly stop. These thresholds or tipping points at which the damage becomes irreversible are generally poorly understood. This uncertainty around tipping points and their potential negative effects on individuals and society is part of the reason why the precautionary principle is essential when considering biodiversity.

The value of biodiversity in terms of the services it provides to mankind is a human-centred argument for why we should care about biodiversity; an alternative argument is that animals and plants have an intrinsic right to exist. An ecosystem services approach is not inconsistent with this argument, but rather supports it by broadening the evidence base for why we need to maintain and enhance biodiversity.

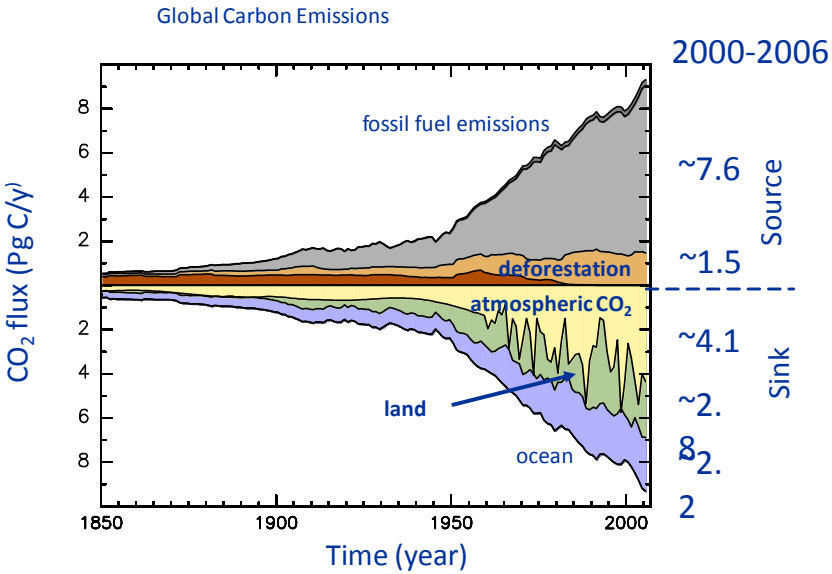
Two examples of the interactions between biodiversity and climate change are presented below:

- Supporting biodiversity delivers clear carbon benefits by enhancing the natural environment's ability to absorb and store carbon via soil and plant matter. Evidence

Ecosystem services

Ecosystems provide a number of basic functions that are essential for using the Earth's resources sustainably. The Economics of Ecosystem Services and Biodiversity (TEEB) study defines ecosystem services as: '*the benefits people receive from ecosystems*'. TEEB also sets out the basis of human dependence upon the natural environment. This European led study builds on the global Millennium Ecosystem Assessment.

Figure 6: Contribution of land to carbon sequestration



PgC/y = peta grams carbon per year

1 petagrams carbon = 1 gigatons carbon = 44/12 gigatons CO2 = 3.67 gigatons CO2

Source: DG Climate Action Synergies for Biodiversity and Climate Presentation

suggests that healthy natural habitats such as soil, wetlands, and forests can sequester significant amount of carbon. Figure 6 shows the contribution that land as a resource makes to carbon sequestration.[12] Damaging the biodiversity or physical environment of these areas can release this stored carbon, even indirectly, contributing to climate change as well as reducing biodiversity.

- Biodiversity and the natural environment also provide services which increase our resilience to the impacts of climate change such as change in precipitation and temperature. For example, well functioning green spaces can regulate storm water flow reducing the risk of flood events. Green spaces and vegetation also provide cooling within cities reducing the impact of heat waves and the urban heat Island effect and plants stabilise soils reducing the potential risks of landslides and erosion.

In addition to providing climate change specific services, biodiversity also provide a wide range of other services such as aesthetic, cultural and recreational spaces. Therefore, climate adaptation and mitigation that is based on biodiversity and ecosystems can have multifunctional benefits. Examples of this can be seen in Table 2.

Table 2: Examples of ecosystem-based approaches for climate change adaptation and mitigation

Climate impact	Ecosystem-based adaptation
Increased droughts	Use appropriate agricultural and forestry practices to increase the water retention capacity and mitigate droughts
Heat extremes	Increase green spaces in cities to improve the microclimate and air quality
River flooding	Maintain and restore wetlands and riverbeds which will act as natural buffers against floods
Increased fire risk	Cultivate diverse forests, which are more robust against pest attacks and present a lower fire risk

Source: European Commission (2009) Nature's Role in Climate Change

The relationship between biodiversity and climate change is not one way – the effects of a changing climate are already having an impact on biodiversity and ecosystem service provision. It is predicted that in the future climate change will be the single biggest driver to biodiversity loss next to land use change[13]. The impacts of climate change on biodiversity stem from the fact that species tend to evolve to a specific range of environmental factors such as temperature, moisture and. As these factors alter due to climate change, species need to migrate to stay in their optimum environment. Some species are more

Environmental limits

The notion of environmental limits can be seen as defining the boundaries of sustainability. In effect the capacity of the environment. Two main types of environmental limit can be distinguished:

- **Threshold limits**: based on biophysical thresholds or breakpoints (mainly for environmental dimensions). For example pollutant levels may have small effects until a critical point is reached and results in significant acute impacts; and
- **Non-threshold limits**: established based on societal preferences. For example a landscape with manmade structures.

Source: SNIFFER, 2010

[12] The significant fluctuations are due to seasonal changes in photosynthesis rates, with more carbon being stored in the growing season of summer
[13] Millennium Ecosystem Assessment (2005) Synthesis Report

adaptive, such as those which are mobile and reproduce quite quickly. For others, this threatens their ability to survive and hence increases extinction rates and reduces biodiversity.

The ability of species to respond to this climate enforced migration is also limited by human activity – which has changed land uses and fragmented habitats. When roads, urban areas and agricultural land stand in their way, many species will find it almost impossible to migrate across the landscape. There is therefore a need to facilitate this natural adaptation process by, for example, creating migration corridors of natural habitats and reducing fragmentation, as well as reducing GHG emissions to reduce the overall likely impacts of climate change in the future.

Relationship between mitigation and adaptation

Climate change adaptation and mitigation are closely interrelated. While they are often considered as separate topics or policy fields, it is nevertheless critical to consider the interactions between them. Certain adaptation responses have clear mitigation benefits. An example is the creation of green spaces and planting trees in urban areas which not only sequester carbon but also reduce the urban heat-island effect - this delivers both GHG and adaptation benefits. Conversely, some actions can result in 'maladaptation' – actions that instead of reducing vulnerability to climate change actually increase it or reduce adaptive capacity. Examples of maladaptation include:

- Actions to cope with the effects of climate change that conflict with mitigation (for example energy intensive air conditioners if the required energy is provided by fossil fuels);
- Actions that use resources unsustainably (for example the over use of groundwater for irrigation in response to droughts); and,
- Actions that distribute the benefits of adaptation unequally across society (for example the prevention of climate change induced diseases only for affluent people).[14]

One of the roles of SEA is to manage these conflicts and potential synergies – this is considered in Part II.

***Maladaptation** is an action or process that increases vulnerability to climate change-related hazards. Maladaptive actions and processes often include planned development policies and measures that deliver short-term gains or economic benefits but lead to exacerbated vulnerability in the medium to long-term.*

[14] Taken from Guiding principles for adaptation to climate change in Europe ETC/ACC Technical Paper 2010/6

2. Why Address Climate Change and Biodiversity in SEA?

This section reviews some principles for SEA which are relevant throughout the Guidance, as they underpin the recommended approaches and techniques for integrating climate change and biodiversity into SEA. It is based upon the view that the "spirit" or intent of the SEA Directive is a preventive one, and that integration of climate change and biodiversity into SEA not only is integral to the requirements of the Directive, but also presents opportunities to enhance plans and programmes through greater resilience to the impacts of climate change. This section also outlines how SEA can help to deliver climate change and biodiversity objectives and how this in turn presents benefits for both the environment and plan/programme proponents.

The legal basis and "spirit" of the Directive

The SEA Directive contains a number of starting principles that provide a useful basis for considering climate change and biodiversity in SEA. The Directive makes explicit reference to "*biodiversity*" and to "*climatic factors*" in its list of factors to be assessed, as well as fauna and flora, along with interactions between other factors such as population, human health, fauna, flora, soil, water, air, material assets, cultural heritage and landscape (Annex 1). The Directive sets out unambiguously to establish a high level of protection for the environment (Art. 1) and to integrate environmental considerations into the preparation of plans and programmes likely to have a significant effect on the environment, with a view to promoting sustainable development. It is therefore the only formalised tool available to help integrate climate change and biodiversity into strategic planning processes.

The Directive's preamble refers to Article 174 of the Treaty on environmental protection and to the Convention on Biological Diversity, as well as the Birds and Habitats Directives 79/409/EEC and 92/43/EEC respectively, seen today as the bedrock of EU biodiversity policy. Annex I emphasises the need to take into account during preparation the environmental protection objectives, established at international, Community or Member State level, which are relevant to the plan or programme. As such, EU policy on climate change and biodiversity will need to be considered as part of the information referred to in Art 5 (1).

The SEA Directive strongly supports a preventive and precautionary approach to avoiding significant environmental effects of proposed plans and programmes, through a requirement for reasonable alternatives to be evaluated alongside the proposed

Relationship between SEA and EIA

Strategic environmental assessment under the SEA Directive 2001/42/EC is carried out alongside certain plans and programmes that might have a significant effect on the environment and which set the framework for projects requiring EIA under the EIA Directive. There is therefore an explicit link between the two where SEA of plans/programmes should help ensure such documents provide a high level of environmental protection and support sustainable development. Environmental reports produced for SEAs should therefore provide very useful context on higher level policies and trends on climate change and biodiversity and therefore key issues, providing they have also considered these topics.

plan or programme. The Directive also requires that assessments aim to prevent, reduce and as fully as possible offset any significant adverse effects (Annex I). The SEA Directive also incorporates provisions for ensuring consistency with the UNECE Espoo Convention SEA Protocol and the UNECE Aarhus Convention on Access to Information, Public Participation and Access to Justice in Environmental Matters. Public participation – with the public affected in neighbouring Member States as well as within the country of origin of the plan/programme proposal – should be early and effective (Art. 6(2)). The public affected shall include non-governmental organisations, which may be particularly active in the fields of climate change and biodiversity. Importantly, the Directive requires Member States to consult with the designated environmental authorities at the scoping stage (Art. 5(4)), which is particularly important for climate change and biodiversity as these will be the authorities that hold the appropriate knowledge on these issues.

The SEA Directive also requires monitoring of the significant effects of implementing plans and programmes *"in order,* inter alia*, to identify at an early stage unforeseen adverse effects, and to be able to undertake appropriate remedial action"* (Art. 10(1)). Implicit within this provision is therefore a resilience and adaptive management approach to plan and programme preparation and adoption.

There is, therefore, explicit recognition in the SEA Directive of the need to consider climate change and biodiversity as integral factors in the assessment of significant effects. The Directive offers the opportunity not only to avoid negative impacts in terms of GHG emissions and loss of biodiversity arising from plans and programmes, but also to build in positive benefits for climate change mitigation and adaptation, and the enhancement and restoration of biodiversity, while at the same time creating greater resilience of plans and programmes to future environmental change.

SEA as a means for delivering climate change and biodiversity objectives

SEA is a procedural and systematic tool that seeks to support the development of a plan or programme. For many types of plans or programmes, it is also the only legally required tool for the early consideration of the environment when alternatives are potentially still being considered and opportunities exist to avoid environmental effects and integrate environmental considerations into the plan or programme.

Certain characteristics of the SEA process mean it is particularly effective for the consideration of climate change and biodiversity. Not least, the requirements to engage and consult with key stakeholders as part of SEA process presents an opportunity to gather information and consider a range of parameters which may not necessarily be included within the

development process of the plan or programme, including the consideration of potential alternatives. SEA can therefore provide the mechanism to assess key issues effectively and transparently and bring opportunities to achieve wider environment objectives, and climate change and biodiversity in particular, to light. For climate change this might include, for example:

- Understanding the potential GHG emissions from the implementation of the plan or programme and potential alternatives to avoid or reduce these effects.
- Ways to improve the resilience of a plan or programme through considering possible implications of climatic changes on the plan or programme.
- Exploring the possible conflicts and synergies between climate change mitigation and adaptation and therefore avoiding maladaptation.

Benefits of considering climate change and biodiversity within SEA

SEA is not an end in itself; rather it is the appropriate approach for including environmental considerations within the development of a plan or programme. This guidance seeks to demonstrate that there are benefits to the competent authorities for the plan or programme, the key stakeholders and society more generally from incorporating climate change and biodiversity within development of the plan or programme from the outset. Figure 7 shows that the relationship between a plan or programme with biodiversity and climate change as a cycle, where this relationship can be both positive and negative (positive elements are shown in green and negative in red). SEA can help ensure a plan or programme considers biodiversity and climate change effectively and therefore help the competent authority take the positive path.

Policy and other drivers

Clearly, as described previously the consideration of climate change and biodiversity within SEA will have the benefit of facilitating compliance with the Directive and relevant national laws on SEA. Moreover, climate change and biodiversity are the subjects of a large number of EU legislation, policies and strategies, including binding targets on Member States (see Section 1). Each Member State is also likely to have a suite of legislative instruments relevant to climate change and biodiversity. SEA provides opportunities to ensure that plans and programmes are consistent with the requirements of these policy and legal instruments, whether at the international, European, national, regional or local level. The effective consideration of climate change and biodiversity will increase compliance with these objectives and policy drivers and

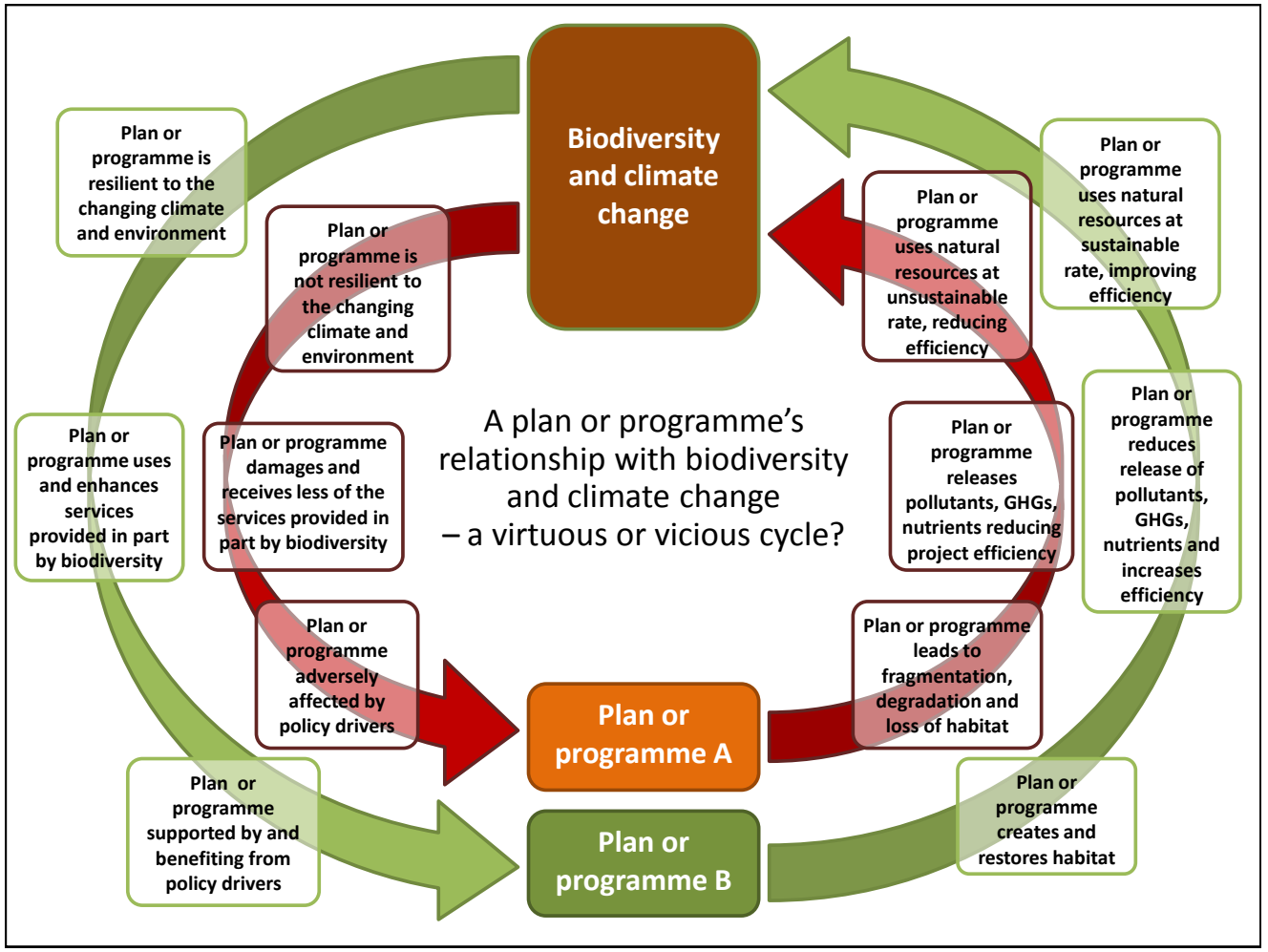
support the planning of any projects that result from the implementation of a particular plan or programme, as well as any EIA or Natura 2000 Assessments undertaken as part of the project planning process.

Beyond these public policy requirements, there is increasingly pressure on competent authorities from stakeholders and the general public to demonstrate that a plan or programme has minimal environmental effects and where possible has positive environmental effects – as such there are reputational benefits. This is particularly true for GHG emissions, in part due to climate change concerns, but also because reducing GHG increases energy efficiency and tends to save costs.

Resilience of a plan or programme to a changing climate

A number of recent studies on the vulnerability of the EU and specific sectors and territories to the changing climate have shown that Europe's infrastructure needs to be more adapted to natural phenomena caused by the changing climate. This represents a shift in thinking from the traditional assessment of the impacts on the environment alone. Over the potentially long lifespan of a plan or programme the parameters relevant at its inception may not be valid as the climate changes. Insurance firms, for instance, are already recognising the value of this form of thinking and including it within their assessments of risks from natural hazards. SEA can allow plans

Figure 7: Virtuous / vicious cycle – relationship between plans / programmes and climate change and biodiversity



or programmes to adapt to this through the concept of resilience.

Building resilience - the capacity of systems to cope with environmental change and recover from disturbance – is increasingly recognised as a key focus for adaptive management responses to climate change.[15] In the context of SEA this entails considering that a plan or programme operates within an evolving environmental baseline and as such the SEA needs to understand the impacts of this changing baseline on the objectives and implementation of the plan or programme and how it may respond over time. Adaptation should not be left until the end of the development of the plan or programme – resilience needs to be built from the very beginning of it development as many are likely to experience a significantly changing environment. More information as to how resilience can be built into SEA is considered further in Part II. The SEA process is particularly important in that it has the potential to set the context for projects– therefore the effective consideration of potential climate change impacts within SEA has huge potential to contribute to more resilient projects (supported by EIAs). Equally ineffective consideration could reduce resilience and effectiveness of projects.

Ecosystem services received by the plan or programme

The ecosystem services provided by biodiversity also need to be considered as part of the development of a plan or programme. Biodiversity can provide a range of ecosystem services that potentially support the objectives of a plan or programme and its implementation. For instance, a plan promoting economic and social development could provide aesthetic, spiritual and cultural services offered by biodiversity through the creation and protection of green spaces and other natural areas associated with residential and commercial development. The long term sustainability of the economic development may be reliant on the climate change adaptation benefits provided by these natural areas in terms of provision of cooling during hot temperatures and/or the attenuation of flood water for example.

Considering and responding to the reliance of a plan or programme upon these services, and hence on biodiversity, can lead to a more effective plan or programme, as well as supporting biodiversity and biodiversity policy objectives. However, the degree to which a plan or programme receives these services will be depend upon local and wider environmental limits which will be affected by not just the plan or programme in question, but also other plans and programmes as well as wider drivers for change. SEA can plan an important role in helping to understand these relationships and wider context.

Biodiversity and ecosystem services risks

- **Reputational risk**, especially concerning access to funding
- **Regulatory risk**, such as the expansion of protected areas or the strengthening of protected species legislation
- **Operational risk**, concerning the sustained provision of key inputs (e.g. clean water) or ecosystem services
- **Legal liability risk**, for example in the case of accidental damage to ecosystems or protected species
- **Systemic risk**, when a business or operation is overly dependent on a particular ecosystem service

Source: TEEB, 2010

[15] Resilience Alliance (2010) gives examples of environmental limits relevant to climate change and biodiversity

Impact on environmental limits

Biodiversity and climate change often react in unpredictable ways to external pressures, and the thresholds for sudden decline or collapse in biodiversity or resilience may not be fully understood. This is in part due to the complexity of the relevant cause-effects relationship and their potentially cumulative nature. This requires SEA to consider a wide range of related actions and impacts that may seem insignificant when considered individually. As with climate change, uncertainty presents the need to research and develop more resilient alternatives and "no regrets" solutions, and potentially to take a precautionary approach. Figure 7 shows examples of pressures a plan or programme may exert on environmental limits – the extent to which a plan or programme impacts negatively on these will reduce the positive elements, described above, that a plan or programme receives.

Considering climate change and biodiversity within SEA should reduce the negative effects of the implementation of a plan or programme upon these aspects of the environment, for instance by limiting fragmentation of habitat, emission of materials which harm biodiversity and GHGs, and the unsustainable exploitation of resources such as water and timber. Beyond reducing these negative impacts, SEA has the potential to provide net gains in both biodiversity and by supporting a plan or programme to be carbon neutral or negative can form a virtuous cycle where the plan or programme contributes to adaptation, biodiversity improvement and GHG reduction and in return is more compliant, resilient and better supported by ecosystem services.

PART II: GUIDANCE

This part provides an overview of the SEA process and an understanding of how climate change and biodiversity fit within the overall SEA process. It takes you through a sequence of key thematic questions:-

- *How to address the key challenges?*
- *What are the key climate change and biodiversity issues?*
- *How to assess the effects?*

The purpose of this part of the guidance is to provide advice on how to address the key challenges posed by climate change and biodiversity for SEA; how to identify the most relevant key issues in relation to a particular plan or programme, and how to assess the effects of a proposed plan or programme on climate change and biodiversity, and of climate change on a plan or programme.

3. Introduction to the SEA process and the SEA case studies

Overview of the SEA process

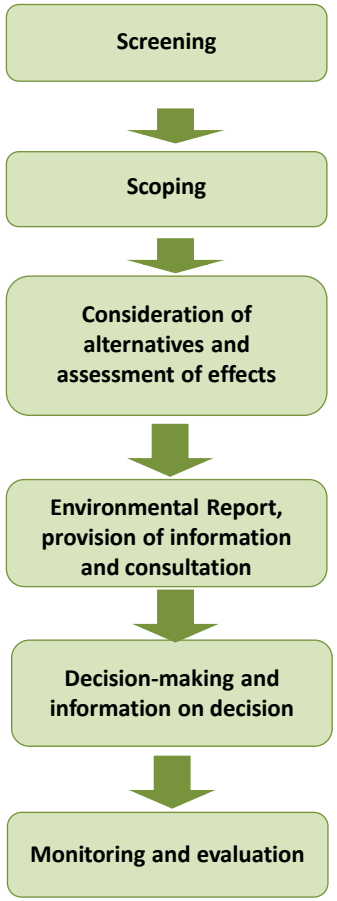
This guidance does not seek to provide generic advice on undertaking SEA, rather it aims to illustrate key approaches, concepts, ways of thinking and tools which allows climate change and biodiversity to be better integrated into SEA. However, SEA is a procedural tool and there are certain generic steps that an SEA tends to go through. These are presented and briefly described here in Figure 8 to ensure consistency of approach and terminology for the users of this guidance. The generic SEA process shown here follows that outlined by the SEA Directive. This guidance is intended to support the SEA Directive while also encouraging best practice in considering climate change and biodiversity in SEA.

For more detail on these processes and for general guidance on implementing the SEA Directive see the further reading at the end of Part II of this document.

The Guidance is structured according to three key questions:

- What is it about climate change and biodiversity that poses a challenge to the assessment process?
- How does that affect the information needs the assessment will have – what type of

Figure 8: The generic SEA process



Description of stage
Screening involves determining whether a plan or programme should be subject to SEA in accordance with Article 3 of the Directive. The outcome of the screening process is likely to be affected by: the legal and other requirements relating to SEA that are applicable; who is preparing the plan or programme and why; and whether the implementation of the plan or programme is likely to have a significant effect on the environment (Annex II of the Directive contains criteria for determining likely significance of effects) .
This stage is to determine the scope of the assessment and the level of detail of the environmental report. The scoping stage also usually involves deciding on the approaches to used as part of the assessment and indentifying relevant stakeholders and collecting baseline and other relevant contextual information. It also involves consulting the relevant authorities and giving the public an early and effective opportunity to express their opinion in accordance with Article 6 of the Directive.
The consideration of reasonable alternatives is a particularly important part of the SEA process (see Article 5 of the Directive). This stage involves predicting and evaluating the potential effects of the plan or programme, including the alternatives, on the environment. Part of this process should include the identification of measures of prevent, reduce and as fully as possible offset the significant adverse environmental effects of the implementation of the plan or programme and enhance the positive effects.
Preparing an Environmental Report in accordance with Article 5 and the information set out in Annex I of the Directive. Undertaking consultation with the relevant authorities and the public, at the same time as the draft plan or programme, in accordance with Article 6 and other Member States in accordance with Article 7.
Taking the information in the Environmental Report and the responses to the consultation into account in preparing the final plan or programme in accordance with Article 8 before the decision is taken to adopt it. Making available information on the decision including how the plan or programme as adopted integrated the environment and the results of consultation and the reason for choosing the plan or programme as adopted in the light of reasonable alternatives (see Article 9 of the SEA Directive).
Monitoring the significant effects of implementing the plan or programme and measures to be taken to ensure that unforeseen adverse effects are identified and remediated (see Article 10 of the Directive).

information, what sources and what stakeholders will hold information and specific knowledge in these areas?

- What are the key aspects to cover in the detailed assessment and how important will those issues be in decision-making?

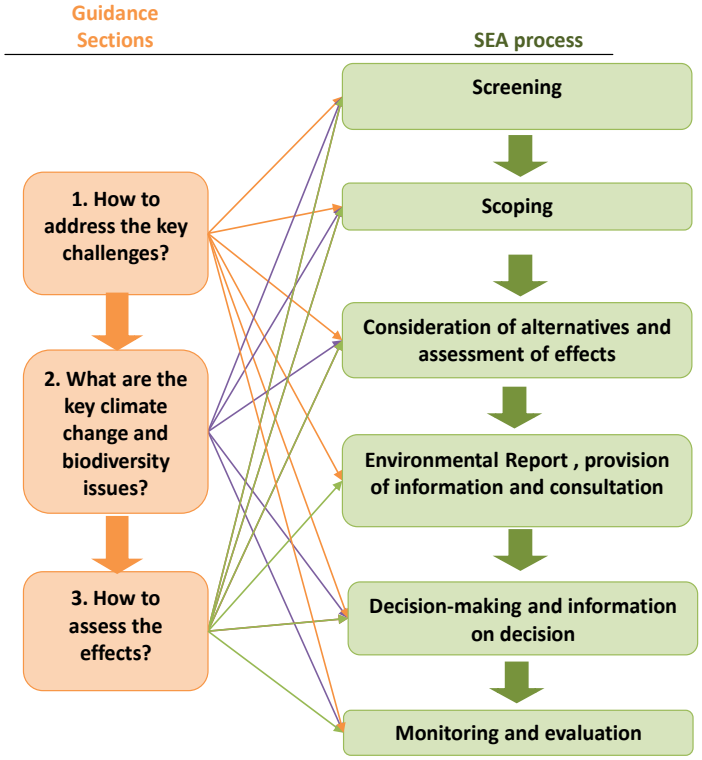
Figure 9 illustrates how each of the key thematic questions is relevant for most - if not all - of the key stages of SEA. However, some issues are likely to be more important for some stages than others and these are emphasised in the guidance below. In general it is better to consider climate change and biodiversity issues as early as possible in the SEA process, since that helps build these issues into the mind set of practitioners as a matter of course.

Key messages

Summary of key messages for integrating climate change and biodiversity into the overall SEA process:

- ☐ To address both climate change and biodiversity effectively means building them into the assessment process from the **earliest stages** – in that way you are more likely to follow them through the whole SEA process. Therefore start thinking about climate change and biodiversity at the screening and scoping stages.
- ☐ Considering climate change and biodiversity early and **integrating them into the design of the SEA process** will help build these issues into the mind set of all the key parties involved, including the competent authorities and policymakers, planners, SEA practitioners and other stakeholders.
- ☐ It is important that the consideration of biodiversity and climate change issues is **tailored to the specific context** in which you are working; it is not simply a set of checklists of issues to tick off having been completed. Every SEA that effectively integrates climate change and biodiversity will potentially be different.
- ☐ SEA offers a **formalised process** for considering climate change and biodiversity concerns in proposed plans and programmes across the EU. SEA has proven to be a critical tool for the implementation of EU environmental policy and the achievement of EU environmental objectives.

Figure 9: Topics of the guidance and the SEA process



Introduction to the SEA case studies

Annex 4 of this guidance includes some SEA case studies. These examples are used throughout the rest of Part II of the guidance to illustrate how climate change and biodiversity can be considered in key elements of the SEA process and how some SEAs have approached the challenges of integrating climate change and biodiversity into SEA. In addition to the full case studies, other SEA examples are also used as illustrations in Part II of the guidance.

An overview of the case studies (and examples) and the challenges and elements of the SEA process they are used to illustrate is provided in the Table 3 below.

Table 3: Overview of case studies used to illustrate how climate change and biodiversity can be considered in key elements of the SEA process

Case study / illustrations	Relevant To:	Key Message:
Case studies		
1: Irish Offshore Energy development plan	• Climate Change and biodiversity inter-relationship • Evolving baseline	This SEA considers the potential impact of climate trends on the plan as well as on the future environment (particularly biodiversity). This is not achieved through site specific assessments or information but rather by a strategic, directional overview of potential climate trends and their potential impacts. This information informs the consideration of alternatives, monitoring requirements and the EIAs to be required as part of the implementation process.
2: Wales Rural development Plan	• Early and effective scoping with stakeholders • Use of network (causal chain) analysis	This case study is an example of early and effective engagement with stakeholders to identify the most important aspects of the environment. This was supported by the use of network analysis.
3: Via Baltica Express Road	• Importance of the early consideration of biodiversity • Consideration of alternatives	Lack of consideration of biodiversity issues up front the scoping stage of the SEA of the relevant programme resulted in a failure to develop and assess suitable alternatives for the project, and led to a formal complaint being made against the programme (at the project level) which eventually halted construction. Alternative routes were assessed and agreed upon later, but the process resulted in several years of delay and considerable added cost. There have also been concerns that the wider strategic project is being 'salami sliced'; into smaller project to mask the total impact of the programme.
4: Strategy for Wild Deer in Scotland	• Use of network (causal change) analysis • Consideration of alternatives • Use of futures thinking and managing uncertainty	Causal chain analysis is an effective approach for considering complex long term issues (such as climate change and biodiversity). In particular this case study shows that it useful for bringing together stakeholders and the identification of various alternative management options.
5: Thames 2100 Flood Risk Management Plan	• Assessment of alternatives • Monitoring	The integration of climate change and biodiversity into SEA requires long-term thinking and a dedicated approach to dealing with uncertainty. This can be approached in a number of ways, such as developing a range of potential

Case study / illustrations	Relevant To:	Key Message:
	• Long-term horizon for climate change • Dealing with uncertainty	alternatives for the longer term, and putting in place sound monitoring arrangements to improve adaptive capacity.
6: Spanish Transport Infrastructure Development Plan	• Scoping • Ecosystems approach • Assessment of alternatives	SEO Birdlife has developed a methodology to accurately determine the relevance of territories for biodiversity conservation. This methodology, which has been developed for SEAs of large-scale infrastructure plans, was applied to the Spanish 2000-2007 transport infrastructure plan and a case study developed. It concluded that SEAs cannot limit themselves to consideration of the effects of plans and programmes on protected areas or even networks of protected areas, as the preservation of these depends upon the quality of their surroundings. SEAs for large-scale infrastructure development plans in particular must contribute to conserving biodiversity outside the system of protected areas and promoting biological connectivity by adopting a scope that is commensurate to the plan's potential impact.
7: Plzen Region Waste Management Plan	• Assessment of climate change and biodiversity	[details to follow]
[other case studies to be added?]	•	
Illustrations	•	
London Climate Change Adaptation Strategy	• Alternatives • Climate scenarios	
Greater Dublin Region Water Project	• Evolving baseline	

In addition to the case studies in Annex 4, the guidance includes other resources to support the SEA process:

- Annex 2 of this guidance includes details of the sources of information available to support the SEA process.
- Annex 3 of this guidance includes details of some of the tools and approaches that can be used as part of the SEA process.

4. How to Address the Key Challenges of Climate Change and Biodiversity in SEA?

A number of characteristics of climate change and biodiversity shape the way in which we need to look at them in the context of SEA:

- Long-term and cumulative nature
- Complexity
- Uncertainty

These characteristics influence how these topics are integrated into the SEA process, but are particularly relevant to the screening, scoping and assessment stages of the SEA itself, and for long-term follow-up through monitoring and evaluation. They are relevant also to report preparation and decision-making, but that should follow through if you have considered them at the earlier stages. Understanding the challenges climate change and biodiversity will pose to an assessment given their inherent characteristics, within the specific context of a particular plan or programme, will enable you to deal with them and communicate them more effectively through the SEA process. Table 3 below summarises how you might approach these three main challenges and each is discussed in more detail in the following sections.

Table 3: Recommended SEA approaches to meet the challenges of the characteristics of climate change and biodiversity

Key challenges to considering climate change and biodiversity in SEA	Recommendations for SEA approach
Long-term and cumulative nature of impacts	• Avoid 'snapshot' analyses and consider trends without and with the proposed plan or programme
Complexity	• Analyse impacts of proposed plans or programmes on the key trends and their drivers • Work with worst case and best case scenarios
Uncertainty	• Acknowledge assumptions and limitations of current knowledge • Base your recommendations on the precautionary principle • Prepare for adaptive management

Consider long-term trends without and with the proposed plan or programme

Climate change issues (mitigation and adaptation) are concerned with long term trends and often apparently imperceptible changes over the short-term. So the long–term nature of climate change makes it more difficult to consider within normal (often short-medium) planning horizons. However, as many plans and programmes are implemented over the longer-term, and set a framework for infrastructure and other projects that will have a lifespan of many years, climate change and biodiversity will be critical to their viability. This influences the baseline environment against which the plan or programme should be assessed as part of an SEA.

Biodiversity is also long-term in that biodiversity loss is recognised as a megatrend which in the EU we have failed to halt as intended by 2010 and now have a new target of 2020. Effects on biodiversity are cumulative over long time scales and once species or habitats are completely lost they cannot be replaced or recovered. This means that we need to avoid impacts wherever possible and make positive efforts to enhance and better manage existing biodiversity, not least because of the ecosystem services and benefits derived from biodiversity (see Section 2). What would no net loss of biodiversity mean for the implementation of a specific plan or programme?

In light of the above facts, it is strongly suggested that SEA practitioners avoid 'snapshot' analyses (i.e. at a single point in time) and consider trends *without* and *with* the proposed plan or programme (and its alternatives). The cumulative aspects of climate change and biodiversity impacts are particularly important with regard to the evolving baseline. The current state of the environment will not necessarily be the future state of the environment, even if the implementation of the proposed plan or programme does not go ahead. A snapshot of the baseline in current time is not therefore sufficient against which to evaluate a proposed plan or programme. An evolving baseline over time needs to be considered, which will entail understanding recent trends and likely future trends in key issues.

The current state of the environment will not necessarily be the future state of the environment, even if the proposed plan or programme does not go ahead.

Manage complexity by considering impacts of the implementation of the proposed plan or programme on key trends and their drivers

Both climate change and biodiversity are complex issues because they involve complex systems and interactions between the biophysical environment and the human environment. The climatic system is still relatively poorly understood and the more we understand the more complex it can be seen to be. For example, forecast models of GHG emissions and climate

Complexity

Impacts that may appear to have positive climate change mitigation benefits (such as renewable energy infrastructure) could impact on biodiversity, for instance via the effect of turbines on birds. Longer term negative effects might occur, for instance diverting water for hydro-electrical schemes could dry out and lead to the loss of carbon stored in wetlands as well as methane released from the reservoir.

change are still unable to account fully for feedback effects we understand, let alone those we do not yet know about. Since we cannot fully understand some aspects of complex systems at the required decision point, we need to be able to work with what we have. At times this will require simplified models to give best estimates of emissions and impacts.

Both climate change and biodiversity operate at multiple scales, and this can cause specific challenges for SEA. The complexity of cause-effect relationships and impact interactions should not deter SEA practitioners from analyzing direct and indirect impacts of the implementation of the proposed plan or programme on the trends in key issues. Conventional assessment approaches can be made more rigorous by asking two basic questions: firstly, it is important to examine whether the implementation of the proposed plan or programme is likely to have any significant direct impacts on the expected future state of the environment in the study area; secondly, it is useful to know whether the implementation of the proposed plan or programme can significantly alter drivers of trends in the key issues. Consideration of these direct and indirect effects of the implementation of the proposed plan or programme should determine whether the relevant trends will reach any critical turning points or bottom-lines when major changes in the functioning of the ecosystem can be expected. In complex situations, SEA practitioners can use best case and worst case scenarios to illustrate different futures states under various assumptions. (See Annex 2 for further information on scenarios and other relevant tools)

The judgment of impact magnitude and significance must be context-specific. For an individual plan or programme – a transport plan, for example – while its contribution to greenhouse gases may be insignificant at the global scale it may well be very significant at the local or regional scale in terms of its contribution to targets set at those levels for GHG reductions. Similarly, impacts on biodiversity will also depend on geographical and temporal scales of impacts and the sensitivity of the habitat or species concerned. For instance the implementation of the plan could have possible negative effects upon a relatively common species at the global level, but at the local level this could be the only viable population of that species. Both climate change and biodiversity therefore demonstrate the importance of distinguishing between magnitude and significance as you should normally in SEA, but in these cases temporal and geographical scales may need to be much greater.

Acknowledge uncertainty and use precautionary principle for guiding the development of plans and programmes and decision-making

Uncertainty exists within any decision making system but it increases with complexity and timescale. There may be uncertainty about what is already known (e.g. errors, or *known unknowns*), and there may be uncertainties due to what is not known at all (i.e. ignorance or *unknown unknowns*!). For SEA this becomes particularly relevant for plans and

Case study: xxx

Example of SEAs that have used scenarios to be added

(see Annex 4 for further information)

Tips for dealing with uncertainty:

- ☐ Be comfortable with uncertainty; when seeking to anticipate the future you will never be able to be certain.
- ☐ You can gather more information which may be useful up to a point, but only if it is the appropriate information and it is feasible to fill an information gap. For more see Annex 1 on information needs.
- ☐ Scenarios are an effective way to deal with the uncertainty inherent within complex systems and imperfect data. They can present a range of possible outcomes or pathways. For more information on scenarios see Annex 2.
- ☐ Use proxy indicators if direct indicators are not available, e.g. trends in traffic levels if vehicle GHG emission data are not available.
- ☐ Think about risks when impacts are too uncertain.
- ☐ Monitor to improve adaptive capacity

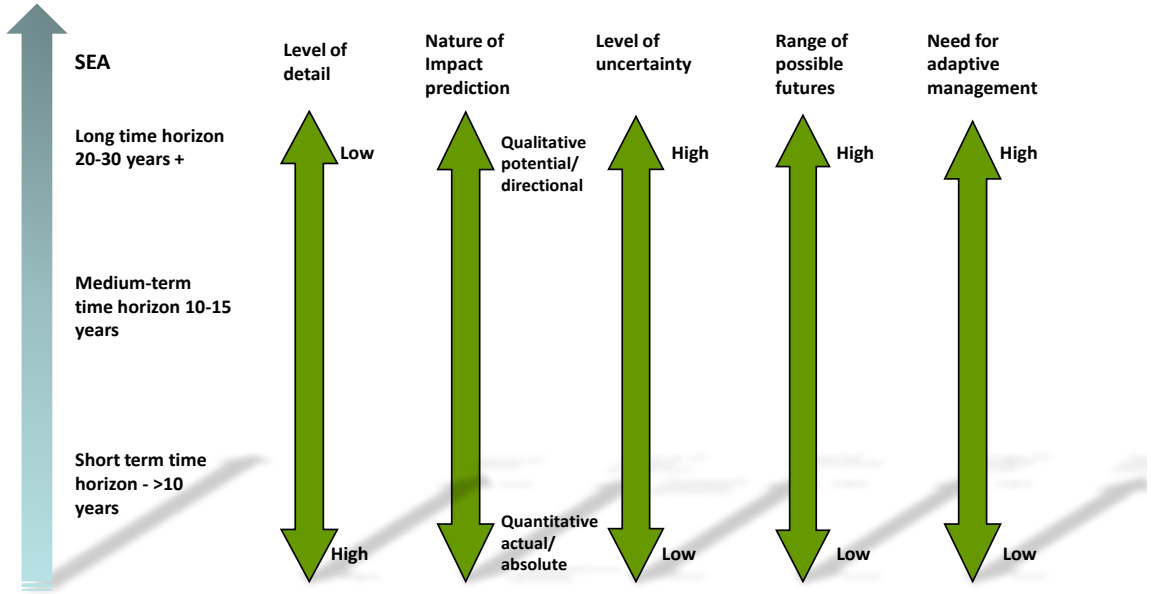
programmes that take a long time to implement and that will result in activities and projects over long time horizons - there is therefore a high degree of potential uncertainty. Uncertainties will exist regarding the impacts of the plan or programme upon biodiversity and climate change and also the impacts of changing biodiversity and climate on the plan or programme. Both sides of this coin need to be considered.

Many SEA practitioners - often with a natural or physical science background - will be used to working with quantitative data (from surveys, monitoring programmes, and modelling, for example), but feel less comfortable dealing with long-term uncertainty and therefore, by necessity a more qualitative approach (see Figure 10). However, being comfortable with uncertainty is essential when dealing with long-term climate change and biodiversity assessment, where we cannot *accurately* predict future impacts of a plan or programme in an uncertain world. We can however, consider possible future scenarios and their associated risks – to the environment and to the plan or programme. (See Annex 2 for further information on scenarios and other relevant tools)

There may be a high degree of uncertainty as to whether the significance of the impacts of the plan or programme is likely to be sufficient to require SEA (i.e. during screening). Does the plan or programme type and scale (e.g. planning duration and investment level) justify considering climate change risks and vulnerability? Could the plan or programme potentially be sensitive to climate change? If so what would that mean? This will require looking a long term trends, for example in biodiversity loss (species/habitat/genetic) to establish the sensitivity of receptors or habitats. Looking forward into the future will also help establish things like the increasing susceptibility of biodiversity to the impact of the plan or programme and the plan or programme to climate change (and potentially to changes in biodiversity caused by climate change, e.g. the increase in alien species).

Uncertainty therefore needs to be factored in to scoping – for example, temporal boundaries may need to be longer than normal; spatial boundaries may need to be greater for certain species. What climate variables and aspects of the

Figure 10: SEA – embracing uncertainty in long-term futures



Case study: SEA of the Strategy for Wild Deer in Scotland – dealing with uncertainty

This strategy sought to provide a long term vision for the effective management of wild deer across Scotland – the SEA process facilitated many elements of this, including the use of futures thinking to help manage uncertainty. This included a brain storming session with stakeholders to identify long term drivers and assess their importance and level of certainty.

(see Annex 4 for further information)

plan or programme need to be assessed to address climate change and biodiversity? What expertise is needed on the SEA team to do so? What information is available or needed (see Annex 1)? In so doing you are likely to be thinking about and assessing risks, because impacts themselves may simply be too uncertain to have sufficient confidence in your predictions.

The assessment, therefore, should always acknowledge:

- The assumptions behind the assessment (i.e. under what circumstances can an impact occur);
- likelihood of the impact (i.e. probability that the impact will occur);
- uncertainties that constrain more precise assessment; and
- prepare for adaptive management (what measures can be put in place to respond to future changes)[16].

The choice of the project alternatives and mitigation measures should be guided by the precautionary principle. This includes thinking about the most appropriate kinds of alternatives and mitigation measures that can help build resilience into the plan or programme in the context of the evolving environmental baseline and preparing early warning systems and responses to potentially significant adverse effects. An ongoing environmental management plan (EMP) becomes more of a necessity rather than simply best practice, if you are to implement, monitor, evaluate and adjust effectively for resilient plans or programmes and build adaptive management into the plan review process.

Key messages

Climate change and biodiversity have certain characteristics that present a specific challenge within SEA. The key messages section below summarises recommended ways to approach and address these challenges. Each of these issues - long-term and cumulative nature, complexity, uncertainty, and adaptive management - may influence your choice of assessment tools and techniques, e.g. use of modelling, scenarios, risk assessment, public engagement processes etc (see Annex 2 for an overview of some of the tools and approaches that are available to support the assessment of climate change and biodiversity within SEA).

Adaptive management

The SEA directive is quite explicit in Annex II about the need to consider the regenerative and absorption capacity of natural resources and the natural environment when considering whether a project is likely to have significant effects on the environment. This is consistent with a resilience approach to assessment. Having considered the resilience of different alternatives, build into the selected alternative adaptive capacity (flexibility and responsiveness) and adaptation measures (specific measures to moderate harm or exploit opportunities). Adaptive management is all about being responsive in the light of lessons learned.

(Further guidance on adaptive management can be found at http://www.for.gov.bc.ca/hfp/amhome/Admin/index.htm)

[16] See for example guidance on adaptive management produced by British Columbia's Ministry of Forests, Land and Natural Resource Operations at http://www.for.gov.bc.ca/hfp/amhome/Admin/index.htm

Summary of key messages for climate change and biodiversity challenges in SEA:

- ☐ Consider **long-term trends** without and with the proposed plan or programme and avoid 'snapshot' analyses.
- ☐ SEAs should assess the plan or programme against the **future baseline** and key trends and their drivers.
- ☐ SEA will also need to consider **the impact that projected changes in the climate and biodiversity** will have on the proposed plan or programme, potentially over a long timescale, and its resilience and capacity to cope.
- ☐ Manage **complexity**, consider for example whether the implementation of an element of a plan or programme that may appear to be positive against one topic, such as climate change mitigation, could have a negative impact on climate change adaptation and/or biodiversity.
- ☐ SEAs need to consider the complex nature of climate change and biodiversity and the potential of plans or programmes to cause **cumulative effects**
- ☐ Be comfortable with **uncertainty**; when seeking to anticipate the future you will never be able to be certain. Use tools such as scenarios (working with worst-case and best case scenarios for example), to help deal with the uncertainty inherent within complex systems and imperfect data. Think about risks when impacts are too uncertain.
- ☐ SEAs need to reflect the uncertainty inherent in climate change and predicting impacts on biodiversity and help to develop **more resilient alternatives and solutions** based on "win-win" or "no regrets" approaches to plan and programme development.
- ☐ Prepare for **adaptive management** and monitor to improve adaptive capacity.
- ☐ Base your recommendations on the **precautionary principle** and acknowledge **assumptions** and limitations of current knowledge.

Case study: SEA of the Thames 2100 Flood Risk Management Plan – dealing with uncertainty

This SEA demonstrates an approach to dealing with long-term horizons and their inherent uncertainties and acknowledges uncertainty directly.
It deals with uncertainty through, for example, the options that are considered and the emphasis placed on monitoring of the implementation of the plan.

(see Annex 4 for further information)

5. What are the Key Climate Change and Biodiversity Issues?

This section looks at the scope of climate change and biodiversity issues in SEA and how to identify which ones are appropriate for consideration in any particular context. It is structured around three key recommendations:

- Use stakeholders early to help identify the key issues;
- Understand the key climate change issues, as well as how climate change interacts with the other topics to be assessed in SEA; and
- Understand the key biodiversity issues, as well as how biodiversity interacts with the other topics to be assessed in SEA.

Tips for determining which types of effects are relevant:

- ☐ When considering the potential effects on biodiversity (and on potential carbon sinks) draw out the considered sphere of influence of a project. This should include direct, indirect and cumulative effects and be informed by consideration of ecosystem chains.
- ☐ Consult with relevant stakeholders early to identify potential cumulative effects.

Use stakeholders early to help identify the key issues

Identifying the key issues from a climate change and biodiversity perspective early in the SEA process is critical to ensuring those issues are assessed effectively throughout the rest of the SEA process. Early participation of targeted stakeholder groups and institutions as well as the wider public at an early stage will also be essential to ensure you capture the most important and relevant issues. Somewhat uniquely perhaps, climate change and biodiversity have very vocal stakeholders with a high profile within the wider political context.

Early engagement is likely to help improve compliance with the Directive, but also make use of stakeholder knowledge and opinion to highlight potential areas of contention and areas of improvement in a timely and effective way. Engaging proactively with stakeholders can also help build climate change mitigation and adaptation measures and/or biodiversity enhancement schemes into the proposed plan or programme from the very beginning of planning. (See Annex 2 for further information on stakeholder engagement and other relevant tools, such as network analysis, that can be used with stakeholders to identify key issues and effects)

The wide range of sectors and actors involved in climate change complicates the process of consulting the correct authorities and stakeholders when carrying out SEA. The SEA Directive requires early and effective consultation with authorities with "specific environmental responsibilities" and the public affected or likely to be affected by, or having an interest in, the decision-making related to the plan or programme in question, including relevant non-governmental organisations, such as

those promoting environmental protection and other organisations concerned. These authorities are typically defined by the Member States as ministries or specialised agencies for environment, but climate change issues typically require a different and often broader perspective, including authorities responsible for energy, transport, health and economic sectors.

Again, here SEA can help plan and programme proponents and experts to better define the range of authorities and stakeholders that need to be part of climate change-related decision-making, and to get them involved early in scoping out the key issues. SEA also has a role to play in building consensus over longer term scenarios and alternatives.

A series of key questions can be used to help identify which aspects of climate change and biodiversity might be most relevant. Annex 3 provides a set of questions and issues to help you think through those that might be most relevant in any situation – the headline concerns covered within Annex 3 are listed in Table 4 below.

Table 4: Key concerns related to climate change and biodiversity to consider as part of SEA

Climate change adaptation concerns related to:	Climate change mitigation concerns related to:	Biodiversity concerns related to:
• Sea level rise, storms surge, coastal erosion and saline intrusion • Flood regimes and extreme rainfall events • Landslides • Heat waves (including impact on human health, damage to crops, forest fires etc) • Droughts (including decreased water availability and quality and increased water demand) • Storms and high wind (including damage to infrastructure, buildings, crops and forests)	• Energy demand in industry • Energy demand in housing and construction • Greenhouse gas emissions in agriculture • Greenhouse gas emissions in waste management • Travel patterns and greenhouse gas emissions from transport • Greenhouse gas emissions from energy production	• Ecosystems (including the extent or quality of the habitat, protected areas and habitat fragmentation or isolation, as well as the impacts on the processes which are important for the creation and / or maintenance of ecosystems) • Species diversity • Genetic biodiversity

Case studies: Wales Rural Development Plan and Strategy for Wild Deer in Scotland – engagement with stakeholder

These case studies both illustrate how early and effective engagement with stakeholders can be used as part of an SEA process, including for example to identify the most important aspects of the environment.
Both these case studies also used network analysis as a tool to help identify key issues with stakeholders.

(see Annex 4 for further information)

Understand the key climate change issues to be assessed in SEA

The starting point for considering climate change in relation to your SEA is likely to involve considering climate scenarios and what the implications of those might be for the plan or programme. Key issues of concern are likely to be around GHG emissions for mitigation, and adaptive measures needed to deal with anticipated extreme weather events and other impacts resulting from climate change. For climate in particular you need to consider not just the impacts of the plan or programme on climate and climate change, but also the impact of climate change on the plan or programme (see Annex 3 for key questions you might need to consider).

So how is climate affected by the implementation of the plan or programme? And how may the plan or programme be affected by climate change?

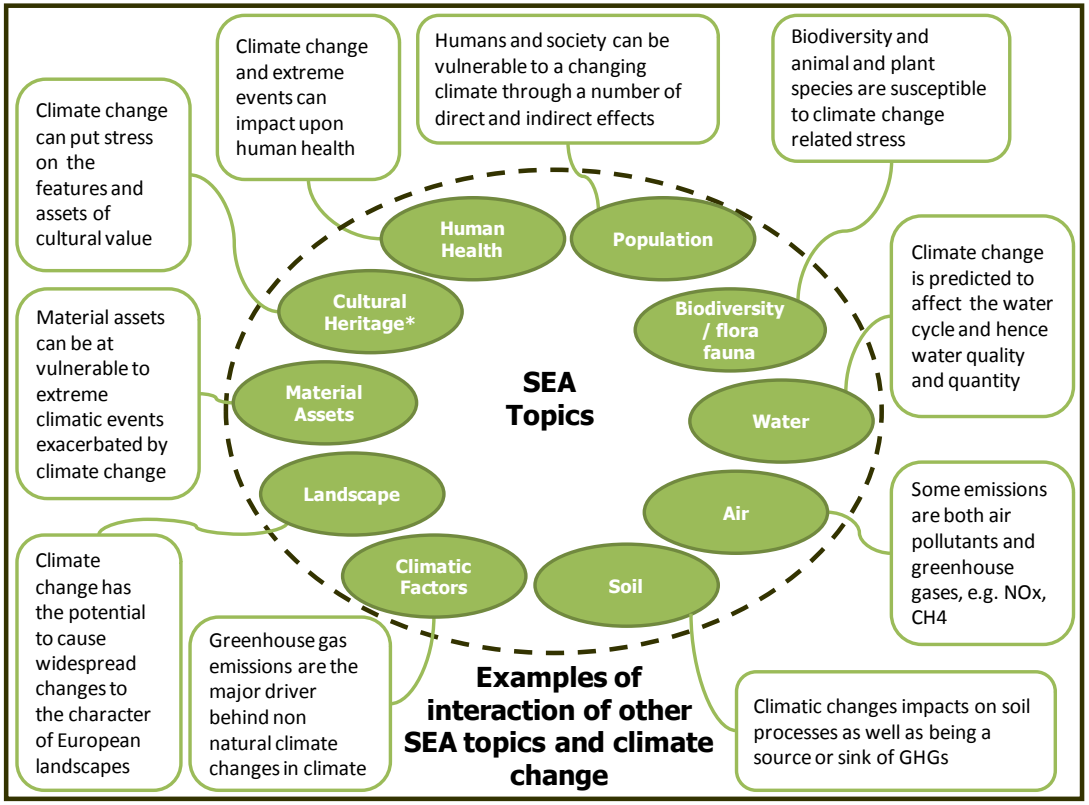
Among other things the implementation of the plan or programme may lead to:

- GHG emissions;
- Demand for energy (and therefore GHG indirectly);
- Embedded GHG emissions (through energy used in materials, manufacturing and processing; transport etc.);
- Loss of habitats that provide carbon sequestration;
- Impacts on landscape and habitats that affect local microclimate (e.g. construction of major water bodies).

Some of the things that may affect the plan or programme are:

- Increased flood risk, sea level rise, storm surges;
- Drought;
- Heat waves;

Figure 11: Examples of interactions between the other SEA topics and climate change



* Including architectural and archaeological

- Strong winds and storms.

Figure 11 illustrates how climate change fits within the overall set of environmental topics to be considered in SEA.

Case study: SEA of the Irish Offshore Energy development plan

This case study considered, amongst other issues, the inter-relationship between climate change and biodiversity.

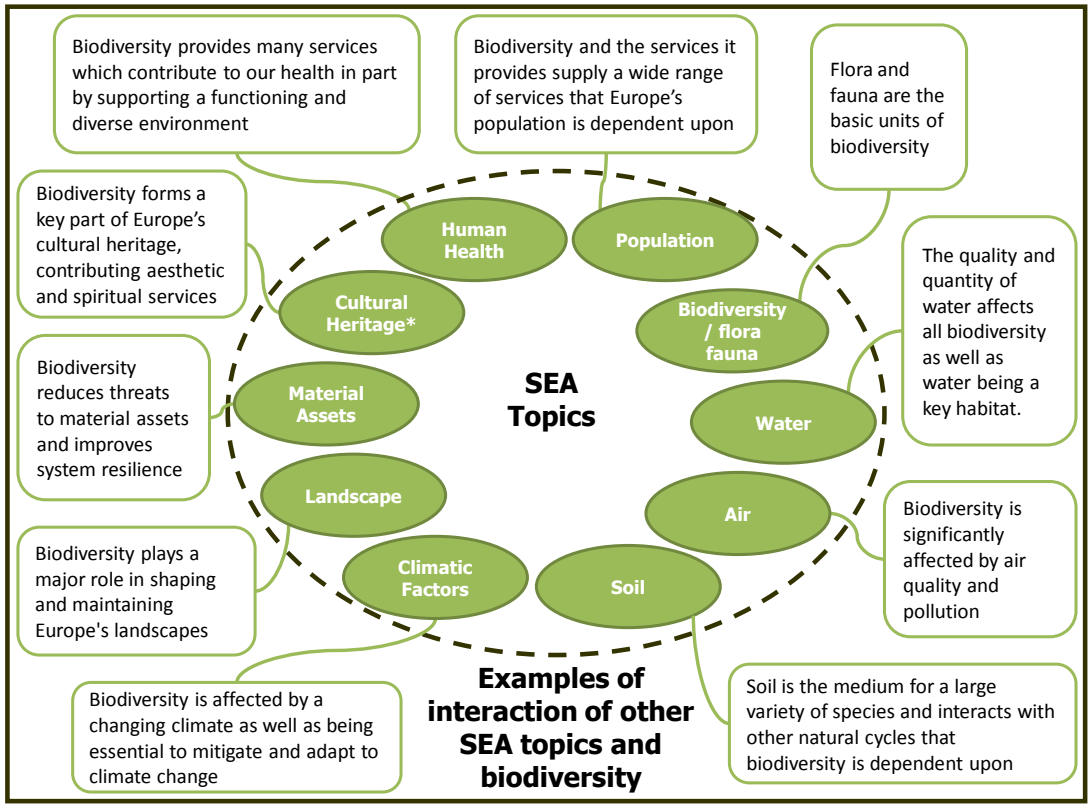
(see Annex 4 for further information)

Understand the key biodiversity issues to be assessed in SEA

How is biodiversity affected by the implementation of the plan or programme? Among other things the implementation of the plan or programme may lead to:

- Habitat loss and degradation, e.g. the destruction of wetlands, grasslands and forests for housing and industrial development;
- Habitat fragmentation - ecosystems and their species need a certain amount of interconnectivity for processes to continue. Breaking a natural area into smaller pieces, means that eventually species disappear and certain functions are lost;
- Loss of species, e.g. the plants and animals endemic to a particular habitat will not be able to survive if that habitat is destroyed or altered by development;
- Natural environmental processes, such as continued river flow, water purification, coastal sediment transport, and erosion control, are altered which can have a long term impact on habitat and species;
- Direct impacts, for example birds colliding with power lines, wind turbines;
- Alien invasive species that can transform natural habitats and disrupt native species;
- Pollution effects on ecosystems and species.

Figure 12: Examples of interactions between the other SEA topics and biodiversity



For biodiversity key concerns should centre on ensuring no net loss of biodiversity and how other SEA topics can support or enhance this aim (see Figure 12).

Impacts on biodiversity are best investigated by a specialist ecologist, botanist, zoologist etc., though at the early stages of SEA, such as scoping, ecologists who can take a broad look across the ecosystem can identify areas where more specific specialists might need to be brought in for any more detailed assessment work.[17]

IAIA's guiding principles[18] refer to the use of biodiversity 'triggers' for screening; using scoping as an opportunity to raise awareness of biodiversity concerns and discuss alternatives to avoid or minimise negative impacts on biodiversity; and the need to address biodiversity at all appropriate levels and allow for enough survey time to take seasonal features into account. (See Annex 2 for further information on tools to help identify and assess effects on biodiversity)

The *CBD Voluntary Guidelines on Biodiversity-inclusive EIA and SEA*[19] recommend the identification and mapping of valued ecosystem services so that these can help influence the type of alternatives and mitigation measures considered. (See Annex 2 for further information on tools and approaches, such as ecosystem services, and how they might be used within SEA)

In scoping out the key issues for SEA, it will be appropriate to consider if any SEAs that have been undertaken at higher decision-levels that might have an influence on the scope of the SEA and on climate change and biodiversity aspects of the evolving baseline. Similarly, where Natura 2000 sites might be affected, an assessment undertaken under Article 6 (3) of the Habitats directive can be used to inform the SEA (see Box).

Relationship between SEA and Habitats Directive Article 6 assessment

Article 6 of the Habitats Directive requires a site-specific conservation assessment when a plan or project is likely to have an adverse effect on the conservation status of a Natura 2000 designated site. There is therefore a clear link to SEA (and EIA), but both SEA and EIA have a wider environmental remit as they should consider all biodiversity, and not just impacts related to Natura 2000 sites. In some cases the assessments are combined, or data and information from the Article 6 assessment for the Natura 2000 site used by the SEA (and EIA).

Key messsages

This section considers the scope of climate change and biodiversity issues in SEA and how to identify which issues are appropriate for consideration according to the context of your plan or programme. In sum, it makes three over-arching recommendations: use stakeholders early to help identify the key issues; understand the key climate change issues; and understand the key biodiversity issues. It also highlights the need to understand how both climate change and biodiversity interact with the other topics to be assessed in SEAs – see the key messages below.

[17] www.ewt.org.za
[18] IAIA (2005), *Biodiversity in impact assessment*, Special Publication Series No. 3, July 2005.
[19] CBD/IAIA (2006), *Biodiversity in EIA and SEA - CBD Voluntary Guidelines on Biodiversity-inclusive EIA and SEA, Background document to CBD Decision VIII/2.*

Key messages for the scope and identification of key climate change and biodiversity issues in SEA:

- ☐ SEAs need to help identify and bring together all the **relevant stakeholders** that need to be part of biodiversity / ecosystems- related and climate change-related decision-making. SEAs should use stakeholders to help identify the key climate change and biodiversity issues early in the process.
- ☐ There are various **tools and approaches to stakeholder engagement** that can be used within SEA depending on the purpose of the engagement and the nature of the stakeholders – design the engagement process and select the tools to use for your particular situation, including the needs climate change and biodiversity and the SEA more generally. See Annex 2 for further information on stakeholder engagement approaches and tools.
- ☐ Understand the **key climate change and biodiversity issues** relevant to your SEA – see Annex 3 which includes a series of key questions you can use to help identify which aspects of climate change and biodiversity might be most relevant.
- ☐ Understand **how both climate change and biodiversity interact with the other topic**s to be assessed in SEA, as well as with each other (remember, for example, that a positive effect on climate change mitigation may lead to negative effects on adaptation and/or biodiversity).

6. How to Assess Effects Related to Climate Change and Biodiversity in SEA?

This section addresses specific tips, tools and methods for assessing effects related to climate change and biodiversity throughout the SEA process. There are a number of key aspects of SEA where climate change and biodiversity are likely to have most resonance and where proper consideration can have most effect:

- Consider climate change scenarios that may influence environmental issues and the implementation of the proposed plan or programme;
- Analyse the evolving environmental baseline trends;
- Assess consistency between the proposed plan or programme and the relevant policy objectives for biodiversity protection and climate change;
- Assess alternatives that make a difference in terms of climate change and biodiversity impacts;
- Assess climate change and biodiversity cumulative effects; and
- Seek to avoid impacts.

The sections below look at the practical elements of SEA where climate change and biodiversity considerations are most relevant and examples of techniques that are most helpful. They draw on the overarching frameworks discussed in Part I – ecosystem services, resilience, and environmental limits. Many of the techniques suggested can be used at various stages of SEA, not only the ones shown here.

Example: Assessment of the London Climate Change Adaptation Strategy – use of scenarios

The Sustainability Assessment of the London Climate Change Adaptation Strategy, which incorporated the requirements of the SEA Directive, considered a range of climate change emission scenarios. A single climate change emission scenario was selected to inform the description of the evolving baseline, the consideration of strategic alternatives and potential enhancement options. This reduced, to some extent, the uncertainty around the potential scale of potential climate change impacts.

Source:
The Strategy and assessment reports: http://www.london.gov.uk/climatechange/strategy (Part B considers the baseline and emission scenario)

Consider climate change scenarios at the outset of the SEA

SEA practitioners should outline extreme climate situations that may either adversely affect implementation of the proposed plan or programme or may worsen its impacts on the biodiversity and other environmental factors. These may include 'big surprises' such as mega droughts, larger fires, species extirpations, loss of resilience and system collapses.

In order to put the climate change factors into the background of the assessment, it useful to outline the future climatic conditions upfront. These may include, at a minimum, the following factors:

- Changing temperatures (general expected changes, extreme conditions such as heat waves and cold spells)
- Extreme rainfall events (heavy rainfall and droughts)
- Windstorms
- Changing sea levels
- Other potential extreme climatic conditions (snowstorms, hails, etc.)

Most of these direct manifestations of the climate change will cause further secondary and indirect effects which can be considered in the analysis of environmental baseline trends (see the section below on analysing the evolving baseline trends.) (See Annex 2 for further information on scenarios and other relevant tools, and also some of the case studies in Annex 4 and the boxes with examples of SEAs that have used scenarios.)

Analyse the evolving baseline trends

The evolution of the baseline in light of the expected changes in the climate and as a result of implementation of other development interventions, besides the proposed plan or programme, is critical to be able to understand how the proposed plan or programme might impact on the future environment and how its implementation might be impacted by the changing environmental context.

The baseline environment will be a moving baseline, in particular for plans and programmes, which may easily take 5-10 years or more to implement. The current state of the environment may significantly change before all proposed interventions in the plan or programme are implemented, and in that time biodiversity as well as other environmental issues related to the plan or programme may have changed. So the plan or programme may need to be designed to operate in different environmental conditions from the current ones.

Essential in looking at the evolving baseline is a consideration of:

- **Trends in key issues over time,** e.g. water quality and availability during droughts, ecosystem deterioration, vulnerability of infrastructure to extreme climatic events, etc. Are these trends continuing, changing, or levelling out? Are there environmental outlooks or scenario studies available that have looked at the likely future direction of these trends? If data are unavailable for certain indicators are proxy indicators available, e.g. if air quality

Illustration: SEA of the Greater Dublin Region Water Project – evolving baseline

The SEA of the Irish Greater Dublin Region Water Project, which aims to abstract water from certain Irish catchments and pump it across the Country to supply Ireland, considered among other aspects the potential impact of climate change on water abstraction and the potential implications of this on *inter alia* biodiversity.

This analysis suggested that although the predicted extraction rates were unlikely to harm biodiversity within historical and current precipitation levels, it was less clear what the impact would be due to climate change. This information was incorporated into the assessment of the alternatives and influenced the decision making process.

Source:
Project Website: http://www.watersupplyproject-dublinregion.ie/. Non Technical Summary of the SEA: http://tinyurl.com/64t66yt

monitoring data is not readily available for an urban area, are there data relating to trends in traffic flow/volumes over time?

- **Drivers of change**, e.g. major drivers such as demographic trends and the economic affluence of the society, legal and policy framework, market forces and economic incentives, major projects that affect the issue, climate change, institutional powers and capacities to regulate and manage the issue, etc. The drivers can be broken down into:
    - **Endogenous drivers** – i.e. the factors and root-causes that can be influenced by the proposed plan or programme. These drivers should be highlighted because their identification may provide useful suggestions for focusing the plan or programme on the root causes of problems, rather than on symptoms. Example include: changes in land use and land cover; fragmentation and isolation; extraction, harvest or removal of species; external inputs such as emissions, effluents, chemicals; disturbance; introduction of invasive, alien or genetically modified species; restoration.
    - **Exogenous drivers** – factors that are beyond the sphere of influence of the plan or programme which is being assessed. The SEA can either acknowledge and treat these factors as 'given' or it can proactively highlight them for consideration in other decision-making processes.
- **Thresholds/limits**, e.g. have thresholds already been breached (such as air quality thresholds in urban areas), or are limits expected to be reached? Are there tipping points to be avoided in order to prevent serious deterioration or breakdown of relevant ecological and social systems?[20]
- **Key areas that may be particularly adversely affected by the worsening environmental trends.** Attention should be given especially to areas of particular environmental importance, such as areas designated pursuant to Birds Directive (79/409/EEC) and Habitats Directive (92/43/EEC).
- **Who benefits and who loses as a result of these trends.** Adverse impacts are not generally proportionally distributed within society – some population groups and economic sectors are more seriously affected than others by these changes in the ecosystems.

When developing the baseline against which the proposed plan or programme is to be assessed it is also important to acknowledge uncertainty (see Section 4 above) – depending on the timescale and spatial scale being considered some

Case study: SEA of the Irish Offshore Energy Development Plan - evolving baseline

This is an interesting example of a case where projected climate change effects are factored into the assessment of the environmental baseline, particularly with regard to the impacts on biodiversity.

(see Annex 4 for further information)

Illustration - adaptation

Possible climate impacts include hotter summers leading to melting of tarmac, or on railways – buckling of rails under heat. Cold winters lead to cracking and maintenance demands on roads, freezing of points, snow intake into train engines etc…. For possible information sources as to climate change impacts see Annex 1.

[20] Note: you can find examples of environmental limits relevant to climate change and biodiversity at http://www.resalliance.org/index.php/thresholds_database

uncertainty is inevitable and this will increase over larger scales. A qualitative description of trends is perfectly valid in such situations. This can be done using terms such as 'strongly suspected' or 'suspected' – terms used by IPCC in their Fourth Assessment report (2007).

Vulnerability assessment is helpful when taking a resilience approach to climate change and needs to be built into any effective assessment of the evolution of the baseline environment, and of alternatives – how will the environment change without implementation of the plan or programme, and in relation to different alternatives?

Major infrastructure will in particular be vulnerable[21], and therefore relevant plans and programmes should reflect this, for example:

- Increased flood risk to fossil fuel and nuclear power sites and electricity substations;
- Reduced availability of cooling water for inland power stations;
- Reduced quality of wireless service from increased temperatures and intense rainfall;
- Increased flood risk to all transport sectors;
- Increased scour of bridges from intense rainfall/flooding;
- Reduced security of water supply from changing rainfall patterns;
- Increased flood risk to wastewater infrastructure.

During flash floods, for example, poorly designed sewage networks can overflow and release contaminated flood waters into other neighbourhoods of the urban areas. Plans and programmes that will place future demands on the sewerage system will need to take account of the capacity of the system to cope not just with the expected sewage effluent/disposal requirements of the development resulting from the implementation of a plan or programme, but also its capacity in the long-term and in the face of climate change. Biodiversity considerations may also be particularly relevant if, for example, river courses carrying sewage effluent discharge into estuaries designated as being of importance for biodiversity.

For biodiversity, the Institute of Ecology and Environment Management (IEEM)[22] in the UK recommend the following considerations when establishing the baseline from the point of view of biodiversity:-

Case study: SEA of the Spanish Transport Infrastructure Development Plan – assessment of biodiversity and an ecosystems approach

This SEA developed a methodology to determine the relevance of territories for biodiversity conservation. And emphasised the importance of SEAs not limit themselves to consideration of the effects of plans and programmes on protected areas or even networks of protected areas, as the preservation of these depends upon the quality of their surroundings.

(see Annex 4 for further information)

[21] HM Government (UK) (2011), *Climate Resilient Infrastructure: Preparing for a Changing Climate* - Summary Document, at http://www.official-documents.gov.uk/document/cm80/8065/8065.pdf

Designated sites

- Are there any sites designated for nature conservation that fall within the zone of influence?
- Does the project affect any sites likely to be designated in the foreseeable future?
- Is there any policy presumption in favour of habitat protection/creation/restoration in the area?

General ecological considerations

- What ecological features at or above the defined threshold level of value may occur within the zone of influence?
- What are their distribution and status elsewhere for comparison?
- What were their historical distributions, status and management compared with the present?
- What are their scales of variation, vulnerability and likely exposure to the project?
- What are the key ecological processes or species activity periods; are there seasonal variations in distribution, abundance and activity?
- Are there any species, the disappearance of which would have significant consequences for others?
- Are there any other projects planned within the same area or time-frame that may contribute to cumulative effects?

Annex 2 suggests relevant tools and methodologies that can assist in consideration of the evolving baseline in SEAs.

Assess consistency between the proposed plan or programme and the relevant policy objectives for biodiversity protection and climate change

The SEA Directive requires determination of environmental protection objectives, established at international, Community or Member State level, which are relevant to the plan or programme and to analyse the way those objectives (and any environmental considerations) have been taken into account during its preparation.

[22] IEEM (2006), *Guidelines for Ecological Impact Assessment in the UK,* at http://www.ieem.net/ecia/.

Section 1 in Part I of this guidance outlines the main legislative and policy documents that were established at the international and European levels for biodiversity protection and climate change at the time of writing this guidance. Additional policy objectives were (or are being) established at national and sub-national levels in different member states.

The SEA process should identify the relevant policy objectives for biodiversity protection and climate change which may be relevant for the proposed plan or programme and clearly describe whether the proposed plan or programme facilitates or contradicts their achievement.

Assess alternatives that make a difference in terms of climate change and biodiversity impacts

Alternatives in SEA are often considered to be at the heart of the SEA process, as they provide confidence that the proposed course of action is the best one available. While higher level decisions and/or processes may impose constraints on the types of alternatives that can be considered (e.g. a national or regional transport strategy may pre-determined the broad approach that can be adopted in a local transport plan), it is nevertheless useful to consider alternatives from project conception stage. In this sense, a hierarchical approach to assessing alternatives is helpful:

1. Is the plan or programme needed (could the objectives be achieved by some other means)?
2. If so, what mode or process (alternative approaches and methods)?
3. Where should it go (alternative locations)?
4. How should it be implemented (alternative timings, procedures etc)?

Climate change and biodiversity require a number of additional considerations if they are to be addressed effectively within SEA, particularly if consideration of long-term resilience – of the environment and of the plan or programme – is to be built into the SEA process.

The consideration of appropriate alternatives should be built into each step of the hierarchical approach above, so that for each question above (1-4) you should consider alternative approaches that:

- Result in no net loss to biodiversity and/or seek to restore biodiversity; and
- Consider the context of different climate change scenarios and climate impacts, and possible alternative futures (see Annex 2, Scenarios).

Case studies: Via Baltica Express Road, SEA of the Strategy for Wild Deer in Scotland – assessment of alternatives

These case studies illustrate the assessment of alternatives. In the case of the Via Baltica, whilst alternative routes were assessed and agreed upon later, the process resulted in several years of delay and considerable added cost.
In the Strategy for Wild Deer case it shows that it useful for bringing together stakeholders and the identification of various alternative management options.

(see Annex 4 for further information)

Vulnerability assessment, as outlined under evolution of the baseline above, should also be used in evaluating alternatives in order to help identify and select the most resilient alternative(s). With respect to climate change mitigation this is likely to include considerations of energy demand and flow, energy efficiency, GHG emissions and perhaps the use of carbon calculators as one basis for comparing alternative options. Apply the precautionary principle when considering risks and adjust your plan or programme rather than seek to defend against all future climate change impacts. This is fully consistent with the requirements of the Directive to *prevent, reduce or offset* environmental effects [Annex I (g)].

Some examples of what to consider when assessing alternatives are provided in Annex 3.

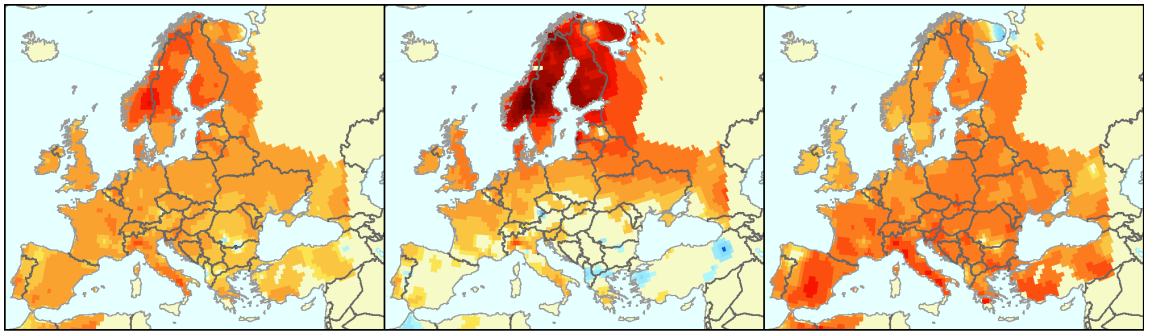
Case study: xxx

Example of SEAs that have assessed cumulative effects to be added

(See Annex 4 for further information)

Assessing climate change and biodiversity cumulative effects

Assessing cumulative effects is often seen as difficult enough already without having to factor in changes due to climate change over a long time scale. However, the key to the consideration of cumulative effects is to recognise their importance as early as possible in the SEA process. You should, for example, be considering potential cumulative effects with respect to biodiversity at the scoping stage of the SEA. Given the extent of ecological interconnectivity, biodiversity effects will inevitably involve cumulative effects. Different plan or programme components may contribute to negative impacts on biodiversity, e.g. by breaching certain thresholds or environmental limits. Individual impacts may not be significant to tip populations/communities over the edge, but cumulative impacts may be. So the key here is to understand how individual seemingly insignificant effects may combine to result in a significant effect and that may best be achieved by talking to the right stakeholders as early as possible (see below).



Observed temperature change over Europe during the period 1976–2006
Left: annual mean; middle: winter (DJF); right: summer (JJA)

°C per decade

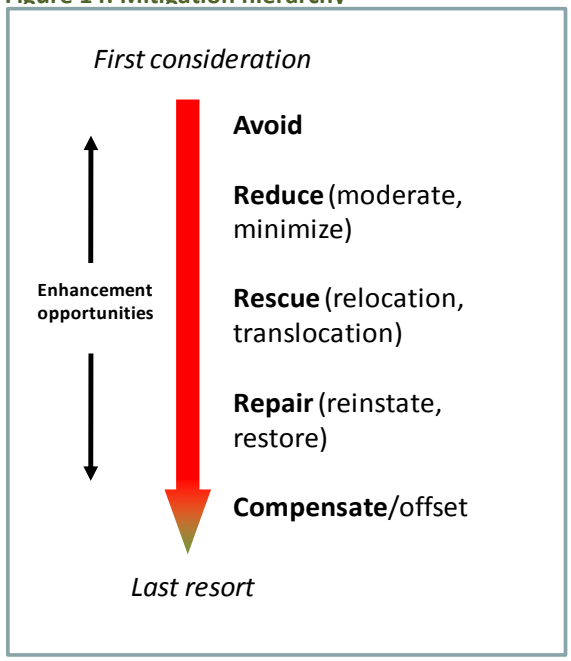
−2 −1.8 −1.6 −1.4 −1.2 −1 −0.8 −0.6 −0.4 −0.2 0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2

The cumulative aspects of climate change and biodiversity impacts are particularly important with regard to the evolving baseline. The current state of the environment will not necessarily be the future state of the environment, even if the proposed project does not go ahead. The climate and the species that make up the natural world are both in a constant state of flux driven by different mechanisms, but sharing a dynamic nature. Biodiversity and the organisms it constitutes are considered to be in a state of succession, i.e. a change in species composition in response to different environmental

contexts. In part species alter the environmental conditions and in doing so change which species are favoured. For example, if grass species colonise an area of poor soil they serve to stabilise the soil, add organic matter through their death and over time improve the suitability of the soil for other species such as shrubs and ultimately trees. This is also partly a passive response to physical changes such as sea level rise or changing climate space (the space in which the climate is suitable for a particular species).

This is critical for SEA as over a longer time span the nature and type of the habitats will alter, meaning that what was for instance initially a poor quality brownfield site may become a wooded area or what was once high value grassland, because of changing management practices, becomes a degraded shrub area. In particular this needs to be considered within mitigation and monitoring measures to ensure appropriate management of high value habitats. This issue is exacerbated by climate change – which increases the rate of change in the environment. An adaptive management response to this may be to provide buffers in certain areas potentially threatened by sea level rise, or facilitating migration through corridors and ecological networks.

Figure 14: Mitigation hierarchy



This evolving baseline has implications for plans and programmes as well; a changing climate may mean that the interventions within a plan or programme are intended for a certain climate scenario which will no longer be relevant in 20 years' time. For instance, warmer summers may increase the susceptibility of materials to heat deformation or increase the risk of wildfires within an area. Considering potential impacts such as these are a unique challenge of climate change within SEA.

Causal chains/network analysis can be particularly helpful in trying to understand the interactions and associated cumulative effects between specific elements of the plan or programme and aspects of the environment. The point is not to be comprehensive, but to understand what might be the most significant cumulative effects. These may often be best identified through discussions with stakeholders who can help work through potential pathways in causal chains. (See Annex 2 for further information on tools such as network analysis and also the Wales Rural Development Plan and Strategy for Wild Deer in Scotland

case studies in Annex 4)

As in SEA generally it is important to distinguish between magnitude and significance – a large magnitude impact may not be significant if the species affected is common, widely distributed and readily able to recover, but a small magnitude impact may be very significant to a highly sensitive or rare species or habitat. The scale and nature of the impact and the sensitivity, abundance and distribution of the receptor all need to be considered in evaluating significance. Significance criteria should be developed from existing policy and guidance documents, such as biodiversity strategies; biodiversity action plans for habitats and species; international, national and local designations, legislation and/or using an ecosystems approach by identifying the valued ecosystem services and how those will be affected by drivers of change over time. (See Annex 2 for further information on tools and approaches such as ecosystem services, and Figure 13 above)

Seek to avoid impacts wherever possible

The SEA Directive requires a description of measures envisaged to avoid, reduce or offset significant effects on the environment. This establishes a clear hierarchy in the way in which impacts should be first avoided and then mitigated (reduced or remedied). In assessing biodiversity impacts there is a recognised hierarchy of mitigation (see Figure 14) which seeks to ensure residual impacts are reduced to zero while maximising opportunities for positive enhancement:-

For climate change it is therefore preferable and consistent with a precautionary approach to avoid GHG emissions in the first place, rather than to have to deal with mitigating their effects after they have been released. Mitigation measures such as requiring energy efficiency measures in buildings may contribute to climate change mitigation, but do not always mean that the implementation of a plan or programme will have overall positive impacts in this regard. It may be less negative in terms of quantity of emissions, but still have negative impacts unless there is unequivocal zero carbon in terms of embedded carbon in developments, transport and use. Zero carbon is unlikely except in the highest performance buildings with renewable energy generation incorporated on site.

For climate change adaptation, the key is to treat the climate change events (flooding, droughts, fire) as natural ecological disturbances that test resilience of ecological and social systems. Do not excessively protect ecological and social systems from these phenomena – rather use SEA to facilitate adjustments of human activities and the proposed plan or programme to cope with extreme climate events.

For biodiversity key concerns should centre on ensuring no net loss of biodiversity. Mitigation measures for biodiversity can help mitigate and adapt to climate change. For example, the creation of new habitat, green space, green corridors, green

Biodiversity offsetting (banking)

Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from development plans or projects after appropriate prevention and mitigation measures have been taken. They should:

1. Aim for no net loss;
2. Seek additional conservation outcomes;
3. Adhere to the mitigation hierarchy;
4. Recognise there are limits to what can be offset;
5. Be used in a landscape context;
6. Achieved through stakeholder participation;
7. Seek equity among stakeholders;
8. Be based on adaptive management and long-term outcomes;
9. Be transparent;
10. Informed by sound science.

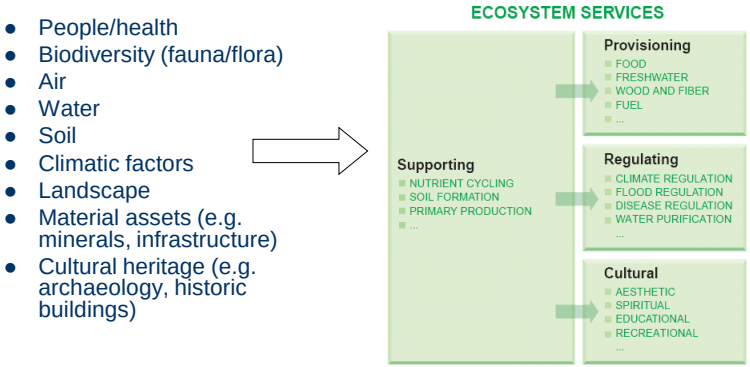
Business and Biodiversity Offsets Program
http://bbop.forest-trends.org/index.php

and brown roofs (enhancement) can provide biodiversity benefits to maintain and enhance biodiversity, aid species in adapting to long-term climate change, and help provide essential ecosystem services such as flood storage capacity, rainfall interception, shade and heat regulation, and air quality regulation as part of adaptation to climate change. Bear in mind that your mitigation measures may themselves have significant environmental impacts that need so to be take into account (e.g. renewable energy generation or tree planting may have adverse impacts on biodiversity).

Key messsages

This section addresses specific tips, tools and methods for assessing effects related to climate change and biodiversity throughout the SEA process, focussing on aspects of SEA where assessing climate change and biodiversity can be most effective – e.g. climate change scenarios, evolving environmental baseline trends, consistency between objectives, assess alternatives, assessing cumulative effects and avoiding impacts. See the key messages below.

Figure 13: Mapping SEA topics to ecosystem services



(Source: MEA, 2005)

Ecosystem services offer potentially a new tool to use in SEA, using the concepts developed by the Millennium Ecosystem Assessment (MEA, 2005). But this approach is in its infancy and will take some time to become established. It could be used in a number of ways in SEA including: scoping and engagement with stakeholders; baseline data; and assessment and the consideration of alternatives. See Annex 2.

Key messages on how to assess effects related to climate change and biodiversity in SEA:

- Consider **climate change scenarios** at the outset of the SEA, including the extreme climate situations and 'big surprises', that may either adversely affect implementation of the proposed plan or programme or may also worsen its impacts on the biodiversity and other environmental factors.
- Analyse the **evolving environmental baseline trends**, including trends in key issues over time, drivers for change, thresholds and limits, areas that may be particularly adversely affected and the key distributional effects.
- SEAs should encourage an integrated and **"ecosystems" approach** to planning and investigate relevant thresholds and limits. See Annex 2 for tools to help with this.
- SEAs should help bring to light opportunities for enhancement and ensure proposed plans and programmes are **consistent with other relevant policy objectives, policies and priority actions** for climate change mitigation and adaptation and biodiversity conservation, protection and sustainable use.
- Assess **alternatives that make a difference** in terms of climate change and biodiversity impacts using a hierarchical approach (i.e. that review the need for the programme, the process for its implementation, locations, timings, procedures, etc.)
- Consider alternative approaches that result in **no net loss to biodiversity and/or seek to restore biodiversity**; and consider the context of different climate change scenarios and climate impacts, and possible alternative futures.
- Use **vulnerability assessment** to help assess the evolution of the baseline environment and indentify the most resilient alternative(s). See Annex 2.
- SEAs should assess climate change and biodiversity **cumulative effects**, as these effects can be particularly significant for these topics. Causal chains/network analysis can be particularly helpful in trying to understand the interactions and associated cumulative effects between specific elements of the plan or programme and aspects of the environment (see Annex 2 and relevant case studies in Annex 4).
- SEAs should seek to **avoid impacts** – the Directive establishes a clear hierarchy in the way in which impacts should be first avoided and then mitigated (reduced or remedied).

Further Reading

The documents, reports and datasets described below are presented as both documents referred to within this guidance but also as potentially useful sources of information within SEA practice. The table presented below provides a short title, hyperlink and short description as to the potential relevance of each of the documents.

Hyperlinks to be added for all sources/sites available!

Reference / further reading	Comments on relevance
Climate change	
UN Framework Convention on Climate Change (UNFCCC)	• Provides information regarding the last developments through the United Nations Conference of Parties (COP) process • Links detailing international requirements (such as Kyoto, Bali Action Plan, Copenhagen Accord and Cancun Agreement) including likely developments • Good source of supra-national GHG data
Understanding Climate Change, SOER thematic assessment. (European Environment Agency, 2010)	• Introduction to climate change, including scientific background, policy context, possible risks and impacts, policy actions and current targets and goals
Climate change - mitigation	
Mitigating climate change, SOER thematic assessment. (European Environment Agency, 2010)	• Considers global and European trends in GHG and associated challenges
EEA (2010) Climate change mitigation - SOER Thematic Assessment	• Summary of the European union's progress towards green house gas reduction targets
Wightman, J. (undated): Production and Mitigation of Greenhouse Gases in Agriculture	• Case study on the GHG emissions from agriculture, with a focus on dairy farming (NY, US)
Climate change - adaptation	
White paper - Adapting to climate change: towards a European framework for action. (European Commission, 2009)	• White paper setting out the EU's approach to adapting to climate change, based on the concept of mainstreaming • Refers to resilience of biodiversity and natural systems
Guiding principles for adaptation to climate change in Europe ETC/ACC Technical Paper 2010/6 (ETC, 2010)	• Technical consideration of the higher level principles for adapting to climate change, effect introduction to the concept and supporting principles.
Adapting to Climate Change, SOER thematic assessment. (European Environment Agency, 2010)	• Good source of European climate change impact analysis; description and analysis of current and possible future policy actions
Fabrizi, Lara (undated): Droughts and water shortage - The English case.	• Illustrates the disruptive effects of climate change on weather patterns, with a particular focus on droughts in South-East England

Biodiversity	
Biodiversity — SOER 2010 thematic assessment. (European Environment Agency, 2010)	• Provides comprehensive assessment of the state and trends of Europe's biodiversity
The Use of Environmental Limits in Regulating Environmental Systems - How Could the Concept Be Applied in Environmental Agencies? (SNIFFER 2010)	• Description of the concept of environmental limits and how it may usefully applied within environmental agencies
Assessing biodiversity in Europe — the 2010 report. (European Environment Agency, 2010)	• Provides good understanding of European biodiversity with a focus on designated areas and progress towards the EU's biodiversity loss targets
Biodiversity. 10 messages for 2010. (European Environment Agency, 2010)	• Provides a range of specific assessments based on Europe's bio-geographic regions and the interrelationship between climate change and biodiversity
Biodiversity Baseline Flyer (European Environment Agency 2010)	• Focussed summary of EEA's biodiversity assessments as part of the SOER 2010 reports.
The Economics of Ecosystems and Biodiversity (TEEB) (2010)	• Global assessment of the current provision of ecosystem services and the economic and decision support tools that can support its integration into policy and decision making.
Millennium Ecosystem Assessment (2005)	• Seminal report considering the status and trends of global biodiversity and the services it provides
Biodiversity Baseline (European Environment Agency, 2010)	• Detailed assessment of the status and trends of Europe's biodiversity
Biodiversity and climate change	
Climate change and biodiversity. 10 messages for 2010. (European Environment Agency, 2010)	• Exploration and description of the main issues surrounding climate change and biodiversity in Europe
Nature's Role in Climate Change(European Commission, 2009)	• Analysis of the potential role of nature and ecosystem services in mitigating and responding to climate change
Resilience Alliance (2010) examples of environmental limits relevant climate change and biodiversity	• Database of a wide range of examples and case studies of environmental limits research, experience and analysis
Adapting through natural interventions (Climate North West, 2011)	• Detailed description and analysis of environment based interventions that increase adaptive capacity with regard to climate change.
DG Climate Action Synergies for Biodiversity and Climate Presentation.	• Presentation given on behalf of DG Climate Action which considers the relationship between biodiversity and climate and how these can be combined to result in win – wins.
Jones Walters, L. and Nieto, A. (Eds.) (2007). *Climate change and biodiversity. The role of the European regions*. European Centre for Nature Conservation (ECNC).	• Discusses the role of the European regions in responding to climate change-related issues, from both an adaptation and a mitigation perspective
SEA	
Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment	• The SEA Directive applies to a public plans and programmes. The Directive aims to provide a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation of plans and programmes

Reference / further reading	Comments on relevance
Report on the application and effectiveness of the Directive on Strategic Environmental Assessment (COM (2009) 469 final)	• Assesses the application and the effectiveness of the SEA Directive and includes proposals for its amendment (in particular the amendment of its scope)
Implementation of the SEA Directive (2001/42/EC)- Ireland	• Report describing the implementation requirements of the SEA Directive in Ireland The report refers to climatic factors and biodiversity at certain stages of the SEA procedure
Handbook on SEA for Cohesion Policy 2007-2013 (GRDP Project, 2006)	• Step-by-step guidance specifically tailored for SEAs of Cohesion Policy Operational Programmes for the current programming period • Useful as a reference for division of SEA into clear steps • Guidance format (practical tips, example illustrations, etc.) are a useful model for the assessment stages approach
Strategic Environmental Assessment good practice guide. (Portuguese Environment Agency, 2007)	• Promotes integrated approach to assessments
SEA effectiveness criteria - equally valid in all countries? The case of Italy. (Thomas B. Fischer, Paola Gazzola - Environmental Impact Assessment Review 26 2006, p. 396–409).	• Discusses the universal applicability of effectiveness criteria presented in international SEA literature • Contends that SEA effectiveness criteria need to be tailored to national context and gives some information about the differing approaches to SEA across the EU based on political culture, administrative and institutional concerns
EIA and SEA	
Opinion of the Committee of the Regions on improving the EIA and SEA Directives. (Committee of the Regions, 2010)	• Assessment of the EIA and SEA Directives and the potential for improvement • Recommends *inter alia* greater consideration of the Habitats Directive and Biodiversity Action Plan
The relationship between the EIA and SEA Directive. (ICON Consultants, 2005)	• Identifies areas of potential overlap between the Directives as well as potential loop holes.
SEA and biodiversity	
Biodiversity in Strategic Environmental Assessment. Quality of national transposition and application of the SEA Directive (European Environmental Bureau, 2005)	• Provides snapshot of the quality of transposition and implementation of the SEA Directive across Member States as of end-2005 as well as relevant country-based examples (may need updating NB: summarises the results of an NGO survey
Treweek, J., Therivel, R., Thompson, S. and Slater, M. (2005). Principles for the use of Strategic Environmental Assessment as a tool for promoting the conservation and sustainable use of biodiversity. Journal of Environmental Assessment, Policy & Management, 7, 173 - 199	• Paper contextualising the potential of SEA to promote biological conservation, including the overarching principles • Identifies ‘‘insertion points’’ for biodiversity along the SEA process
SEA Topic guidance for Practitioners. SEA topic: biodiversity. (Countryside Council for Wales, 2007)	• Introduction to biodiversity and SEA for responsible authorities; provides source information and examples for the various stages of SEA

Reference / further reading	Comments on relevance
Guidelines for ecological impact assessment in the united Kingdom. (Institute of Ecology and Environmental Management, 2006)	• Good example of how biodiversity could be included into assessment methodologies (although not directly applicable to EIA)
Impact assessment: Voluntary guidelines on biodiversity-inclusive impact assessment. (Convention on Biological Diversity)	• Assessment guidelines that seek to incorporate the requirements of the CBD into plans and programmes (via SEA) and projects (via EIA) • Considers higher level principles and provides relevant case studies
The Integration of Biodiversity into National Environmental Assessment Procedures, National Case Studies, United Kingdom. (UNEP 2001)	• Good number of possible data sources and a good example of possible approaches to including biodiversity into environmental assessment
Position paper on environmental assessment in the European Union. (Birdlife 2010)	• Incorporation of advocacy into guidance. Includes higher level principles supported by a process based approach that highlights common problems with each stage of assessment. • Sets out "dos and don'ts" for practitioners and reviewers. Also of use to support the rationale for inclusion of biodiversity into assessment as the document specifically addresses the role of impact assessment in achieving biodiversity policy objectives
Resolution X.17 - Environmental Impact Assessment and Strategic Environmental Assessment: updated scientific and technical guidance. (RAMSAR Convention 2010)	• Based on the CBD guidelines described above. Includes RAMSAR-specific additions that seek to include consideration of wetlands
TEEB for local and regional policy makers. (TEEB 2010)	• Considers how SEA (and EIA) could seek to include ecosystem services
Bagri, A. and Vorhies, F. (1997) Biodiversity Impact Assessment - Convention on Biological Diversity, Discussion Paper.	• Proposes biodiversity impact assessment, includes consideration of the principles and processes this would require.
Brooke, C. (1998) Biodiversity in impact assessment - Convention on Biological Diversity Discussion Paper.	• Specific consideration of biodiversity, good approach to principles and structures that could incorporate biodiversity into impact assessment
Biodiversity, Ecology, and Ecosystem Services - Impact Assessment Considerations/Approaches. (International Association of Impact Assessment, 2006)	• Useful meta-study pulling together work and synthesising. Good range of overarching principles, supported by case studies and possible tools
Biodiversity in Impact Assessment (International Association on Impact Assessment, IAIA, 2005).	• Short special publication, user-friendly structure reviewing key strategic and operational issues concerning the integration of biodiversity-related considerations into impact assessment practices
SEA and climate change	
The Consideration of Climactic Factors within Strategic Environmental Assessment (Scottish Government Environmental Assessment Team, 2010)	• Key screening questions for mitigation/adaptation • Baseline information sources (Scottish) for scoping • Tables showing typical influences on climactic factors from different types of plans, which could be referred to in the guidance sections on alternatives assessment and impacts • Useful examples of SEA objectives, cumulative effects, indicators, data sources, etc.
Strategic Environmental Assessment and climate change: Guidance for practitioners (UK Environment Agency, revised 2007)	• Useful, concise information on how climate change should be considered in each stage of

Reference / further reading	Comments on relevance
	the SEA process • Possible climate change indicators and information sources
Draft guidance on strategic assessments and climate change (final title TBD) (Regions for Sustainable Change project, due 2011 – draft version reviewed)	• Particularly relevant as it focuses on regional-level planning • Discussion of key challenges for integrating climate change to SEA • Contains case studies from across Europe
SEA Topic Guidance for Practitioners (Climate Change Countryside Council for Wales, revised 2007)	• Potential plans, programmes, objectives, policies and legislation to be taken into consideration for the Climate Change Topic (international, national and regional) • Potential climate change-related environmental issues and opportunities • Examples of SEA Objectives/Sub-Objectives and Indicators for Climate Change • Interrelationships with other SEA topics (including biodiversity)
OECD/DAC Advisory note: Strategic Environmental Assessment and Adaptation to Climate Change. (OECD, 2008)	• No in-depth guidance but advice and links to additional resources (an OECD/DAC document ''Good Practice Guidance on SEA'' exists since 2006). Uses a question-based approach to consider climate change adaptation in SEA, supported by information and case studies. • Illustrates how SEA can provide a framework for integrating climate change, adaptation-related considerations (risks and opportunities) into strategic planning • Key questions to ask during each step of SEA (Setting context, Implementation, Informing/Influencing Decision Makers, Monitoring/Evaluation)
ENEA Working Group on Climate Change and Cohesion Policy (2009). Improving the Climate Resilience of Cohesion Policy Funding Programmes. An overview of member states' measures and tools for climate proofing Cohesion Policy funds.	• Presents MS' strategies for integrating climate change to Cohesion Policy programmes
Slootweg, R. and Jones, M.: Resilience thinking improves SEA: a discussion paper. Forthcoming, December 2011. DOI: 10.3152/146155111X12959673795886	• Draws from a workshop on resilience thinking and SEA at the 2010 IAIA conference in Geneva. It introduces the basic concepts of resilience thinking, and develops ideas for its integration within SEA practice
Incorporating climate change impact and adaptation in environmental impact assessments opportunities and challenges. (OECD 2010)	• Multi-purpose document that assesses the current state of the inclusion of adaptation into EIA with examples of current approaches – Canada and CARICOM
Climate change and impact assessment symposium. (International Association of Impact Assessment, 2010)	• Provides links to a range of presentations on various aspects of climate change

PART III: RECOMMENDATIONS

7. Recommendations for Further Work or Action

The recommendations are aimed mainly at the European Commission and Member States. They have been placed in a separate Part of the guidance so that they could be removed before the Guidance is issued and disseminated widely for practical use by experts, practitioners and stakeholders.

As there is a considerable overlap between recommendations for EIA and for SEA, the two have been combined here into a single set of recommendations stemming from the overall work. The recommendations are in first draft form and will be further reviewed throughout the remaining course of the project.

Preparation of this *Practical guidance and recommendations for integration of climate change and biodiversity into EIA and SEA procedures* has been carried out based on targeted research and consultation activities. A comprehensive literature review of European and international studies, reports, articles and other guidance documents covering climate change, biodiversity, EIA and SEA has been carried out. A list of the most relevant documents consulted is included in the Further Reading section of this guidance document and the one for EIA. The guidance team also carried out interviews with European Commission officials responsible for environmental assessment, climate change mitigation and adaptation, biodiversity and Natura 2000. In addition, ten expert stakeholders from within the Member States, including government officials, consultants, academics and NGOs have been consulted by email and telephone interview for their impressions on the state of integration of these issues into both EIA and SEA. Two senior expert advisors also contributed to the work as part of the project team. This guidance is based to a great extent on the key messages that were distilled from these preparation activities.

This work, along with the process of drafting the guidance, has led to a number of recommendations for further work or action that would support effective integration of climate change and biodiversity into EIA and SEA. These recommendations are summarised below.

Proposals for modifications to the EIA and SEA Directives

There are a number of ways in which the EIA and SEA Directives could be modified to render it more responsive to some of the specific challenges that climate change and biodiversity pose to the assessment process. Most of these issues apply equally to the EIA and SEA Directives, unless otherwise indicated.

The definition of "project". Cumulative impacts and effects from other developments are very important for climate change and biodiversity, as these are such complex issues and are related to so many different factors. The definition of a "project" in the EIA Directive could therefore be broadened to include associated projects or works. A principal project/accessory project test could put in place to test the relationship between projects and associated activities.[23]

The problem is particularly acute in the case of linear infrastructure projects, which are long-term in nature and for which climate change and biodiversity considerations are likely to be significant. Many linear schemes, e.g. road schemes, overhead power lines, railways may be promoted as single large projects, but in practice are consented as separate sections and/or through separate consent procedures e.g. railway stations and railway tracks, or power stations and power transmission lines. These separate consents result in separate EIAs being undertaken for individual sections, for example, often without an overall assessment being undertaken of the project as a whole and its associated works or sub-projects. An amendment along the lines could help to ensure climate change and biodiversity impacts are properly considered for the overall project. Unfortunately SEA does not solve this problem because often the schemes are for separate consent processes for which no strategic planning process (with SEA) exists. However, where associated activities, as well as plans and programmes are identified, the relevant SEAs and/or EIAs should be consulted. This is a case that could be referred to by both the EIA and SEA Directive(s).

Monitoring requirements. The guidance preparation process has indicated that there is a clear need for improved monitoring in EIA and SEA, particularly if projects are to become more resilient to climate change impacts. There is currently no monitoring requirement for EIAs in the Directive, and while Article 10 of the SEA Directive does require monitoring the environmental effects of plans and programmes, the requirements are not extensive or explicit.

As a result, EIA and SEA follow-up and monitoring requirements are currently dependent upon the national requirements in the Member States – e.g. under spatial planning or licensing regulations, or specific provision of a programme or other existing arrangements – rather than consistently as part of EIA and SEA. One way to do this would be to include a requirement for an environmental management plan for certain high-impact project types, to facilitate implementation of mitigation measures and to provide a means of delivering responsiveness (adaptive management) to changing circumstances during construction and operation.

[23] As recommended in research conducted for the DG ENV in 2005 on the Relationship between the EIA and SEA Directives (Sheate et al, 2005).

While it is likely that Member States would consider such a requirement as an additional burden on project developers and authorities, without such a legal provision, there is little likelihood that the monitoring necessary for climate change and biodiversity impacts will be put in place and carried out effectively.

Make scoping mandatory. Scoping in EIA is a critical step for the consideration of climate change and biodiversity. As these are complex issues with wide-ranging and many cumulative effects, establishing the relevance of impacts early on is important, and a clear scoping stage in the assessment process will help ensure that this is carried out. Scoping is also an opportunity to ensure that key issues are consulted with stakeholders and the public at an early stage, which is important given the expanded range of stakeholder to be included on these issues, as well as the potential for stakeholders to provide information. This approach is also more consistent with the requirements of the Aarhus Convention. The Directive should require that authorities in charge of biodiversity protection, climate change and disaster/risk management are formally consulted during the scoping and the outcomes of these consultations are taken into due account during determination of the scope of the EIA.

Within the SEA Directive, where scooping criteria are set forth in Annex II, the Directive should require that authorities in charge of biodiversity protection, climate change and disaster/risk management are formally consulted during the scoping and the outcomes of these consultations are taken into due account during determination of the scope of the SEA.

Consideration of evolving baseline trends. The Directive should require EIAs to describe the evolving baseline trends and the impacts of the EIA on these trends – not only on only baseline situation at the time when EIA is undertaken. This is particularly important for incorporation of assessment related to climate change adaptation, but also for biodiversity considerations.

Factors to be assessed. There is currently some ambiguity about the scope of the legal requirement to assess climate change and biodiversity. While this guidance maintains in Section 2 that there is no contradiction between the EIA Directive and the need to consider climate change and biodiversity as integral factors in the assessment of significant effects, experience has shown that this is not always the interpretation taken in practice across the Member States. In fact, a more “literal” interpretation of the Directive is often taken. One result of this is that impacts on biodiversity are considered only with regard to species on designated protection lists, rather than in the wider sense of no net loss to biodiversity and the functioning of ecosystem services. An update of factors to be assessed should also include not impacts of the project on the environment, but also impacts of a changing environment on the project, with reference to climate change.

Explicit acknowledgement of uncertainties and the probability of various impacts and risks in EIA and SEA: It is recognised that currently many EIAs and SEAs do not address uncertain impacts (particularly those related to climate change) due to the desire to provide an impression of accuracy within the assessment. This is problematic because effective management of potential climate change impacts requires working with the probability of different situations and impact combinations. This issue can to some extent be handled through proper monitoring, but this has also been recognised as problematic. It could therefore be useful to consider a more direct acknowledgement of the need to incorporate uncertainty and the probability of impacts into the assessments, to prevent them being left out entirely.

Promotion and awareness raising work

Targeted and detailed research on good practice case studies. Preparation of this guidance found that there are not many readily available, well-written and detailed case studies of good practice on integrating climate change and biodiversity into EIAs and SEAs. Part of the reason for this is that there is limited experience, as these issues (particularly climate change) have only recently gained political and population recognition. Research has indicated that some experience and practice exists, but it has not been researched or written about in a manner that would facilitate easy transfer of experience to authorities, practitioners and other potential users. A targeted research project, which would involve interviews with a wide range of authorities and practitioners from around the EU to draw out and document the experience and lessons learned on a grand scale could have a very positive impact on the body of knowledge available in this rapidly evolving field.

Dissemination of these guidance documents. A targeted dissemination programme for this guidance will be needed if it is to reach the wide audience for which it is intended. Translation of the guidance from English into Member State languages will greatly facilitate this process as many authorities, practitioners and project developers will not have a strong enough command of English to find it useful in the original version. All key events related to environmental assessment, climate change, and biodiversity should be used as an opportunity to disseminate the guidance, along with targeted mailings to Member States, local and regional authorities, NGOs, academics and others who can further publicise and disseminate the document, both in print and online (.pdf) versions.

Training and capacity building. As experience is limited, so is capacity. For example, research for this guidance document found that many practitioners simply have not considered the concept of looking at the impacts of the environment or climate change on the project, as this is not traditionally part of the EIA approach. This and other factors dealt with in this guidance document, such as dealing with uncertainty and the increased importance of cumulative effects will undoubtedly also require improvements in the capacity of authorities, practitioners, project developers and others who play a role in EIA.

This type of work could be carried out in many ways, mainly within the Member States, but could be encouraged by the European Commission.

Policy-level recommendations

Linkages with Cohesion Policy and other EU co-funded investments. EU Cohesion Policy co-finances many of the large infrastructure projects that will have major impacts on climate change and biodiversity issues and will themselves be especially vulnerable to the impacts of a changing climate. As regulations, and the specific investment terms with Member States are yet to be finalised for the 2014-2020 period, there is time to consider inserting a conditionality regarding the quality of SEAs for Operational Programmes, and EIAs for those projects that will have significant climate change and biodiversity impacts, and the extent to which they consider these impacts, in light of recent legislation and policies in these sectors.

Linkages with the EU Climate Change Adaptation Strategy process. The EU is in the process of preparing a strategy on adaptation to climate change, via the process outlined in the 2009 White Paper. A key aspect of this process is the mainstreaming of climate change adaptation issues into other policy areas and into investments, through a process of "climate-proofing". It will be important to link this work to EIA and SEA and to stress the use of these tools as the legal instruments and appropriate processes to make important contributions to delivering this mainstreaming.

Member State guidance and recommended procedures. As presented in the guidance, it is not possible to consider the wide range of specific climate change and biodiversity impacts that will affect users across the EU Member States, and the way in which these issues are considered for EIA and SEA will strongly depend on how the issues affect specific regions. In addition, approaches to environmental assessment vary considerably across the Member States, according to national legislation, political culture, working culture and other conditions. It is therefore important that Member States consider developing their own, place-specific guidance on integrating climate change and biodiversity into environmental assessment, which may be based upon the principles and resources given in this EU-level guidance.

ANNEXES

Annex 1: Sources of Information

This annex considers what information can be used to support an SEA. It outlines the different types and sources of information that may be available. Information needs are likely to be particularly relevant to the SEA screening, scoping and assessment stages, and then monitoring/follow-up.

Types of information

Examples of the types of quantitative datasets relevant to climate change and biodiversity include:

- Species distribution
- Trend data, e.g. loss of species/habitats
- Protected area status (SACs, SPAs etc, national designations etc.)
- GHG emission inventories etc
- Climate projections (IPCC etc)
- Future scenarios (climate and socio-economic).

These datasets may already exist, depending upon the location and scale required.

Sources of information

A starting point for sources of information on climate change and biodiversity will be other plans and policies that provide the context in which a plan or programme must be considered. These may include, for example, municipal/local authority spatial plans and policies/strategies on biodiversity protection (e.g. biodiversity action plans for species and habitats) and climate change mitigation and adaptation plans, strategies or vulnerability assessment studies.

Other forms of assessment may also be relevant, such as SEAs carried out for higher level plans and programmes or assessments carried out under the Habitats Directive 92/43/EC.

For biodiversity – potential specialist sources are likely to include:

- environmental authorities with responsibility for nature conservation
- environmental NGOs
- stakeholders dependent or influential on biodiversity derived ecosystem services, e.g. foresters, fisheries, water companies/authorities

For climate change – potential specialist sources are likely to include:

- environmental authorities with responsibility for climate change mitigation and adaptation

- local authorities/municipalities
- environmental NGOs
- health services
- social well-being organisations
- infrastructure providers, e.g. transport authorities, utilities

In some instances it may be necessary effectively to create new knowledge and understanding with regard to biodiversity and climate change, their interactions together and with the proposed project. Cooperation with stakeholders and the public can help to build understanding around the relevance and seriousness of climate change and biodiversity issues. At the scoping stage this fits well with the reviewing of other relevant policies, plans and programmes, what the key issues are and defining the temporal and spatial scope, boundaries and parameters. So build climate change and biodiversity explicitly into your scoping process to ensure you access the most appropriate source of information and data as early as possible in the SEA.

Details on the EU climate change adaptation clearinghouse expected in 2012 should be added here for the final version as well as a box in Section 5.

Key European sources of data, including data repositories and online digital datasets:

Source	Description	Link
Climate change – mitigation and adaptation		
Climate Change Data Centre	Repository of a wide range of climate change relevant data and information. This includes all the latest climate change relevant developments within the EEA. Good meta-source of developments across European climate policy and reporting.	http://www.eea.europa.eu/themes/climate/dc
IPCC Fourth Assessment Report: Climate Change 2007	Latest release of global climate change science. Split into range of working groups and sectoral reports.	http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml
Climate change - mitigation		
Greenhouse Gas Emission Viewer	The EEA GHG viewer provides easy access and analysis of the data contained in the Annual European Union greenhouse gas inventory from 1990. The EEA GHG data viewer can show emission trends for the main sectors and allows for comparisons of emissions between different countries and activities.	http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2011
European Topic Centre for Air Pollution and Climate Change Mitigation (ETC/ACM)	The ETC/ACM assists the European Environment Agency (EEA) in its support to EU policy in the field of air pollution and climate change mitigation. The ETC/ACM provides reports and databases relevant to climate change mitigation	http://acm.eionet.europa.eu/
Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007	Consideration of the climate change mitigation drivers and trends within a wide range of sectors.	http://www.ipcc.ch/publications_and_data/ar4/wg3/en/contents.html
Climate change - adaptation		
Vulnerability and adaptation to climate change	Technical report by the EEA that assesses European vulnerability to climate change impacts and adaptation measures being undertaken as of 2010.	http://www.eea.europa.eu/publications/technical_report_2005_1207_144937
Adapting to climate change	European Commission Green Paper presenting major risks to European society from climate change and possible policy responses.	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52007DC0354:EN:NOT
Mapping the impacts of natural hazards and technological accidents in Europe	The report assesses the occurrence and impacts of disasters and the underlying hazards such as storms, extreme temperature events, forest fires, water scarcity and droughts, floods, snow avalanches, landslides, earthquakes, volcanoes and technological accidents in Europe for the period 1998-2009. Useful for scoping potential vulnerability.	http://www.eea.europa.eu/publications/mapping-the-impacts-of-natural
EmDAT	International disaster database that seeks to inform preparedness and decision making to natural disasters. Useful for scoping vulnerability.	http://www.emdat.be/
NatCatSERVICE	Insurance based database analysing approximately 1,000 every year. The information collated can be used to document and perform risk and trend analyses on the extent and intensity of individual natural hazard events in various parts of the world.	http://www.munichre.com/en/reinsurance/business/non-life/georisks/natcatservice/default.aspx
Impacts of Europe's changing	The main part of this report summarises the relevance, past trends and future projections for about	http://www.eea.europa.eu/publications/eea

Source	Description	Link
climate — 2008 indicator-based assessment	40 indicators covering all aspects of climate change and impacted sectors. The report also addresses adaptation and the economics of climate change impacts and adaptation strategies and policies, and data availability and uncertainty as of 2008.	_report_2008_4
IPPC - Climate Change 2007: Working Group II: Impacts, Adaption and Vulnerability	IPPC Chapter on impacts of climate change across Europe. Considers key vulnerabilities and possible policy responses	http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch12.html
National Adaptation Strategies	Up to date database of EU Member States progress under the EU's Adaptation White Paper. Good source for country specific actions.	http://www.eea.europa.eu/themes/climate/national-adaptation-strategies
European Severe Weather Database	Database of severe weather events across Europe. Useful for indicating general vulnerability of projects.	http://www.essl.org/ESWD/
Green and Blue Space for Adaptation (GRaBS) Adaptation Risk and Vulnerability Toolkit	Online toolkit that presents spatially various aspects of climate change adaptation includes physical risk and aspects of social vulnerability.	http://www.ppgis.manchester.ac.uk/grabs/start.html
Climate Change Data Centre	Repository of a wide range of climate change relevant data and information. This includes all the latest climate change relevant developments within the EEA. Good meta-source of developments across European climate policy and reporting.	http://www.eea.europa.eu/themes/climate/dc
IPCC Fourth Assessment Report: Climate Change 2007	Latest release of global climate change science. Split into range of working groups and sectoral reports.	http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml
Vulnerability and adaptation to climate change	Technical report by the EEA that assesses European vulnerability to climate change impacts and adaptation measures being undertaken as of 2010.	http://www.eea.europa.eu/publications/technical_report_2005_1207_144937
Biodiversity		
Assessment of Biodiversity	EEA Report describing and analysing biodiversity trends compared to 2010 target.	http://www.eea.europa.eu/publications/assessing-biodiversity-in-europe-84/at_download/file
Biodiversity Baseline	Assessment of various habitat types across Europe as of 2010.	http://www.eea.europa.eu/publications/eu-2010-biodiversity-baseline/
Biodiversity	Thematic summary of the status of Europe's biodiversity as of 2010.	http://www.eea.europa.eu/soer/europe/biodiversity
Biodiversity Data Centre	Repository of a wide range of biodiversity relevant data and information. This includes all the latest biodiversity relevant developments within the EEA. Good meta-source of developments across European biodiversity policy and reporting.	http://www.eea.europa.eu/themes/biodiversity/dc
BISE (including European Clearing House Mechanism) Data	Database of all relevant European biodiversity data sources. Good source of indicators and maps collated from across European institutions.	http://biodiversity.europa.eu/data
European Topic Centre for Biological Diversity (ETC/BC)	The ETC/BD is an international consortium working with the EEA under a framework partnership agreement. The ETC/BD presents expert knowledge and reporting in a range of reports and databases.	http://bd.eionet.europa.eu/

Source	Description	Link
Global Biodiversity Information Service	Publicly accessible biodiversity data including species occurrence and taxonomic information. Very detailed species specific data source. Good indicator of potential species presence across Europe for use in scoping. Likely to require site investigation to confirm occurrences.	http://data.gbif.org/welcome.htm
Biodiversity Action Plan - European Commission	Inventory of European Biodiversity Action Plan and assessment of Member States.	http://ec.europa.eu/environment/nature/biodiversity/comm2006/bap_2010.htm
General		
Group on Earth Observatories (GEO)	Database of global data components on a range of environmental aspects, including climate change and biodiversity	http://geossregistries.info/holdings.htm
EUROSTAT	Database holding a huge range of environmental, economic and social data.	http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home
EUROSTAT Sustainable development indicators	The Sustainable Development Indicators (SDIs) are used to monitor the EU Sustainable Development Strategy (EU SDS) in a report published by Eurostat every two years. They are presented in ten themes including climate change and natural resources down to Member State levels.	http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/indicators
EUROSTAT Country profiles	Country specific data on a range of issues including climate change emissions and sectoral activity.	http://epp.eurostat.ec.europa.eu/guip/introAction.do
EEA Data and Maps	Access the EEA's maps, indicators, databases and graphs.	http://www.eea.europa.eu/data-and-maps
EEA IMS Indicators	Indicators and factsheets about Europe's environment.	http://www.eea.europa.eu/data-and-maps/indicators#c7=all&c5=&c0=10&b_start=0

Annex 2: Tools for Assessing Climate Change and Biodiversity within SEA

This annex provides an overview of some of the tools and approaches that are available to support the assessment of climate change and biodiversity within SEA. This is not an exhaustive list and many other tools may be relevant.[24] Some of the tools and approaches listed are used to support the assessment of specific aspects of climate change and biodiversity (e.g. GHG emission calculators and ecological surveys). Other tools and approaches can be more generally applicable across the different environmental topics but have been included here as they are particularly relevant to climate change and biodiversity.

The tools and approaches that will be relevant and useful for your SEA will depend upon the specific circumstances of the plan or programme (e.g. the type of plan or programme and the sector it covers, its location, scale and area covered and the characteristics of the receiving environment etc) and therefore its potential effects. These circumstances will define the type, level of detail and nature of analysis that is appropriate to a particular SEA and therefore which tools may be relevant. The decision about whether to use any of these tools for the SEA should be taken early in the process, most likely at the scoping stage.

The table below provides an overview of tool and approaches that can be used to support the assessment of climate change and biodiversity as part of the SEA process, with fuller descriptions and details of sources of further information included in a second table.

Overview of tools and approaches that can be used to support the assessment of climate change and biodiversity as part of the SEA process

This table is a draft idea and will be completed. Rather than present tools/approaches according to topics/SEA stages, it may present them according to the types of advice given in the guidance sections in Part II.

Tools and approaches	Type of tool / approach	Topic which tool and approaches are applicable to			Key elements of SEA process and the challenges of climate change and biodiversity					
		Climate change mitigation	Climate change adaptation	Biodiversity	Screening and scoping	Establishing baseline	Identifying effects	Evaluating effects	Impact avoidance and mitigation	Monitoring
Biodiversity offsetting										
Biodiversity screening map										
Confidence levels										
Critical Factors										

[24] The IAIA wiki is a useful resource for more general tools and concepts for the practice of EIA: http://www.iaia.org/iaiawiki/

Tools and approaches	Type of tool / approach	Topic which tool and approaches are applicable to			Key elements of SEA process and the challenges of climate change and biodiversity					
		Climate change mitigation	Climate change adaptation	Biodiversity	Screening and scoping	Establishing baseline	Identifying effects	Evaluating effects	Impact avoidance and mitigation	Monitoring
Ecological Surveys										
Ecosystem services approach										
Ecosystem services valuation										
GHG emission calculators										
GIS and spatial analysis										
GRaBS Adaptation Risk and Vulnerability Toolkit										
Industry (project) profiles of GHGs										
Life Cycle Assessment (LCA)										
Natural capital approaches / Four-Capitals / Quality of Life Capital										
Network analysis										
Risk management, vulnerability assessment										
Scenarios										
Spheres of influence and Ecosystem chains										
Stakeholder engagement										
SWOT and STEEP analysis										
Vulnerability assessment										

Description of tools and approaches that can be used to support the assessment of climate change and biodiversity as part of the SEA process

Name	Description	Application Comments	Source of further Information
Biodiversity offsetting	Biodiversity offsetting is an approach which seeks to compensate for unavoidable loss of habitats and species due to development. Though not formalised in every Member State there are allowances for offsetting within the Environmental Liability Directive and Habitats Directive - Article 6.4.	This practice is developing across Europe and recent examples include the 2011 Biodiversity Strategy making reference to the Commission developing practice in line with previous studies (see sources of further information). It is likely that, within the context of European policy, Member States will develop this area as they see fit. It is likely to be a more relevant approach to programme level SEA and EAI, rather than more strategies SEAs.	Business led offsetting programme: http://bbop.forest-trends.org/index.php Commission feasibility study: http://ec.europa.eu/environment/enveco/pdf/eftec_habitat_technical_report.pdf Online resource for overview of the sector: http://www.ecosystemmarketplace.com/
Biodiversity screening map	Screening maps are a form of spatial analysis that requires the identification of the habitats sited around a particular project. Having done this these habitats should be assessed for their relative worth considering wider trends and likely impacts of the project. If there is considered to be some potentially significant effects this should inform the screening decision.	Useful for screening and scoping stages and to identify areas of potential higher value biodiversity that may be used within the consideration of the alternatives.	Can be supported by some of the information sources presented in Annex 1, but will more normally be based on expert judgement and the experience of other stakeholders.
Confidence levels	Confidence levels are an effective approach to communicating uncertainty; this may be useful when considering potential climate change impacts.	Increasingly climate change impacts are being presented in probabilistic scenarios which can be presented in terms of confidence levels.	The provision of confidence levels varies within different climate scenarios – e.g. the IPPC provides information as to specific confidence levels within different assessments.
Critical Factors	An alternative approach to consider is one based on "critical factors for decision-making". These constitute the fundamental decision-making factors that should be underlying the focus of the SEA. These critical factors identify the aspects regarding design and implementation of the plan or programme that must be considered in the decision process. The resulting critical factors for decision-making will provide the structure to the analysis and assessment of opportunities and risks across the SEA, defining the technical studies that need to be performed under the SEA in order to gather the information required for a decision. The critical factors should be derived through wider public participation and consultation with key	This is a structured approach to the scoping stage of SEA. The critical factors are generated out of an integrated analysis of the following elements: • *Strategic reference framework* - which constitutes an assessment benchmark and gathers the relevant policy objectives established at international, European, national and local levels and also other relevant plans and programmes. • *Strategic issues* - the strategic objectives and core principles of the strategy being assessed. • *Environmental/sustainability/health/equality etc factors* - defines the relevant scope of the SEA which must be adjusted to each specific case according to the strategic focus, the assessment	Strategic Environmental Assessment Good Practices Guide. Methodological Guidance. Portuguese Environment Agency http://www.sea-info.net//files/events/SEA_guide_Portugal.pdf

Name	Description	Application Comments	Source of further Information
	stakeholders.	scale and, as a result, their relevance.	
Ecological Surveys	Undertaken by expert ecologists a site survey can identify and describe the ecosystems, habitats and species present on a site or within an area. This allows the identification of protected species or habitats as well as informing project design to reduce avoidable damage to higher value areas of biodiversity and seek areas of potential enhancement. However, undertaking primary surveys is unlikely to be appropriate for SEA (apart from potentially at the programme level) and is more common for EIAs.	The scale and type of expertise required will vary hugely between types of programme / projects and should be defined based on local circumstances. An early ecological survey can save time and effort at later stages by allowing the early identification of certain species and habitats that require particular protection or mitigation measures. There is also the need to consider Member State legal requirements based on the Birds and Habitat Directives. For SEAs it is more likely that existing survey information will be used rather than primary surveys – for example floral atlases or aggregated GIS data on habitats may be used as part of the scoping and assessment stages.	There are a wide range of consultants available to undertake ecological surveys, ensuring competence and experience is essential.
Ecosystem services approach	Ecosystem services offer potentially a new tool to use in SEA, using the concepts developed by the Millennium Ecosystem Assessment (MEA, 2005). Ecosystem services can be used as additional or alternative assessment criteria within SEA, even at a generic/strategic level e.g. what will be the effects on: i) supporting services; ii) provisioning services; iii) regulating services; and iv) cultural services? But this approach is in its infancy and will take some time to become established. See also ecosystem services valuation below.	In practice ecosystem services could be could be used in a number of ways in SEA: **Baseline** - ecosystem services could help make baseline data much more relevant to the assessment process by combining datasets in a useful way for planners and decision-making. **Scoping, and engagement with stakeholders** – using network analysis for example to understand the range of ecosystem services provided by an area and as a means to identify key issues/areas. **Assessment and consideration of alternatives** - ecosystem services can provide important information on the potential for multifunctionality of an area when considering alternatives. And for assessment they can be supplementary or an alternative to the typical assessment objectives or criteria – e.g. an objective *"To protect and enhance biodiversity"* might be re-cast in ecosystem service terms *"What will be the effect on biodiversity provisioning services?"* However, 'ecosystem services thinking' could also provide an important perspective in the same way that life cycle thinking provides wider benefits to sustainable product	Millennium Ecosystem Assessment (MEA) (2005) Ecosystems and Human Well-Being: Synthesis. Island Press, Washington. http://www.maweb.org/en/index.aspx OECD (2008) Strategic Environmental Assessment and Ecosystem Services http://www.oecd.org/dataoecd/24/54/41882953.pdf World Resources Institute (2008) Ecosystem Services: A Guide for Decision Makers http://www.wri.org/publication/ecosystem-services-a-guide-for-decision-makers Sheate W, Eales R, Daly E, Murdoch A, and Hill C (2008), Case study to develop tools and methodologies to deliver an ecosystem-based approach: Thames Gateway Green Grids, Project report NR0109, London, Defra, 2008, available at http://www.cep.co.uk/Thesaurus.htm

Name	Description	Application Comments	Source of further Information
		and service provision beyond heavily data dependent life cycle analysis/assessment.	
Ecosystem services valuation	The economic valuation of ecosystem services has developed significantly as a potential tool within impact assessment. Recent analysis within the TEEB and various Member States indicate this approach has some potential for making clear the economic value of biodiversity, this in theory would allow a more informed understanding of the societal impact of a project. Valuation is a useful tool but the most efficient use of the concept of ecosystem services within impact assessment may be in demonstrating that the environment is important to us rather than in quantifying the cost equivalence of this importance.	The time and resource requirements for ecosystem valuation are significant and may undermine its potential to support impact assessment practice where resources are often limited. This is particularly true at the strategic scale. It is possible to relate existing valuation studies to a different area this can be useful at the strategic scale but its effectiveness is limited at more local levels due to the contextual nature of value. However certain ecosystem services (i.e. provisioning services) can be relatively simply valued and may add value to some assessments. Within SEA the focus should be on the value of services and areas broadly rather than specifically, this can be based on linking land or habitat types to services using existing studies or stakeholder and expert engagement.	Chapter 6 of TEEB for Local and Regional Policy makers considers economic valuation as part of EIA (and SEA) practice: http://www.teebweb.org/ForLocalandRegionalPolicy/tabid/1020/Default.aspx Guide to valuing ecosystem services: http://www.defra.gov.uk/environment/policy/natural-environ/documents/eco-valuing.pdf
GHG emission calculators	Emission calculators seek to quantify the total green house gas (or often carbon alone) emissions from an activity or project as a whole. Emissions can be calculated for operation or the construction of a project. A range of calculators exist and are generally based on GHG equivalents for certain indicators such as energy consumption.	Depending on the level of detail contained within your plan or project it may be possible to quantify possible GHG emissions. This can be undertaken by specific engage consultants or via online tools where available.	A number of consultancies operate GHG emissions calculators that can be undertaken for individual projects. Calculators can be found online though the accuracy and assumptions (such as the type of fuel use to generate power etc) will vary and may not be relevant to your plan or programme area.
GIS and spatial analysis	Geographic Information Systems (GIS) and its use as a form of spatial analysis has proven value in communicating and identifying environmental impacts of plans and programme. There is a huge spectrum of possible GIS methods and uses and these can be tailored depending on the required scales and available resources.	The nature of the GIS required will vary depending on the scale of the plan or programme and the intended purpose of the GIS. GIS is a broad technique and can be used to undertake analysis of various morphological or technical factors or to support consultation exercises via visualisation.	GIS is largely dependent upon the available data, potentially useful sources of pan European information and data are presented in Annex 1.
GRaBS Adaptation Risk and Vulnerability Toolkit	This is an online toolkit that presents spatially various aspects of climate change risk and vulnerability. It has relatively low data resolution but may be useful to understand broader regional vulnerabilities.	Useful tool for the scoping stage and for identifying regional trends for certain climate hazards.	http://www.ppgis.manchester.ac.uk/grabs/start.html
Industry (project) profiles of GHGs	SEAs should, where possible, make use of existing information – one potential source of useful	This information will be useful during the scoping and screening stages of the SEA and to understand the	Industry profiles may often be based on the experience of various stakeholders and looking to

Name	Description	Application Comments	Source of further Information
	information may be sectoral or technology profiles of the energy requirements of various elements of a project during operation and construction.	relative profiles of different sectors.	see examples of previous plans or programme (or EIAs where appropriate). In certain Member States specific industry profiles may exist.
Life Cycle Assessment (LCA)	LCA is a technique that seeks to consider all the environmental impacts of particular actions - over their lifetime. This is particularly relevant to climate change as the greenhouse gas emissions are often released during the construction stage. LCA can include a full assessment of all impacts in detail or be a less quantitative and detailed consideration of the materials in use and their probable environmental impacts. For example responsibly sourced wood has a lower carbon footprint that steel and responsibly sourced (certified) wood has a generally lower impact on biodiversity than un-certified wood. LCAs can be undertaken by consultants or in-house.	Undertaking full LCA can be a very costly and timely process, however certain elements of a project may already be subject to LCA, there is therefore the potential for the EIA to use this information where available. It may also be possible to undertake a qualitative assessment of possible LCA impacts based on readily available information such as material types. LCA is particularly useful during the impact assessment stage of the EIA and can inform the consideration of alternatives buy identify the most significant elements of a project in terms of biodiversity and climate change. But for SEA, LCA is more likely to be relevant for providing a way of thinking about strategic options rather than being applied more formally.	Online repository of LCA tools: http://www.dantes.info/Tools&Methods/Software/enviro_soft_SW.html
Natural capital approaches / Four-Capitals / Quality of Life Capital	Various similar approaches that use the concept of 'capital' as derived from economics and describe benefits through the services and outputs provided by natural and other capital. The Four Capitals Model considers development (and the meeting of needs and aspirations) to take place through the services provided by economic, human, social and environmental assets. Development is then considered to be sustainable if and only if the stock of all assets or capital (wealth) per capita remains constant or rises over time. The four types of capital are: manufactured capital (infrastructure); natural capital (natural resources); human capital (health, well-being and productive potential of individuals); and social capital (human well-being on a societal level).	The four-capitals model, and other similar approaches, provide an alternative framework for defining and assessing sustainable development and can provide an alternative assessment framework to use as part of an SEA ensuring that that all three of the pillars of sustainable development - economic, social and environmental - are included in the analysis and that the focus is on the evaluation is not just on stocks, but on the flows of benefits to which they give rise to. It can also provide a good means of engaging stakeholders with the concerns of sustainable development.	The SDRTOOLS programme design evaluation methods to assess sustainable development, using the Four Capitals Model as a starting point. http://www.srdtools.info/index.htm
Network analysis	Network analysis is an effective way to consider complex systems by linking causes and impacts via a chain of causation. The concept is based on the idea that there are links and impact pathways between	This approach can be used to ascertain the probable impacts and benefits on climate change and biodiversity of various elements of a project by identifying their outcomes via the development of a	Network analysis is generally dependent upon the use of expert knowledge and judgement and the accurate identification and linking of drivers and impacts.

Name	Description	Application Comments	Source of further Information
	elements of a project and environmental outcomes, and that these can be identified. This enables the identification of actions that may achieve desired objectives, such as reduced impact or enhancement. Within SEA it is particularly useful in relating non material elements of a plan or programme (such as funding or management options) to specific environmental impact (see case studies in Annex 4 for examples)	chain of causation. It is best undertaken during the scoping stage, but may be extended into the following stages of assessment.	Examples of the application of this approach can be seen in case studies in Annex 4 of the guidance.
Risk management, vulnerability assessment	When considering climate change it is particularly useful to frame potential impacts in terms of the probability and magnitude of impacts. These two components make up risk. This can be achieved by considering the probability of impact (for example how likely is it that sea level rise will impact on a plan or programme) in relation to the magnitude of the impact (what would be the likely impact of sea level rise on a plan or programme). Understanding these two elements is essential to reducing vulnerability and increasing resilience.	Thinking in terms of probability and magnitude within an SEA can inform the stakeholders as to the vulnerability of a plan or programme and therefore the necessity of adaptation measures (what alternatives are available) and what monitoring is required to enable adaptive management.	Vulnerability and climate change: http://www.metrovancouver.org/planning/ClimateChange/ClimateChangeDocs/Vulnerability_climate_change.pdf IAIA's risk management advice: http://www.iaia.org/iaiawiki/ra.ashx
Scenarios	Scenarios relate to climate change scenarios (e.g. IPCC scenarios) and socio-economic/alternative futures scenarios for considering the resilience of projects and the environment into the long term future. The use of scenarios is a response to uncertainty.	Scenarios are effective ways of considering the evolution of the baseline – both in terms of the potential impacts of the climate on a project and the changes to wider socio-economic context that the project operates in. The scenarios can also support the consideration of alternatives.	Potential European resources include the information on the European Environment Agency's website: http://www.eea.europa.eu/themes/scenarios/scenarios-and-forward-studies-eea-activities http://scenarios.ew.eea.europa.eu/
Spheres of influence and Ecosystem chains	Spheres of influence are based on using spatial tools to assess the potential effects of a project beyond the specific project boundaries; as such these concepts use tools such as network analysis but apply them spatially. This entails looking at the indirect impact on downstream or related ecosystems, for instance how will changing water abstraction impact downstream systems, how will increased dust impact on the turbidity of downstream environments, how will removing one habitat type impact on neighbouring habitats?	This concept is particularly useful for the screening and scoping stages and for identifying indirect and secondary effects. Requires an understanding of possible impacts and causal chains, as such network analysis is a related tool. This may also be a useful tool when considering alternatives and their impacts.	Can be supported by some of the information sources presented in Annex 1, but will more normally be based on expert judgement and the experience of other stakeholders.

Name	Description	Application Comments	Source of further Information
Stakeholder engagement	Stakeholder engagement encompasses a broad range of approaches or activities that involve stakeholders in a decision-making process – a stakeholder is any person who has, or perceive that they have, a stake in the strategy, plan or programme and/or assessment process or its outcomes, this may include statutory bodies, academics, individual members of the public and representatives of organisations/groups whether from the public, private, voluntary or community sectors. There are a range of methods of stakeholder engagement and consultation available using different levels of involvement. The levels and purpose can range from just education and Information provision, to information and feedback, involvement and consultation, and ultimately extended dialogue.	Stakeholder engagement is important throughout the SEA process and a range of different methods can be used depending on the purpose of the engagement and stakeholders involve. For example stakeholders can be used to input to an initial assessments of a plan or programme as part of screening or scoping. Stakeholder workshop(s) or series of roundtable meetings with stakeholders can be used to facilitate this type of input. Depending on the purpose different methods can be used: ***Education and Information provision*** (e.g. leaflets and adverts in local paper) - these have limited use in the assessment process though could be used to inform people of the screening decisions or of the adopted plan or to let people know where the environmental report is for comment. (SEA stages: screening, consultation on draft plan and environmental report) ***Information and feedback*** (e.g. staffed exhibits/ displays) - could be used at the start of an assessment process to convey information about the issue, collect views of stakeholders on what aspects they regard as important, and have expert staff on hand to answer questions. It could also be used at the end of an assessment process as a method of communicating to a wider group of stakeholders. (SEA stages: Scoping, Consultation on the draft plan and environmental report). ***Involvement and consultation*** (e.g. Stakeholder forums/ working groups, workshops) - this could be used in a number of ways, to discuss with stakeholders their views of what is valued in an area but also to understand their perception of impacts and benefits of a particular issue or to provide weighting for different criteria in an assessment. (SEA stages: scoping, developing and refining strategic options) ***Extended dialogue*** (e.g. stakeholder dialogue) - this could be used to set the objectives for the assessment, as well as carrying out parts of the assessment. (SEA	Journal of Environmental Assessment Policy and Management 2003. Volume 5, No 3, Special Issue: Public and Stakeholder participation in environmental decision-making, edited by William Sheate, Imperial College Press. IEMA 2002. Perspectives: guidelines on participation on environmental decision-making. Institute of Environmental Management and Assessment. UNECE 2006 Your Right to a Healthy Environment: A simplified guide to the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters http://www.unece.org/env/pp/guidancedocs.htm André, P., B. Enserink, D. Connor and P. Croal 2006 Public Participation International Best Practice Principles. Special Publication Series No. 4. Fargo, USA: International Association for Impact Assessment.

Name	Description	Application Comments	Source of further Information
		stages: scoping, developing and refining strategic options)	
SWOT and STEEP analysis	SWOT (**S**trengths, **W**eaknesses, **O**pportunities and **T**hreats) and STEEP (**S**ocio-cultural, **T**echnological, **E**conomic, **E**nvironmental and **P**olitical) analysis are strategic planning method used to evaluate a project, plan or a business venture for example. They involves identifying the internal and external factors that are favourable and unfavourable to achieve an objective of the activity.	SWOT analysis and STEEP analysis may be appropriate to use within an SEA, particularly as part of identifying effects. SWOT analysis, for example, could be used to summarise the main strengths, weaknesses, opportunities and threats presented by a draft plan or programme, and as a result what could be addressed in the final plan or programme to improve its overall performance. STEEP analysis could similarly be used, for example it could offer an opportunity to help take account of environmental equality in assessments: Social: use the idea of community and wellbeing; Technical: look at soft and hard solutions for social and environmental benefits for all; Environment: use simple language about the environment in the context of wellbeing and sharing it equally with others; Economic: explore models that work to provide equitable economic benefits for all; Political: discuss good stewardship of environmental, community and financial resources.	http://rapidbi.com/created/SWOTanalysis.html simple info http://www.gcvcore.gov.uk/downloads/futures/STEEPanalysisOutputs.pdf http://www.mindtools.com/pages/article/newTMC_05.htm
Vulnerability assessment	A vulnerability assessment is the process of identifying, quantifying, and prioritizing (or ranking) the vulnerabilities in a system. Vulnerability assessment has many things in common with risk assessment. Assessments are typically performed according to the following steps: • Cataloguing assets and capabilities (resources) in a system. • Assigning quantifiable value (or at least rank order) and importance to those resources • Identifying the vulnerabilities or potential threats to each resource • Mitigating or eliminating the most serious vulnerabilities for the most valuable resources	Vulnerability assessment is helpful when taking a resilience approach to climate change and needs to be built into any effective assessment of the evolution of the baseline environment and of alternatives to investigate how will the environment change without implementation of the plan or programme, and in relation to different alternatives. It can therefore be used to evaluate alternatives in order to help identify and select the most resilient alternative(s).	Climate change Clearing House. Technical Briefings(5) Climate Vulnerability Assessment. http://www.theclimatechangeclearinghouse.org/Resources/TechBrief/default.aspx Glick, P., B.A. Stein, and N.A. Edelson, editors. (2011) Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment. National Wildlife Federation, Washington, D.C. www.nwf.org/vulnerabilityguide

Annex 3: Key Climate Change and Biodiversity Issues and Impacts

This annex provides an overview of some of the key climate change and biodiversity issues and impacts to be considered as part of an SEA. It is important to note that this is only an indicative list and it is not comprehensive! The issues and impacts that will be relevant to any particular SEA will be dependent upon the specific circumstances of each plan or programme (e.g. the type of plan or programme, the sector covered by the plan or programme, its location and scale and the characteristics of the receiving environment etc) and therefore this annex should be used just as a starting point for considering what issues and impacts as well as alternatives and mitigation may be relevant.

The advice in this annex is divided into three tables covering:

- adaptation to climate change
- climate change mitigation
- biodiversity

This annex can be used during the scoping stage to help identify which climate change and biodiversity issues and impacts might be most relevant to an SEA of a particular plan or programme. Some key questions are provided to help you think through those that might be most relevant in your situation. It may be useful to explore these questions with stakeholders with an interest or expertise in climate change or biodiversity.

For climate change in particular, it will be important to consider early in the SEA process not just the impacts of the plan or programme on climate and climate change, but also the impact of climate change on the plan or programme – the key questions therefore provide a guide on both of these dimensions:

- How may the climate be affected by the plan or programme?
- How may the plan or programme be affected by climate change?

Alternatives in SEA are often considered to be at the heart of the SEA process, as they provide confidence that the proposed course of action is the best one available. Some examples of what to consider during the assessment stage when assessing alternatives, as well as mitigation measures that may be relevant, are provided in the tables below. Use these as a guide to considering alternatives and mitigation in your SEA, but remember these are just examples and you will need to consider what else is relevant given the specific circumstances of the plan or programme concerned.

Basic questions regarding adaptation to climate change

Concerns related to:	Key guiding questions that could be asked within the assessment (FOR SCOPING STAGE)	Approach to alternatives or mitigation measures (FOR ASSESSMENT STAGE)
Sea level rise, storms surge, coastal erosion and saline intrusion	• What are the key aquatic and coastal habitats and migration corridors that may be significantly adversely affected by sea level rise, coastal erosion and changes in and salinity levels? How will the proposed plan or programme impact them? • What are the key infrastructural assets (e.g. road segments and intersections, water supply infrastructure; energy infrastructure; industrial zones and major landfills) at risk due to their location in areas that may be inundated by sea level rise or subject to coastal erosion? Will the proposed plan or programme reduce or enhance these risks? • What areas may be affected by 4ppt saline intrusion? Will the proposed plan or programme reduce or enhance these risks?	• Avoid that the plan or programme promotes development in coastal areas at risk of sea level rise, coastal erosion and flooding during storms • Move water intakes and any economic activities that depend on supply of clean water or ground water (agriculture) away from areas that will be affected by saline intrusion.
Flood regimes	• What critical infrastructure (e.g. existing or planned road segments, water supply, energy, etc) is at risk due to location in extreme flood zones? • Is the capacity of drainage networks sufficient for potential extreme rainfall? • Does the design of drainage systems prevent channelling drainage water into lower laying areas? • Will the proposed plan or programme reduce or enhance the capacity of existing ecosystems and flood plains for natural flood management? • Will the plan or programme increase the exposure of the vulnerable (e.g. the elderly, unwell or young people) or sensitive receptors (e.g. critical infrastructure) to floods?	• Ensure that any existing or planned essential infrastructure (e.g. transport, energy) is protected from future flood risk • In high risk areas, consider arrangements for supply of goods and services that may be disturbed by floods • Increase resilience to floods through use of sustainable drainage systems • Enhance permeable surfaces and green space in new plans or programmes • Avoid decreasing storage volumes in flood plains
Landslides	• What property, persons or environmental assets are at risk because of landslides and their vulnerability?	• Avoid new developments in areas at risk from erosion • Protect and expand native woodland cover • In high risk areas, consider arrangements for supply of goods and services that may be disturbed by landslides
Heat waves	• What are the key terrestrial habitats and migration corridors that may be significantly affected by heat waves? How will the proposed plan or programme impact on them? • What urban areas, population groups or economic activities are most	• Avoid development patterns that fragment habitat corridors for the movement of species and seek to enhance where possible • Encourage design for environmental performance –reduce the need for cooling • Improvements in urban structure - expansion of green areas, open water

Concerns related to:	Key guiding questions that could be asked within the assessment (FOR SCOPING STAGE)	Approach to alternatives or mitigation measures (FOR ASSESSMENT STAGE)
	vulnerable to heat waves? How will the proposed plan or programme impact on them? • Is the proposed plan or programme reducing or enhancing the "urban heat island" effect? • Will the proposed plan or programme increase or reduce the resilience of landscape/forests to wildlife fires? [25]	surfaces and wind paths (along rivers and waterfronts) in urban areas to reduce the possible heat island effect • Suppression of thermal storage in buildings / roofs and roads (by use of different materials and colouring) • Encourage the greater use of green roofs • Reduction of man-made exhausts during heat waves (industries, and car traffic) • Awareness raising about the risks associated with heat waves and opportunities for reducing them • Heat wave early warning systems and response plans
Droughts	• What are the key terrestrial habitats and migration corridors that may be significantly affected by droughts? How will the proposed plan or programme impact on them? • Will the proposed plan or programme increase water demand and to what extent? • Are there any significant risks associated with worsening water quality during droughts (increased pollution concentrations due to limited dilution, saline intrusion, etc)? • What freshwater bodies will be exposed to excessive water pollution – especially during droughts when the pollution will become less diluted in reduced river volumes	• Encourage water efficiency measures • Explore efficient use / re-use of rainwater and grey water • Restrictions on excessive / non-essential use water use during droughts (depending on severity of the drought)[26] • Minimizing low flow withdrawals • Restrictions for effluent discharges into water bodies during droughts • Maintain and improve the resilience of watersheds and aquatic ecosystems by implementing practices that protect, maintain, and restore watershed processes and services
Storms and high winds	• What areas and critical infrastructure will be at risk because of storms and strong winds?	• Ensure new infrastructure considers the impacts of increased high winds and storms • In high risk areas, consider arrangements for supply of goods and services that may be disturbed by increased storm events

[25] See http://www.fs.fed.us/ccrc/topics/wildland-fire.shtml
[26] See http://www.lenntech.com/water-shortage.htm#Water_restrictions_in_England

Basic questions regarding climate change mitigation

Concerns related to:	Key guiding questions that could be asked within the assessment (FOR SCOPING STAGE)	Examples of alternatives or mitigation measures (FOR ASSESSMENT STAGE)
Energy demand in industry	• Will the proposed plan or programme increase or decrease demand for energy in industry? • Does the proposed plan or programme encourage or restrict opportunities for low carbon businesses and technologies?	• Reducing demand for energy (electricity or fuel) in industry • Branding of energy efficiency • Targeted support to businesses engaged in eco-innovations, low carbon business and low carbon technologies
Energy demand in housing and construction	• Will the proposed plan or programme increase or decrease demand for construction of housing and for energy use in housing?	• Improve the energy performance of buildings • Greenhouse gas capture and storage measures
Greenhouse gas emissions in agriculture	• Will the proposed plan or programme increase or decrease generation of methane (CH4) and nitrous oxide (N2O) in agriculture? • Will the proposed plan or programme increase or decrease use of nitrogen in fertilizing practices? • Will the proposed plan or programme adversely affect or protect carbon rich soils?	• Reducing the use of nitrogen in fertilizing practices • Managing methane (enteric and manure) • Protect natural carbon sinks such as peat soils
Greenhouse gas emissions in waste management	• Will the proposed plan or programme reduce or decrease waste generation? • Will the proposed plan or programme influence the waste management system? • How will these changes affect emissions of CO2 and methane (CH4) from waste management?	• Consider ways in which the plan can increase waste prevention, re-use and recycling, particularly to divert waste from landfill
Travel patterns and greenhouse gas emissions from transport	• Can the proposed plan or programme increase or decrease personal travel - the number and length of journeys made and the mode of travel? • Can the proposed plan or programme significantly increase or decrease freight transport - the volume of transported goods, length of journeys and the mode of travel?	• Promote plan or programme patterns that reduce need to travel • Support car free plan or programme • Encourage walking and cycling • Encourage public transport • Provide transport choices to encourage modal shift, such as an effective and integrated public transport system • Transport demand management schemes • Encourage car sharing • Prioritise high density urban plans or programmes (smaller housing at higher density) and reuse of brown-field land
Greenhouse gas emissions from energy production	• Will the proposed plan or programme increase or decrease energy consumption? • How will these changes in the energy demand affect the energy supply mix? • What implications will this change in the energy supply have on the greenhouse gas emissions from energy production?	• Generic recommendations are intentionally not provided as these are context-specific, depending upon the energy production capacity and energy supply sources of the area in question.

Basic questions regarding biodiversity

The following sources are recommended to help determine which key biodiversity issues and impacts that it might be relevant to consider as part of an SEA, and how to approach alternatives and mitigation measures (the advice in the table below is based on these sources):

- The Convention on Biological Diversity's Impact assessment: Voluntary guidelines on biodiversity-inclusive impact assessment http://69.90.183.227/decision/cop/?id=11042#_Toc124570466
- The IAIA's Biodiversity in Impact Assessment http://www.iaia.org/publicdocuments/special-publications/SP3.pdf

Concerns related to:	Key guiding questions that could be asked within the assessment (FOR SCOPING STAGE)	Approach to alternatives or mitigation measures (FOR ASSESSMENT STAGE)
Ecosystems (including the extent or quality of the habitat and habitat fragmentation or isolation)	• Will the proposed plan or programme, either directly or indirectly, lead to serious damage or total loss of ecosystem, or land-use type thus leading to a loss of ecosystem services of scientific/ecological value, or of cultural value? • Will the proposed plan or programme affect the exploitation of ecosystems or land-use type in such manner that the exploitation becomes destructive or non-sustainable? • Will the proposed plan or programme change the amount, quality or spatial organization of habitat? • Will the proposed plan or programme damage ecosystem processes and services, particularly those on which local communities rely? • Will the proposed plan or programme disturb connectivity between habitats of the same or different ecosystems, particularly those habitats which are important for interaction between species populations and breeding? • Will the proposed plan or programme result in emissions, effluents, and/or other means of chemical, radiation, thermal or noise emissions in areas providing key ecosystem services? • Will the proposed plan or programme lead to changes in ecosystem composition, ecosystem structure or key processes / responsible for the maintenance of ecosystems and ecosystem services in areas providing key ecosystem services? • If habitats will be lost or altered, is there alternative habitat available to support associated species populations? • Are there opportunities to consolidate or connect habitats? • Will the proposed plan or programme affect plans to enhance habitat availability or quality?	General guidance on the approach to alternatives: • Evaluate impacts of alternatives with reference to the baseline situation, and how it might evolve in the future without the plan or programme. • Compare against legal standards, thresholds, targets and/or objectives for biodiversity. • Use national biodiversity strategies and action plans and other relevant documents for information and objectives. • The vision, objectives and targets for the conservation and sustainable use of biodiversity contained in local plans, policies and strategies, as well as levels of public concern about, dependence on, or interest in, biodiversity provide useful indicators of acceptable change. General guidance on the approach to mitigation / enhancement: • The purpose of mitigation in SEA is to look for ways to achieve the plan or programme objectives while avoiding negative impacts or reducing them to acceptable levels. The purpose of enhancement is to look for ways of optimizing environmental benefits. Both mitigation and enhancement of impacts should strive to ensure that the public or individuals do not bear costs, which are greater than the benefits that accrue to them. • Remedial action can take several forms, i.e. avoidance (or prevention), mitigation (by considering changes to the scale, design, location, siting, process, sequencing, phasing, management and/or monitoring of proposed activities, as well as restoration or rehabilitation of sites), and compensation (often associated with residual impacts after prevention and mitigation). A 'positive planning approach' should be used, where avoidance has priority and compensation is used as a last resort measure. One should acknowledge that compensation will not always be possible:

Concerns related to:	Key guiding questions that could be asked within the assessment (FOR SCOPING STAGE)	Approach to alternatives or mitigation measures (FOR ASSESSMENT STAGE)
	• Will the proposed plan or programme adversely affect: protected areas; threatened ecosystems outside protected areas; ecological corridors identified as being important for ecological or evolutionary processes; areas known to provide important ecosystem services; and areas known to be habitat for threatened species? • Will the proposed plan or programme involve the creation of linear infrastructure that leads to fragmentation of habitats or in areas providing key and other relevant ecosystem services? Processes which are important for the creation and / or maintenance of ecosystems: • Will the proposed plan or programme change the foodweb structure and interactions that shape the flow of energy and the distribution of biomass within the relevant ecosystem? • Would the proposed plan or programme result in significant changes to water level, water quantity or water quality? • Would the proposed plan or programme result in significant changes to air quantity or pollution?	there are cases where it is appropriate to reject a development proposal on grounds of irreversible damage to, or irreplaceable loss of, biodiversity. • Practical evidence with respect to mitigation suggests that: ○ Timely and ample attention to mitigation and compensation, as well as the interaction with society, will largely reduce the risk of negative publicity, public opposition and delays, including associated costs. ○ Mitigation requires a joint effort of the proponent, planners, engineers, ecologists and other specialists, to arrive at the best practicable environmental option; ○ Potential mitigation or compensation measures have to be included in an impact study in order to assess their feasibility; consequently they are best identified during the scoping stage; ○ In planning, it has to be kept in mind that it may take time for effects to become apparent. Summary of key messages in promoting no net loss of biodiversity: 1. Avoid irreversible losses of biodiversity, for example by the spatial arrangement of a project. 2. Seek alternative solutions that minimize biodiversity losses, in particular consider and prioritise maintaining habitats which are experiencing long term decline 3. Use mitigation to restore biodiversity resources where their loss is unavoidable. 4. Compensate for unavoidable loss by providing substitutes of at least similar biodiversity value. 5. Seek opportunities for enhancement, for example by facilitating the connectivity of fragmented environments, creating beneficial high biodiversity habitats.
Species diversity	• Will the proposed plan or programme cause a direct or indirect loss of a population of a species in the area, especially those identified as priorities in NBSAPs and/or subnational biodiversity plans? • Will the proposed plan or programme alter the species-richness or species-composition of habitats in the study area? • Will the proposed plan or programme affect sustainable use of a population of a species? • Will the proposed plan or programme surpass the maximum sustainable yield, the carrying capacity of a habitat/ecosystem or the maximum allowable disturbance level of populations, or ecosystem? • Would the proposed plan or programme increase the risk of invasion by alien species?	
Genetic biodiversity	• Will the proposed plan or programme result in extinction of a population of particularly rare species, declining species and those with identified as priorities in National Biodiversity Strategies and Action Plans (NBSAPs) and/or subnational biodiversity plans? • Will the proposed plan or programme cause a local loss of varieties of cultivated plants and/or domesticated animals and their relatives, genes or genomes of scientific, ecological, or cultural value?	

Concerns related to:	Key guiding questions that could be asked within the assessment (FOR SCOPING STAGE)	Approach to alternatives or mitigation measures (FOR ASSESSMENT STAGE)
	• Will the proposed plan or programme result in the fragmentation of an existing population leading to (genetic) isolation?	

Annex 4: Case Studies

Case study 1: SEA of the Irish offshore renewable energy development plan

Country / location:
Irish Republic

Relevant To:

- Climate Change and biodiversity inter-relationship
- Evolving baseline

Key Message:
This SEA considers the potential impact of climate trends on the plan as well as on the future environment (particularly biodiversity). This is not achieved through site specific assessments or information but rather by a strategic, directional overview of potential climate trends and their potential impacts. This information informs the consideration of alternatives, monitoring requirements and the EIAs required as part of the implementation process.

Elements of good practice / key lessons from the SEA:
SEA of a strategic Republic of Ireland Government plan to harness energy from its marine environment, through offshore wind, wave and tidal energy technologies. The plan has been developed to help the country meeting its 16% target for energy to be consumed from renewable sources by 2020. The Offshore Renewable Energy Development Plan (OREDP) sets forth the policy context for the development of the sector; includes scenarios for the development of offshore renewable energy in Irish waters up to 2030; and sets out the long term vision for the sector. The main objective of the SEA, carried out by the Sustainable Energy Authority of Ireland in collaboration with the Marine Institute, was to identify where development is most likely to occur, identify the potential environmental constraints in those areas, and taking potential environmental effects into account, assess the levels of offshore energy development that could occur in certain areas. The SEA included considerable assessment of the potential impacts of the range of development options on the baseline environment, including biodiversity, flora and fauna, within the context of climate change.

For the purposes of this guidance, this SEA is most interesting as a good example of a case where climate change effects are factored into the assessment of the environmental baseline, particularly with regard to the impacts on biodiversity. The review of the evolving environmental baseline for each category of species considers “key issues and future trends” with climate change being included within each of these species category assessments. In doing so, information on the climate effects is based on future trends as per the best available information about what can be expected to happen. This information is used to enable the identification and development of win-win alternatives to the development areas and the application of the precautionary principle. Most of the sources of information are published academic sources and other studies. There were no attempts to define very precise details rather the SEA seeks to consider general trends and consider major potential impacts across the strategic plan as a whole.

For example, with regard to future climate change trends and impacts on shellfish, the environmental report refers to the potential loss of species due to shifts in temperature ranges as a result of climate change. The SEA also considered that climate change may damage current fish and shellfish spawning and nursery areas, and provide more suitable conditions for invasive species (destabilising current food webs) and alter the overall distribution range of fish and shellfish species in Irish waters. For other species (otters, seals, turtles marine and coastal birds), the report notes that a rise in sea temperatures could lead to changes in prey availability, affecting the distribution, abundance and breeding cycles of whole populations of many different species, and that rising sea levels may also decrease available feeding areas for migratory wading birds.

Case study 1: SEA of the Irish offshore renewable energy development plan

The assessment part of the Environment Report notes the indirect impact that climate change can have on the renewable energy devices considered as part of the plan, for instance: changing sea temperatures may significantly alter the ecological profile of the area, such that the interaction between the devices and this new ecology would need to be considered. The assessment of interactions reports that "there is potential that climate change could lead to increased water temperatures and possible (changes to) water salinity which could have negative effects on keystone species and habitats and wider marine ecosystems and the overall quality of the marine environment'.

It is important to consider that at the strategic level, the SEA does not require prediction of precise impacts or exact information about how climate change might alter the circumstances surrounding the implementation of the plan over time or specific areas of development activity. In this case, the SEA will be complemented by EIAs (and potentially Natura 2000 assessment) of the individual proposed development projects including the actual construction of renewable energy devices at selected sites. The important thing to keep in mind is the way in which the SEA addresses the potential impacts of climate change on the objectives of the plan, and also on the future environmental (particularly biodiversity) impacts of the plans, setting the stage for more detailed consideration of these wider trends at the project level as well as providing a space for follow-up and monitoring.

Source of further information:
Strategic Environmental Assessment (SEA) of the Offshore Renewable Energy Development Plan in the Republic of Ireland, October 2010
http://www.seai.ie/Renewables/Ocean_Energy/Strategic_Environmental_Assessment_of_the_OREDP/
Section 9: Baseline Environment; Section 9.3 Biodiversity, Flora and Fauna, pp 129-159.

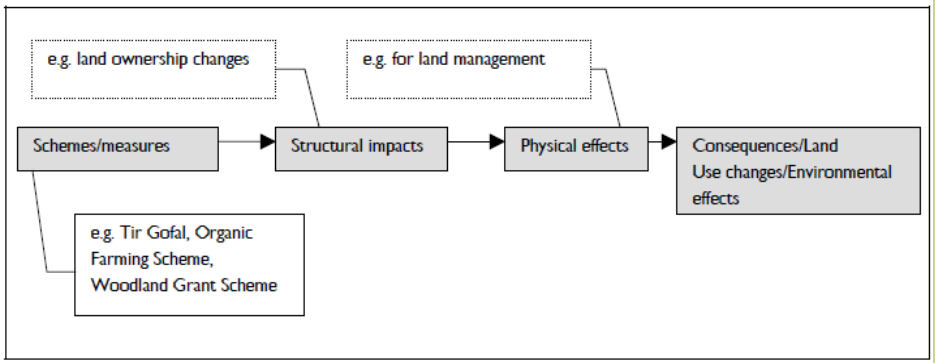
Case study 2: SEA of the Rural Development Plan for Wales 2007 - 2013

Country / location:
Wales

Relevant to

- Early and effective scoping with stakeholders
- Use of network (causal chain) analysis
- Consideration of climate change and biodiversity

Key message:
This case study is an example of early and effective engagement with stakeholders to identify the most important aspects of the environment. This was supported by the use of network analysis and the consideration of climate change and biodiversity.



Elements of good practice / key lessons from the SEA:
The Welsh Assembly Government (WAG) commissioned an SEA to be undertaken alongside their Rural Development Plan (RDP) 2007 – 2013. The SEA is notable for the early and effective engagement with stakeholders during the scoping stage; this led to the consideration of climate change and biodiversity across the SEA. The SEA is also a useful example of the use of network analysis and the consideration of cumulative impacts with regard to biodiversity and climate change.

During the scoping stage the consultants responsible for producing the SEA organised a scoping meeting with WAG officials and representatives from various natural environment and heritage authorities (see Appendix 1 on the Environment Report for list of attendees). These groups worked together to identify SEA objectives and indicators for the assessment process as well as what the 'key issues' were relevant to the plan. These were found to include climate change and biodiversity and their interrelationships. These (and other key issues) were presented within the baseline information and structured to include information as to the 'current situation and trends' and a description of the main elements to consider. A scoping report was circulated widely to stakeholder groups and consultees, with feedback used to refine the SEA objectives and key issues.

Example SEA objectives for climate change and biodiversity used in this assessment are presented in table below.

In terms of specific tools and approaches undertaken in the creation of the SEA the use of network analysis was found to be particularly useful. The necessity for network analysis was felt to be that the relationship between the RDP and environmental impacts was not clear as the RDP refers primarily to funding arrangements. The results of this network analysis are include in Annex 5 of the Environment Report and were found to be effective for relating funding decisions to broad environmental impacts (the basic process is shown in figure above). This was undertaken strategically rather than at the level of specific sites, this process and the results sought to inform the consideration and assessment of the RDP and the various alternatives that were identified through the SEA process. A total of 25 network (causal chain) diagrams were generated to illustrate the likely effects of the different funding schemes.

Case study 2: SEA of the Rural Development Plan for Wales 2007 - 2013

Biodiversity and Climate Change Objectives, Sub-Objectives and Indicators (p.44 of Environment Report)

SEA THEME	HEADLINE OBJECTIVE	SUB-OBJECTIVE (TO…)	INDICATORS (relating to overall headline objective)
BIODIVERSITY	**To maintain and enhance biodiversity**	• Halt the loss of biodiversity and promote recovery • Meet the targets of biodiversity and habitat action plans • Enhance protected species and their overall population • Enhance and protect species without statutory protection and their overall population • Enhance the quality and number of natural and semi-natural habitats • Reduce habitat fragmentation and enhance habitat connectivity where not causing other fragmentation • Avoid damage and adverse impacts to Priority Habitats in	• Area and condition of protected areas (SPAs, SACs, Ramsar, SSSIs, NNRs) • Status of Biodiversity Action Plan priority species • Trends in natural and semi-natural habitats • Volume / number of transiting fish stocks (river salmon, trout): fish catches • Percentage area of independently certified woodland (such as FSC) • Biodiversity index: species indicator: widespread breeding birds
CLIMATE FACTORS (INCLUDING ENERGY)	**To reduce contributions to climate change**	• Reduce the concentration of greenhouse gases • Increase the use of renewable/low carbon energy consistent with wider environmental and rural objectives • Encourage the recovery of energy from waste [as part of the waste hierarchy]	• Total greenhouse gas emissions • Carbon equivalent emissions by sector • Soil carbon [see SOIL] • Electricity use from renewable energy sources • Distribution of land use by type [see LAND USE PLANNING] • Flood risk • Landfill methane emissions • No. and type of livestock and long-term trends [proxy for methane emissions from farm animals] • [and see AIR]
	To adapt effectively to climate change	• Respond to predicted climatic change through adaptation • Ensure access to housing with good environmental standards and ensure high environmental standards are met for buildings • Reduce flood risk and the effects of drought	

Source of further information:

- Environment Report of the SEA of the Wales Rural Development Programme 2007-2013: http://wales.gov.uk/topics/environmentcountryside/farmingandcountryside/ruraldevelopment/?lang=en
- Scoping report: http://wales.gov.uk/docs/drah/publications/100610appendix3studyen.pdf
- Non-Technical Summary and Environment Report (separate) of the Wales Rural Development Programme 2007 – 2013: http://wales.gov.uk/topics/environmentcountryside/farmingandcountryside/ruraldevelopment/ruraldevelopmentplan4wales2007/?lang=en

Case study 3: Via Baltica – biodiversity and SEA lessons learned

Country / location:
Poland.

Key message:
Lack of consideration of biodiversity issues up front the scoping stage of the SEA of the relevant programme resulted in a failure to develop and assess suitable alternatives for the project, and led to a formal complaint being made against the programme (at the project level) which eventually halted construction. Alternative routes were assessed and agreed upon later, but the process resulted in several years of delay and considerable added cost. There have also been concerns that the wider strategic project is being 'salami sliced'; into smaller project to mask the total impact of the programme.

Type and description of project:
Via Baltica was an extensive road project that was planned to run from Warsaw (Poland) to Helsinki (Finland) via Estonia, Latvia and Lithuania as part of a Central / Eastern Europe transport network. An SEA process was undertaken for the route as a whole and a number of separate EIAs were conducted for different parts of the road. This practice has been identified by Birdlife International as an example of 'salami slicing' by dividing a single large scale strategic programme into a number of smaller projects, the intention being to reduce the apparent total impact of the programme. This case study is only focussed on the Via Baltica section within Poland, and in particular the section routed through the internationally important Augustow Forest which is part of the protected Natura2000 Network.

The Polish Government had claimed that the assessment of potential damage, consideration of alternatives and compensatory measures undertaken was compliant with the SEA, EIA and Natura2000 Network Directives. This has subsequently found to not be the case through the investigations of a number of NGOs – lead, primarily by Birdlife International, in particular the assessment of alternatives was found to be inadequate. The NGOs lobbied the Government to find alternative routes to avoid irreparable damage to these internationally important habitats and species. This advice was ignored and the initially proposed route was still preferred by the Government, this resulted in a formal complaint with the European Commission was lodged by the NGOs against the Government. This was not acted upon and construction started – the Commission subsequently referred the case to the European Court of Justice and asked for an urgent order to stop the project – this was subsequently given (April 2007) and construction was forcibly halted.

Particular fault was found with the consideration of alternatives as per the SEA Directive; in particular the lack of consideration of alternative routes undermined the Government's stated case regarding overriding public interest as per the Habitats Directive.

In 2009 a number of roundtables were conducted with the Government, nature NGOs and other stakeholders to determine possible alternative routes avoiding the protected sites. This was supported ultimately by an SEA process which identified possible alternative routes, see figure above. In October 2009 the Government agreed to follow the recommendations and adopted an alternative route; bypassing the majority of the protected sites.

Elements of good practice / key lessons from the SEA:
This is not an example of good practice; rather it serves as an example of the implications of not properly incorporating biodiversity within screening, scoping and the consideration of alternatives. This can be ultimately attributed to a lack of early and effective engagement.

- Interrelationship between EIA, SEA and the Natura2000 network and assessment. In particularly consideration of alternatives in SEA is a key stage in avoiding potential impacts to protected Natura2000 sites.
- Ineffective scoping meant that the presence of protected species such as the Greater Spotted Eagle, Corncrake and Aquatic Warbler was not identified as significant and integrated into

Case study 3: Via Baltica – biodiversity and SEA lessons learned

the development of alternatives. This was symptomatic of a lack of proper investigation of biodiversity concerns resulting in a failure to generate sufficient alternatives. Preliminary screening exercises should have identified these (and other) protected species and the potentially significant consequences of the project and supported the development of alternatives.

- The effects of the project would be beyond the direct footprint of the road, the changes in migration, morphology; water flow and noise are all likely to have negative effects on the immediate environment and due to the importance of these particular habitat species movements and fitness internationally. Only by considering these cumulatively can the true potential impact of the project be accurately considered.
- This example makes clear the status and importance of biodiversity stakeholders and therefore the need for effective early engagement to highlight their concerns and respond in a timely manner. In this instance a lack of early engagement with biodiversity stakeholders (who would have identified these issues) leading to a series of actions which ultimately cost to project and proponents a significant amount of resources. Ultimately by working together the key stakeholders have produced a negotiated solution.

Source of further information:

- Construction of the 'Via Baltica' Motorway (2003) – Report presented by NGOs to Council of Europe: https://wcd.coe.int/wcd/com.instranet.InstraServlet?command=com.instranet.CmdBlobGet&InstranetImage=1326730&SecMode=1&DocId=1440682&Usage=2
- Follow–up of Recommendation No. 108 (2003) Construction of the 'Via Baltica' Expressway in Poland (2004) – presented by NGOs to Council of Europe: https://wcd.coe.int/wcd/com.instranet.InstraServlet?command=com.instranet.CmdBlobGet&InstranetImage=1326964&SecMode=1&DocId=1450596&Usage=2
- Poland's Government spares threatened wildlife from road development: http://www.rspb.org.uk/news/details.asp?id=tcm:9-232944
- Audio – visual presentation of the case study to honour Goldman Prize for Environment 2010: http://www.youtube.com/watch?v=Hgd93rxQyfY&feature=player_embedded
- Delight as Polish court gives road development a 'red light': http://www.rspb.org.uk/news/details.asp?id=tcm:9-178409
- Birdlife International concerns over salami slicing (page 63): http://www.birdlife.org/eu/pdfs/TEN_T_report2008_final.pdf
- Via Baltica - Poland's nature under threat: http://www.birdlife.org/eu/EU_policy/Birds_Habitats_Directives/casework_via_baltica.html

Case study 4: SEA of the Strategy for Wild Deer in Scotland

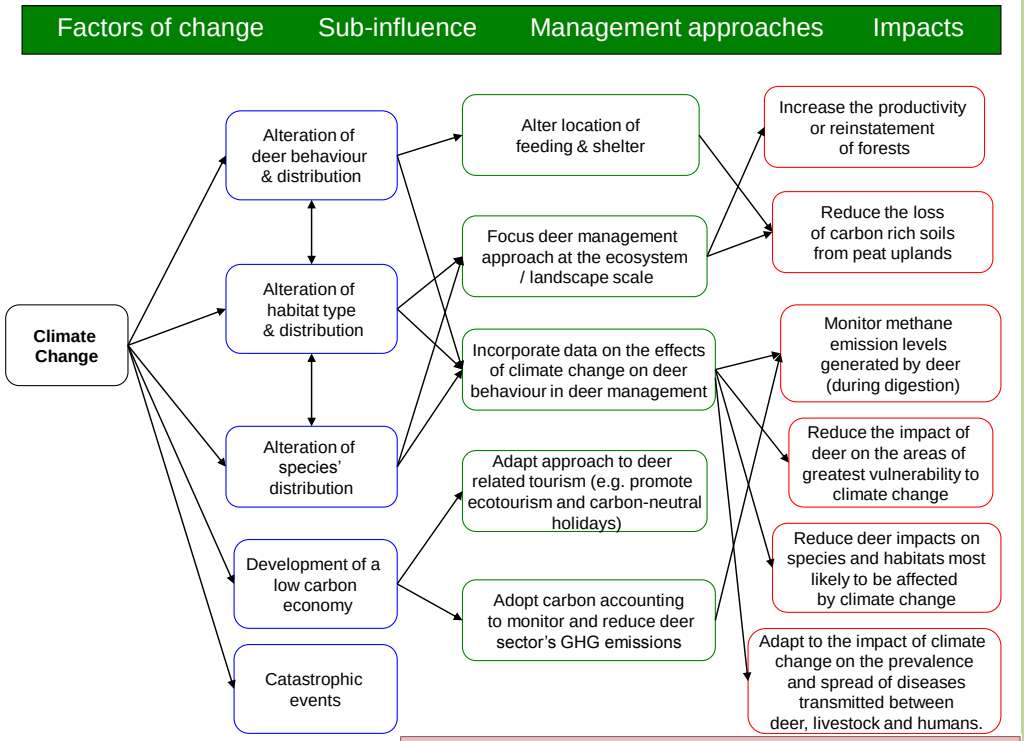
Country / location:
SEA of a Scotland wide strategy

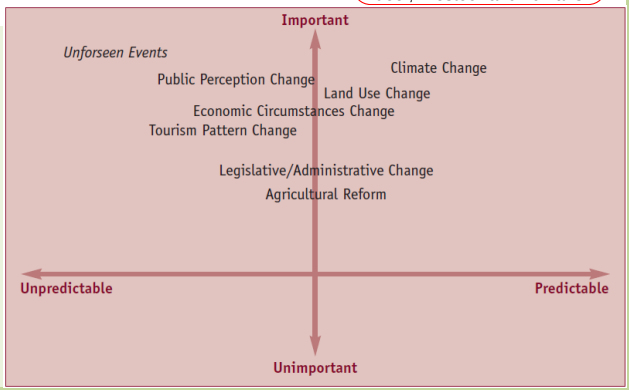
Relevant to:
- Use of network (causal change) analysis
- Consideration of alternatives
- Use of futures thinking and managing uncertainty
- Consideration of climate change and biodiversity

Key message:
Causal chain analysis is an effective approach for considering complex long term issues (such as climate change and biodiversity). In particular this case study shows that it useful for bringing together stakeholders and the identification of various alternative management options.

Elements of good practice / key lessons from the SEA:
The strategy sought to provide a long term vision for the effective management of wild deer across Scotland – the SEA process facilitated many elements of this, in particular providing a medium for cross-departmental and agency engagement. The SEA also sought to provide the opportunity to consider pertinent long term drivers and challenges, how these may have been expected to impact on the objectives of the Strategy and how the Strategy could respond.

Section 6 of the SEA report (p.40) explores 'a suite of alternative approaches to managing wild deer, which could enable the Strategy to respond to future changes and unexpected or unforeseen events'. The first stage of this exploration of future scenarios involved bringing together stakeholders involved in delivering the plan from a range of related departments as well as independent experts to consider the relative importance and predictability of various factors of change. This took the form of a brain storming session and led to the population of a diagram of the main potential long term drivers in terms of those that were most important and certain/uncertain (predictable/unpredictable) (see figure above).





As indicated in the figure the top three drivers (climate change, land use change and public perception change) based on a combination of their importance and predictability were then subject to network (causal chain) analysis. This is an approach that seeks to consider various drivers and identify through qualitative assessment their likely environmental (or other) impacts. Within the SEA this involved bringing together various stakeholders and experts and considering and linking the various elements of the system. The network diagram was based on the relationships between the:

- **Driver:** as identified via brainstorming with stakeholders;

Case study 4: SEA of the Strategy for Wild Deer in Scotland

- **Factors of Change:** the possible broader impacts of the driver;
- **Sub-influence:** impacts specific to the strategy (or plan or programme) due to the factors of change (and ultimately the driver);
- **Management Approach:** what alternatives are available for the strategy (or plan or programme) to adapt and respond to the sub-influences; and,
- **Impacts:** what are the likely final impacts on the ground in relation to the Strategy (or plan or programme).

See figure above for worked example, all the examples are presented in Appendix 14 of the Environmental Report (see source of further information below).

The completed causal chains provide a systematic and transparent means of understanding better how the Strategy might be implemented and also what the likely impact on the ground may be. This process aided the identification and assessment of the potential environmental effects of the strategy as well as identifying various alternative management options whilst retaining its integrity as a strategic plan. It was felt to be a particularly effective tool for the consideration of climate change impacts.

Source of further information:

- Environment Report is available here: http://www.dcs.gov.uk/information/Section%20Content/wDNa.aspx
- Appendices are available here: http://www.dcs.gov.uk/information/Publications/Compiled%20Appendices%20-%20Socio-Economic%20Assessment%20Report.pdf

Case study 5: SEA of the Thames Estuary 2100 Plan for Flood Risk Management

Country: United Kingdom

Relevant to:

- Assessment of alternatives
- Monitoring
- Long-term horizon for climate change
- Dealing with uncertainty

Key Message

The integration of climate change and biodiversity into SEA requires long-term thinking and a dedicated approach to dealing with uncertainty. This can be approached in a number of ways, such as developing a range of potential alternatives for the longer term, and putting in place sound monitoring arrangements to improve adaptive capacity.

Picture: UK Environmental Agency, 2009.

Introduction:

The TE2100 Plan is a long-term flood risk management strategy for the Thames river area. It has been developed by the UK's Environment Agency in response to the gradual deterioration of flood defences in the tidal Thames and the potential for increases in the frequency and severity of flooding due to projected socio-economic and climate change. Alongside its development, this plan has undergone an SEA that is a source of a number of good practices for integrating biodiversity and climate change adaptation in the assessment process.

Good practices to be learnt from this case study:

As the plan itself is about developing responses to long-term risks that partly stem from projected climate change impacts, the SEA defined climate change adaptation as one of its main objectives from the start. According to the TE 2100 Plan's environmental report, this involved "reducing and managing water levels and flood risk resulting from climate change (alone or in combination with other responses)" and avoiding the creation of "significant constraints on future choices in integrated flood risk management". Another of the SEA's main objectives was related to enhancement and restoration of estuarine ecosystems to contribute to biodiversity targets and to maximise the environmental benefits of natural floods.

The inclusion of climate change adaptation constraints as well as biodiversity preservation concerns among the SEA's main objectives is relevant in three different ways.

- First, by designating biodiversity and climate adaptation as key concerns up front, during a scoping stage, the SEA contributes to climate change and biodiversity "proofing" of early conceptual and strategic policy options.
- Second, this SEA demonstrates an approach to dealing with long-term horizons and their inherent uncertainties. Given that the TE 2100 plan covers the period through the year 2100, assessment of long-term impacts and options are obviously required for the SEA. The SEA acknowledges this uncertainty directly; the environmental report warns that there is considerable uncertainty with regard to climate change impacts on the plan's objectives, and that that potential long-term options may need to be reassessed (e.g. in terms of relative cost) as this uncertainty diminishes. As a result, two "front-runner" options are proposed for the post-2065 period instead of a single preferred option (which was the case for the period to 2065).
- Third, the SEA highlights the importance of monitoring the plan, given its long-term focus and the inherent uncertainty. The use of monitoring provisions has consistently been identified as a weakness in SEAs, and one that is particularly relevant for complex and often uncertain issues like climate change adaptation and biodiversity, as monitoring injects flexibility into plans and strengthens their adaptive capacity. The TE 2100 SEA report states that monitoring will help to achieve "timely adaptation of the plan in response to changes in how the Estuary responds to both climate change and the flood risk management approaches." Among the aspects that the SEA expects to monitor are: impacts of flood risk management

Case study 5: SEA of the Thames Estuary 2100 Plan for Flood Risk Management

measures and sea level rise (which will provide an indication of the biodiversity effects and help determine whether habitat replacement measures are correctly aligned with the rate and scale of habitat loss); health and stability of the intertidal habitat; and "climatic factors" as measured by mean sea level rise, peak surge tide level and peak river flood flows.

Sources of further information:

- Environment Agency: Thames Estuary 2100 Strategic Environmental Assessment Environmental Report Summary, April 2009: http://www.environment-agency.gov.uk/static/documents/Leisure/TE2100_EnvironmentSum.pdf
- TE2100 Flood Risk Management Plan: http://www.environment-agency.gov.uk/research/library/consultations/106100.aspx

Case study 6: A methodology for assessing the effects infrastructure plans on biodiversity – the Spanish 2000-2007 transport infrastructure development plan

Country: Spain

Relevant to:

- Scoping
- Ecosystems approach
- Assessment of alternatives

Key message:

SEO Birdlife has developed a methodology to accurately determine the relevance of territories for biodiversity conservation. This methodology, which has been developed for SEAs of large-scale infrastructure plans, was applied to the Spanish 2000-2007 transport infrastructure plan and a case study developed. It concluded that SEAs cannot limit themselves to consideration of the effects of plans and programmes on protected areas or even networks of protected areas, as the preservation of these depends upon the quality of their surroundings. SEAs for large-scale infrastructure development plans in particular must contribute to conserving biodiversity outside the system of protected areas and promoting biological connectivity by adopting a scope that is commensurate to the plan's potential impact.

Picture: www.omoniatrans.gr

Methodology for assessing the effects of large transport infrastructure development plans on biodiversity

Ahead of the entry into force of the Spanish transposition of the SEA Directive, SEO Birdlife proposed a methodology to accurately determine the relevance of territories for biodiversity conservation which can be used in SEAs of infrastructure development plans. It proceeds by establishing an inventory of "sensitive zones" and then estimating the proportion of these zones that are likely to be affected by a given plan. To illustrate its approach, this methodology was applied to the Spanish 2000-2007 transport infrastructure plan (*Plan de Infraestructuras de Transporte, PIT*) and its results were presented in a case study. Due to resource constraints, only high speed railway lines and high-capacity motorways were considered. Birds and mammals are the two main fauna groups used as indicators, as they spread through a large number of habitats and are responsive to the impact of linear infrastructure development. The methodology has a qualitative as well as a quantitative component.

Qualitative analysis

The qualitative analysis identifies "sensitive zones" that could be affected by the construction and exploitation of infrastructure foreseen in the plan (railways and motorways are assessed separately). It calculates the number of planned infrastructure kilometres running through: sensitive zones defined as important bird areas (IBA); important mammal areas; and sites of Community interest. Important bird and mammal areas are defined as being "home to biologically sustainable populations and belong to a broader, integrated scheme for the conservation of biodiversity". These are inventoried on the basis of methodological criteria that draw on publicly available sources and specialised literature.

For bird areas, these criteria include size and state of conservation as well as the level of the extinction threat (if any). SEO Birdlife concluded that only 7,377,173 ha. out of the 15,829,729 ha. of IBA identified in Spain were in fact legally protected. Data for this calculation stemmed from *European Bird Populations: Estimates and Trends*, published by Birdlife International and the European Bird Census Council in 2000, *and Birds in Europe: their conservation status* (Tucker and Heath, 1994).

Important mammal areas were identified according to two main criteria:

Case study 6: A methodology for assessing the effects infrastructure plans on biodiversity – the Spanish 2000-2007 transport infrastructure development plan

- The degree to which species are natural to or characteristic of a particular place(endemism), which is correlated with the risk of extinction
- The priority level of the conservation of these species

Sources for the assessment of these parameters included the *Red List of Threatened Species* of the International Union for the Conservation of Nature (IUCN) as well as the Spain-specific version of this list; annexes to both the "Habitats" Directive and the Bern Convention on the Conservation of European Wildlife and Natural Habitats; and *Mamíferos Terrestres de España* (Palmo and Gisbert, 2002).

Quantitative analysis

While the qualitative analysis appropriately accounts for the size of species' populations and the extent of the threats to endangered species, it neglects other important aspects. For example, areas may require preservation even if they are not home to particularly large populations of endangered species. The SEO Birdlife methodology therefore proposes to fill this gap by means of a quantitative analysis on the basis of 100 sq. km territorial units.

This analysis encompasses three variables:

- Number of species
- How rare the species living in a given territory are (the rarer the species, the less resilient to extinction threats)
- "Interest for conservation", defined, for each species, as a function of the degree of the extinction threat and the relative share of the Spanish population of that species in the European and Global total populations

A composite "importance" indicator is then proposed for each unit. The territorial units in the top 25% that are within the plan's scope are deemed to be "sensitive zones".

In the case of birds, an additional step is built into the analysis that seeks to identify which species are more likely to be affected by the plan's interventions. This is done by calculating the proportion of each species' distribution area that would be affected by the plan's interventions. To do so, the SEO Birdlife methodology refers to Annex I of the Birds Directive; the 20% species of the highest conservation priority; and regional catalogues of endangered species.

To test the methodology in practice, the number of kilometres of sensitive areas actually impacted by the four infrastructure developments already carried out withn the transport strategy was compared to the number of kilometres that would have been affected according to the plan's initial layout.

Limitations of the proposed methodology and future improvements of SEA

SEO Birdlife points out certain caveats that need to be taken into account when applying this methodology:

- There are significant information gaps, notably regarding total population sizes and distribution areas of many species, levels of conservation priority (which at the time only existed for birds and mammals), real impacts (run-overs, disturbances).
- The proposed criteria alone are insufficient to fully assess impacts. This is due to the lack of information about delayed effects as well as to the lack of detail in most strategic-level infrastructure plans (i.e. some features remain unknown, such as the presence of bridges, tunnels, etc.). EIAs at project level are therefore required as a complement.
- Focusing on the number of km affecting sensitive areas is not enough to carry out a comprehensive SEA, as specific thresholds or absolute assessment criteria cannot be developed out of it. In addition, 100 sq. km units may not appropriately account for some direct effects, which often occur within a range of 200m to 500m around the layout of linear infrastructures.

Case study 6: A methodology for assessing the effects infrastructure plans on biodiversity – the Spanish 2000-2007 transport infrastructure development plan

Conclusions of the application of the Methodology to the Spanish 2000-2007 Transport Infrastructure Plan

- 18.5% of the plan's foreseen infrastructure developments were out of compliance with legal requirements for protected biodiversity sites. In addition, 2.314 km of important bird areas and 3.157 km of important mammal areas, as defined by SEO Birdlife through its qualitative analysis, were not under legal protection at the time.
- The Plan's 28 foreseen interventions were ranked according to the number of sensitive areas (as defined by the methodology) that they were likely to affect.
- The assessment of alternatives was recommended for a number of interventions in order to "solve the conflict between the plan's objectives and those of areas of high environmental value." It also highlighted that direct effects of the plan's interventions needed to be considered along with their indirect or differed effects, for which there were significant information gaps.

Sources of further information:

Evaluación estratégica ambiental del Plan de Infraestructuras de Transporte 2000-2007 sobre el medio natural: metodología y limitaciones. SEO Birdlife (undated).
Bern Convention on the Conservation of European Wildlife and Natural Habitats: http://www.coe.int/t/dg4/cultureheritage/nature/bern/default_en.asp
The IUCN Red List of Endangered Species: http://www.iucnredlist.org

Case study 7: SEA Waste Management Plan of the Plzen Region

Possible case study to add

Country / location:
Czech Republic

Relevant To
- Climate Change
- Biodiversity

Key Message:

Elements of good practice / key lessons from the SEA:
SEA of the Waste Management Plan of the Plzen Region (WMP-PL). The Plan was initiated in 2002 as the first strategic document for integrated waste management in the region. WMP-PL follows objectives and measures for management of the main categories of waste as set out in the national Waste Management for the Czech Republic. The focus was not on developing a separate SEA document but rather on providing input into various stages of the planning and into supporting the comparison of alternatives within the plan.

Four technical alternatives were identified as being potentially suitable; having identified these alternatives the SEA and project teams developed a range of indicators that would be used to assess the potential effects of each of the four alternatives. This involved using a matrix of various the waste management technologies involved in each alternative (y axis), and their environmental impact on a range of environmental topics (x axis) including their impact on mitigating climate change and ecosystems. Each of the waste management technologies was then assessed for its potential to contribute to the enhancement or degradation of the environmental topics on a +3 to -3 scale. This matrix informed the assessment of the alternatives based on a similar matrix including the same environmental topics

Source of further information:
TBC