European Commission

Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment

Environment

A great deal of additional information on the European Union is available on the Internet.
It can be accessed through the Europa server ([redacted]

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Foreword

The need for action on climate change and biodiversity loss is recognised across Europe and around the world. To make progress towards combating and adapting to climate change, and halting the loss of biodiversity and the degradation of ecosystems, it is vital to fully integrate these issues in the plans, programmes and projects implemented across the EU.

It is widely recognised that climate change has enormous economic consequences. The evidence gathered in the *Stern Review on the Economics of Climate Change* (2006) shows that 'ignoring climate change will eventually damage economic growth.' The Review also points out that 'the benefits of strong and early action far outweigh the economic costs of not acting'. The Commission's *White Paper – Adapting to climate change: Towards a European framework for action* (2009) tackles this evidence and includes a commitment that '… the Commission will work with Member States and stakeholders setting guidelines and exchanging good practice, to ensure that account is taken of climate change impacts when implementing the Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) Directives and spatial planning policies.' It also encourages Member States to adopt ecosystem-based approaches, including green infrastructure. The Commission's *EU Strategy on Adaptation to Climate Change*, to be adopted in 2013, will build on the White Paper.

The loss of biodiversity has become one of our main environmental challenges. Its impact on the delivery of ecosystem services, society and the economy as a whole is increasingly recognised, including in the international study by TEEB (2010) of The Economics of Ecosystems and Biodiversity — *Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations*. To address this challenge, Member States have committed themselves to halting the loss of biodiversity and ecosystems by 2020 and to restoring them in so far as feasible.

This *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment* is a response to the above commitments. Since climate change and biodiversity loss — like so many other environmental issues we face — are closely related, they are covered in the same guide.

It is clear that 'business as usual' will neither achieve our climate change nor our biodiversity objectives. The time has come to make sure that we employ all available tools to tackle these global threats. Environmental Impact Assessments (EIAs) and Strategic Environmental Assessments (SEAs) are legally-required and systematic tools, and as such are well suited to tackling these problems. The Commission's proposal for a revised EIA Directive adopted on 26 October 2012 also introduced amendments to adapt to these challenges (i.e. biodiversity and climate change, as well as disaster risks and availability of natural resources).

As José Manuel Barroso, President of the European Commission, said at the Athens Biodiversity Conference in 2009 – 'The success of our climate change policy will also be measured by the success of our efforts in stopping the loss of biodiversity.' Our aim is that this guide will help the impact assessment community to better integrate these issues into their work, stepping up global and EU action to combat biodiversity loss and climate change.

Contents

Acronyms and abbreviations

BAP	Biodiversity Action Plan
BISE	Biodiversity Information System for Europe
CBD	Convention on Biological Diversity
CH_4	Methane
CO_2	Carbon dioxide
EC	European Commission
ECCP	European Climate Change Programme
EEA	European Environment Agency
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ETC/ACM	European Topic Centre for Air Pollution and Climate Change Mitigation
ETC-BD	European Topic Centre for Biological Diversity
EU ETS	EU Emissions Trading System
EU	European Union
GHG,GHGs	Greenhouse gas, Greenhouse gases
GIS	Geographical Information System
IAIA	International Association for Impact Assessment
IEMA	Institute of Environmental Management and Assessment
IPCC	Intergovernmental Panel on Climate Change
JRC	Joint Research Centre
NBSAP	National Biodiversity Strategy and Action Plan
NGOs	Non-governmental organisations
NO_x	Nitrogen oxides
N_2O	Nitrous oxide
OECD	Organisation for Economic Cooperation and Development
PP, PPs	Plan or Programme, Plans and/or Programmes
SACs	Special Areas of Conservation
SEA	Strategic Environmental Assessment
SOER	State of the Environment Report
SPAs	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
VOCs	Volatile organic compounds

Glossary

Term	Definition
Adaptation (climate change)	The term used to describe responses to the effects of climate change. The Intergovernmental Panel on Climate Change (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 learning how to live with the consequences of climate change.
Adaptive capacity	The ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities and to cope with the consequences. [redacted]
Adaptive management	A systematic process for continually improving management policies and practices by learning from the outcomes of previously implemented policies and practices.
Article 6(3) on appropriate assessment	Article 6(3) of the Habitats Directive requires an appropriate assessment (also referred to as 'Habitats Directive assessment' or 'Natura 2000 assessment') to be carried out where any plans or projects that are not directly linked to the management of that site may have a significant effect on the conservation objectives and would ultimately affect the integrity of the site. Integrity can be defined as the ability of the site to fulfil its function to continue to support protected habitats or species. Annex I to the Habitats Directive includes a full list of protected habitats and Annex II of protected species.
Baseline	A description of the present and future state if the project is not implemented, taking into account changes resulting from natural events and other human activities.
Biodiversity	'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 of the Convention on Biological Diversity).
Biodiversity offsets	Measurable project outcomes designed to compensate for significant residual adverse impacts of development plans or projects on biodiversity, after appropriate prevention and mitigation measures are taken.
Birds Directive	Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds [codified version], OJ L 20, 26.1.2010, p.7.
Carbon sequestration	The removal of carbon from the atmosphere and its storage in carbon sinks (such as oceans, forests or soil). Carbon sequestration is achieved through physical or biological processes, such as photosynthesis.
Carbon sink	An absorber of carbon (usually in the form of CO2). Natural carbon sinks include forests and other ecosystems that absorb carbon, thereby removing it from the atmosphere and offsetting CO2 emissions. (Modified from [redacted]
Climate	Usually defined as the 'average weather', or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities of variables such as temperature, precipitation, and wind, over a period of time. The conventional period of time over which weather is averaged to calculate climate is 30 years, as defined by the World Meteorological Organisation (WMO). (Modified from [redacted]
Climate change	IPCC defines climate change as '... any change in climate over time, whether due to natural variability or as a result of human activity.' The United Nations Framework Convention on Climate Change (UNFCCC) defines it 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'.
CO_2 equivalent	A metric measure used to compare emissions of various greenhouse gases (GHGs) based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as 'million metric tonnes of carbon dioxide equivalents (MMTCDE)'.
Cumulative effects	The incremental effects of an action when added to the effects of past, present, and reasonably foreseeable future actions. Cumulative effects result from individually minor but collectively significant actions taking place over a period of time.
Direct effects	Environmental effects directly caused by the preparation, construction or operation of a project in a particular location.
Disaster risk management plan	A document that sets out goals and specific objectives for reducing disaster risks and includes a list of actions needed to accomplish them. It can be prepared by an authority, sector, organisation or enterprise.

Ecosystem services	Ecosystems serve 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 on the natural environment. The European-led study builds on the United Nations Millennium Ecosystem Assessment, which defined four categories of ecosystem services that contribute to human well-being: • provisioning services e.g. wild foods, crops, fresh water and plant-derived medicines; • regulating services e.g. filtration of pollutants by wetlands, climate regulation through carbon storage and water cycling, pollination and protection from disasters; • cultural services e.g. recreation, spiritual and aesthetic values, education; • supporting services e.g. soil formation, photosynthesis and nutrient cycling.
Effort Sharing Decision	A decision that sets annual binding greenhouse gas (GHG) emission targets for Member States for the 2013–2020 period. These targets concern emissions from sectors not included in the EU Emissions Trading System (ETS), such as transport, construction, agriculture and waste.
EIA Directive	Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment [codification], OJ L 26, 28.1.2012. The EIA Directive requires Member States to ensure that projects likely to have significant effects on the environment because of their nature, size or location are subject to an assessment of their environmental effects, before development consent is given.
Emissions trading scheme and **EU Emissions Trading System (EU ETS)**	A market mechanism that allows those bodies (such as countries, companies or manufacturing plants) that emit/release GHGs into the atmosphere to buy and sell these emissions (as allowances) amongst themselves. Emissions mean the release of GHGs and/or their precursors into the atmosphere over a set area and period of time. The European Union Emissions trading system (EU ETS) is based on the idea that creating a price for carbon offers the most cost-effective way to achieve the significant cuts in global GHG emissions that are needed to prevent climate change from reaching dangerous levels.
Environmental limits	Following the publication of the Millennium Ecosystem Assessment, it is widely accepted that ecosystems provide a range of benefits. External pressures (e.g. pollution) may impact ecosystems and diminish ecosystem services. In the long run, the system may reach a tipping/critical point beyond which the reduction in benefit is no longer acceptable or tolerable. Such a critical level can best be described as an **environmental limit**. There are several frequently used terms that fall within the category of environmental limits, including: • **Threshold** (also referred to as a biophysical threshold or a tipping point): a tolerance point at which the conditions necessary to maintain a prevailing ecosystem state are exceeded (e.g. pollutant levels may have a small effect until a critical point is reached and the impact becomes significant); and • **Carrying capacity**: the concept that a particular system could indefinitely sustain a particular intensity of use providing it is at its capacity or use limit, but, beyond this, additional pressure would produce undesirable resource degradation.
European Climate Change Programme	A programme launched by the European Commission in June 2000. Its goal is to identify and develop all the necessary elements of the EU strategy for implementing the Kyoto Protocol.
Fauna	The animals of a particular region or habitat.
Flora	The plants of a particular region or habitat.
Green infrastructure	Green infrastructure serves the interests of both people and nature. It can be defined as a strategically planned and delivered network of high quality green spaces and other environmental features. It should be designed and managed as a multifunctional resource capable of delivering a wide range of benefits and services. Green infrastructure includes natural and semi-natural areas, features and green spaces in rural and urban, terrestrial, freshwater, coastal and marine areas. Areas protected as Natura 2000 sites are at the core of green infrastructure.
Greenhouse gas (GHG)	Any atmospheric gas (either natural or anthropogenic in origin) which absorbs thermal radiation emitted by the Earth's surface. This traps heat in the atmosphere and keeps the surface at a warmer temperature than would otherwise be possible.
Habitats Directive	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, as amended, OJ L 206, 22.7.1992, p.7.
Indirect effects/impacts	Effects/impacts that occur away from the immediate location or timing of the proposed action, e.g. quarrying of aggregates elsewhere in the country as a result of a new road proposal, or as a consequence of the operation of the project (see also secondary effects).
Kyoto Protocol	The Kyoto Protocol was adopted at the Third Session of the Conference of the Parties (COP) to the UNFCCC in Kyoto (Japan) in 1997. It contains legally binding commitments. Countries included in Annex B of the Protocol (most OECD countries and Economies in Transition countries) agreed to reduce their anthropogenic emissions of GHGs (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6) by at least 5 % below 1990 levels between 2008 and 2012.
Maladaptation	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 increase vulnerability in the medium- to long-term.

Maximum sustainable yield (MSY)	Maximum sustainable yield (MSY) is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions.
Mitigation (climate change)	A term used to describe the process of reducing GHG emissions that are contributing to climate change. It includes strategies to reduce GHG emissions and enhance GHG sinks.
Mitigation (EIA)	Measures to 'prevent, reduce and where possible offset any significant adverse effects on the environment'. (EIA Directive)
Natura 2000	An EU-wide network of nature protection areas established under the Habitats Directive. The aim of the network is to ensure the long-term survival of Europe's most valuable and threatened species and habitats. It is comprised of Special Areas of Conservation (SAC) designated by Member States under the Habitats Directive and Special Protection Areas (SPAs) designated under the Birds Directive.
No-regret measures	'No-regret' measures are activities that yield benefits even in the absence of climate change. In many locations, implementing these actions constitutes a very efficient first step in a long-term adaptation strategy. For example, controlling leakages in water pipes or maintaining drainage channels is almost always considered a very good investment from a cost–benefit analysis point-of-view, even in the absence of climate change. Improving building insulation norms and climate-proofing new buildings is another typical example of a no-regret strategy, since it increases climate robustness and any additional cost can be paid back within a few years. Once no-regret measures have been identified, it is important to know why they are not yet implemented. Reasons can include: (i) financial and technological constraints; (ii) lack of information and transaction costs at the micro-level; and (iii) institutional and legal constraints. These obstacles can be addressed through adaptation planning, as a first step in a long-term adaptation strategy. [redacted]
Proxy indicator	Indirect measure that approximates or represents a phenomenon in the absence of a direct measure.
Public	One or more natural or legal persons, and, in accordance with national legislation or practice, their associations, organisations or groups. (EIA Directive)
Public concerned	The public affected or likely to be affected by, or having an interest in, the environmental decision-making; for the purposes of this definition, non-governmental organisations promoting environmental protection and meeting any requirements under national law are included.
Residual effects	Effects that remain after mitigation action.
Resilience	The ability of a social or ecological system to absorb disturbances, while retaining the same basic structure and ways of functioning, as well as its capacity to self-organise and adapt to stress and change. There are different ways in which resilience can be framed; the Dutch Climate Changes Spatial Planning research programme provides a [redacted] (Adapted from [redacted]
Risk	The probability that something will cause injury or harm.
Scoping	The process of determining the scope and level of detail of an EIA, 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 project requires an EIA.
SEA Directive	Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment, OJ L 197, 21.7.2001, p.30. The SEA Directive requires that the environmental effects of a broad range of plans and programmes (PPs) are assessed and taken into account while PPs are still being developed. The public must be consulted on the draft PP and environmental assessment, and their views must be taken into account.
Secondary effects	Effects that occur as a consequence of a primary effect or as a result of a complex pathway (see also indirect effects).
Sensitivity	The degree to which a system is affected, either adversely or beneficially, by climate-related stimuli. The effect may be direct (e.g. a change in crop yield in response to a change in the temperature) or indirect (e.g. damages caused by more frequent coastal flooding due to rising sea levels).
Short-term effects	Effects that may occur during construction stage of a development, e.g. the increased traffic going to and from the site during the construction period.
Significant effects	Effects that are significant in the context of the project, i.e. a function not just of magnitude or size of effect, but of the nature, sensitivity and scale of the receptor.
Synergistic effects	Effects that interact to produce a total effect greater (or less than) than the sum of the individual effects.
Vulnerability	The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity.

Summary

The *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment* aims to help Member States improve the way in which climate change and biodiversity are integrated in Environmental Impact Assessments (EIAs) carried out across the EU. This summary gives a brief overview of the guidelines and recommendations presented in the document.

Section 1 contains an introduction explaining the purpose, identifying the target audience and presenting an overview of the contents, to help readers decide when and how to use the guidance. Sections 2 and 3 explain why climate change and biodiversity are so important in EIA and present the relevant EU-level policy background. Section 4 provides advice on how to integrate climate change and biodiversity into selected stages of the EIA process. The annexes provide sources of further reading and links to other relevant information, data, and tools.

The boxes below summarise the main ways of incorporating climate change and biodiversity into EIA. The information has been organised according to four headings, which do not match the structure of the document, but reflect the key messages that appear throughout the guidance.

HOW TO INCORPORATE CLIMATE CHANGE AND BIODIVERSITY INTO EIA:

- **Build them into the assessment process at an early stage (screening and scoping):**
  - You will be more likely to include them in the rest of the EIA process;
  - They will be built into the mindset of all key parties involved, including authorities and policymakers, planners, EIA practitioners, etc.
- **Tailor how you incorporate biodiversity and climate change to the specific context of the project:**
  - It is not a matter of simply ticking off items on a checklist. Every EIA is different.

HOW TO IDENTIFY CLIMATE CHANGE AND BIODIVERSITY ISSUES IN EIA:

- **Bring together all the relevant stakeholders who need to be part of biodiversity/ecosystems-related and climate change-related decision-making:**
  - Let the stakeholders help identify the key climate change and biodiversity issues early in the process;
  - Design the engagement process and select the best tools for your particular situation. Consider the needs of the EIA and of climate change and biodiversity in particular.
- **Understand how both climate change and biodiversity interact with other issues to be assessed in the EIA, as well as with each other.**

CRITICAL CHALLENGES FOR ADDRESSING CLIMATE CHANGE AND BIODIVERSITY IN EIA:

- **Consider the impact that predicted changes in climate and biodiversity will have on the proposed project, potentially over a long timescale, and the project's resilience and capacity to cope.**
- **Consider long-term trends, with and without the proposed project, and avoid 'snapshot' analyses.**
- **Manage complexity.**
  - For example, introducing an element such as climate change mitigation would usually be positive, but it might have a negative impact on climate change adaptation and/or biodiversity.
- **Consider the complex nature of climate change and biodiversity and the potential of projects to cause cumulative effects.**
- **Be comfortable with uncertainty, because you can never be sure of the future.**
  - Use tools such as scenarios (for example, worst-case and best- case scenarios) to help handle the uncertainty inherent in complex systems and imperfect data. Think about risks when it is too difficult to predict impact.
- **Base your recommendations on the precautionary principle and acknowledge assumptions and the limitations of current knowledge.**
- **Be practical and use your common sense! When consulting stakeholders, avoid drawing out the EIA procedure and leave enough time to properly assess complex information.**

HOW TO ASSESS EFFECTS RELATED TO CLIMATE CHANGE AND BIODIVERSITY IN EIA:

- **Consider climate change scenarios at the outset:**
  - Include extreme climate situations and 'big surprises', which may either adversely affect the implementation and operation of a project or worsen its impact on biodiversity and other environmental aspects.
- **Analyse the evolving environmental baseline trends:**
  - Include trends in key issues over time, drivers for change, thresholds and limits, areas that may be particularly adversely affected and key distributional effects.
  - Use vulnerability assessment to help assess the evolution of the baseline environment and identify the most resilient alternative(s).
- **Take an integrated approach to planning and assessment, investigating relevant thresholds and limits.**
- **Seek to avoid biodiversity and climate change effects from the start, before considering mitigation or compensation. For biodiversity, EIA should focus on ensuring 'no-net-loss'.**
- **Assess alternatives that make a difference in terms of climate change and biodiversity.**
- **Use ecosystem-based approaches and green infrastructure as part of project design and/or mitigation measures.**
- **Assess climate change and biodiversity synergies and cumulative effects, which can be significant.**
  - Causal chains/network analysis may be helpful in understanding these interactions.

1. Introduction

1.1 Nature and purpose of this guidance

Climate change and biodiversity loss are among the most important environmental challenges we face today. Both are complex and cross-cutting issues, which affect nearly all human activity. The *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment* ('the guidance') aims to help Member States improve the way in which climate change and biodiversity issues are integrated in EIAs carried out across the EU, under Directive 2011/92/EU[1] (the 'EIA Directive').

EIAs are legally required. They are an opportunity to systematically integrate climate change and biodiversity into a wide range of public and private projects. However, despite climate change and biodiversity being set as priorities within environmental policy agendas (see [redacted] and [redacted], experience[2] shows that they are not being systematically integrated into EIA. The main reason for this is that climate change and biodiversity are not yet explicitly included in the formal requirements of EIA procedures. In addition, they are multi-faceted issues that do not lend themselves to simple or quick analyses.

The EIA Directive

The EIA Directive requires Member States to ensure that projects likely to have significant effects on the environment because of their nature, size or location are subject to an assessment of their environmental effects. This assessment should take place before development consent is given, i.e. before the authority/ies decide(s) that the developer can go ahead with the project.

The Directive harmonises EIA principles by introducing minimum requirements, in particular for the types of projects that should be assessed, the main obligations of developers, the assessment's content and provisions on the participation of competent authorities and the public.

This guidance is designed primarily for EIA practitioners and authorities, as well as other stakeholders across the EU. It is addressed to all Member States and their legislative and governance structures and applies to all project types that require either screening[3] (Annex II projects) or full EIA (Annex I and screened-in Annex II projects) under the EIA Directive. The guidelines and recommendations contained here are general and do not give tailored advice for the specific project types under Annex I and Annex II of the EIA Directive.

The guidance addresses the specific issues and challenges that climate change and biodiversity bring to EIA.[4] It is designed to encourage users to think about how important climate change and biodiversity issues are likely to be for their specific project and EIA. It also includes issues related to disaster risk management, mainly in the context of climate change adaptation. It is assumed that readers will be familiar with EIA, so it does not explain the basic process.

Since it is the first such type of guidance issued by the European Commission, and since the EIA Directive is currently under review (see [redacted] for more details) and the climate change and biodiversity scientific base, policies and EIA practices constantly evolve, it should be considered as a

[1] Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment [codification], OJ L 26, 28.1.2012, p.1. Directive 2011/92/EU codifies Directive 85/337/EEC and its three subsequent amendments (Directives 97/11/EC, 2003/35/EC and 2009/31/EC).

[2] Report from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions on the application and effectiveness of the EIA Directive (Directive 85/337/EEC, as amended by Directives 97/11/EC and 2003/35/EC), COM(2009) 378 final.

[3] The process of deciding if a project requires EIA.

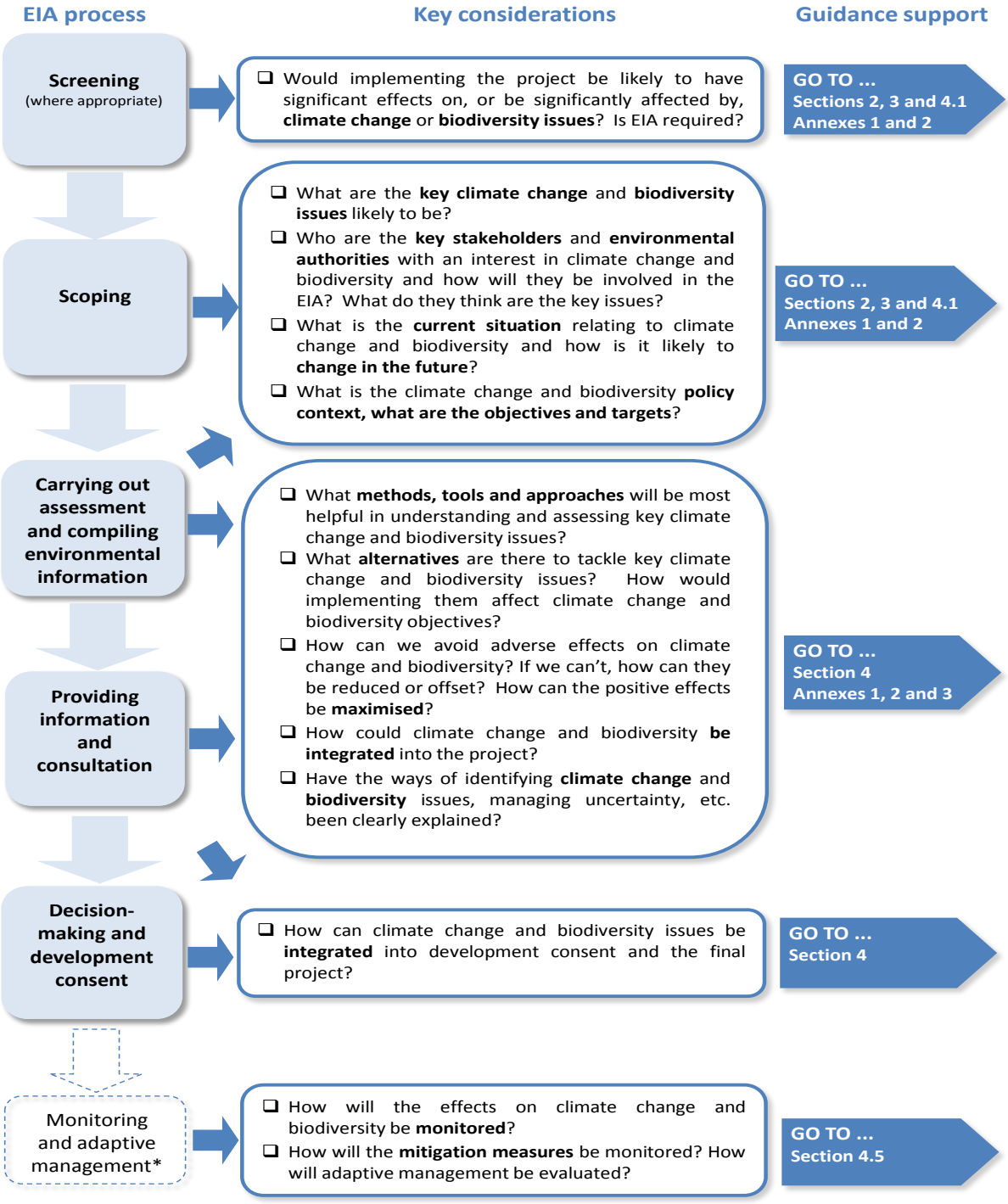
[4] A complementary *Guidance on Integrating Climate Change and Biodiversity into Strategic Environmental Assessment* was prepared.

pilot guidance. Subsequent amended versions are expected as experience with the process is gained. These may include more specific guidance on integrating disaster risk management.

1.2 Overview of how to integrate climate change and biodiversity issues into the EIA process

Figure 1, below, gives an overview of how to integrate climate change and biodiversity issues into the EIA process, as well as where information on specific EIA stages can be found in this guidance.

Figure 1: Overview of how to integrate climate change and biodiversity issues into key EIA stages



*Monitoring is not obligatory under the EIA Directive, but is nevertheless used in some Member States.

2. Climate change and biodiversity in EIA

This section looks at how climate change and biodiversity are currently covered in EIA. It reviews the requirements of the EIA Directive and shows that not only are climate change and biodiversity clearly referenced in the legislation, but that they should be given more weight in light of the Directive's preventive intent or 'spirit'. It also discusses the benefits and challenges of integrating climate change and biodiversity into EIA.

2.1 The legal basis and the 'spirit' of the Directive

The EIA Directive contains a number of principles that provide the basis for considering climate change and biodiversity in EIA, even though it does not refer to either term explicitly (see Table 1). In line with Article 191 of the *Treaty on the Functioning of the European Union,*[5] the Directive clearly sets out to prevent damage to the environment rather than merely counteract it. Furthermore, The European Court of Justice has consistently confirmed that the EIA Directive has 'a wide scope and a broad purpose'[6] and therefore needs to be interpreted as such.

The 2012 Commission proposal for the revised EIA Directive[7] strengthened the provisions related to climate change and biodiversity.

As regards climate change, it introduced clear references to 'climate change' and 'greenhouse gases'. It provided a detailed description of climate change issues to be addressed as part of the screening criteria for Annex II projects — 'impacts of the project on climate change (in terms of greenhouse gas emissions, including from land use, land-use change and forestry), contribution of the project to an improved resilience, and the impacts of climate change on the project (e.g. if the project is coherent with a changing climate)'. Furthermore, it described climate change issues to be addressed in the EIA report in more detail — 'greenhouse gas emissions, including from land use, land-use change and forestry, mitigation potential, impacts relevant to adaptation, if the project takes into account risks associated with climate change'.

As regards biodiversity, the proposal introduced clear references to 'biodiversity' and 'species and habitats' protected under Council Directive 92/43/EEC[8] (the 'Habitats Directive') and Directive 2009/147/EC[9] (the 'Birds Directive). It introduced additional elements of biodiversity to be considered within the screening criteria for Annex II projects — 'population quality and quantity and ecosystem degradation and fragmentation'. It also proposed that the EIA report should cover 'biodiversity and the ecosystem services it provides'.

Lastly, the proposal introduced clear references to disaster risk management, mainly in Article 3 and Annexes III and IV.

[5] The Treaty on the Functioning of the European Union [consolidated version], OJ C 83, 30.3.2010, p.47.
[6] See [redacted] Kraaijeveld and others, paragraph 31 [redacted] Commission v Spain, paragraph 46.
[7] Proposal for a Directive of the European Parliament and of the Council amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, COM(2012) 628 final [redacted]
[8] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, as amended, OJ L 206, 22.7.1992, p.7
[9] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009, on the conservation of wild birds [codified version], OJ L 20, 26.1.2010, p.7.

Table 1: Direct and indirect references to climate change and biodiversity in the EIA Directive

Issue	Directive reference (direct)	Directive reference (indirect)
Climate change	• Climate/climatic factors' and interactions with other factors to be assessed within EIA (Article 3 and Annex IV(3)).	• The Directive refers to the precautionary principle and the need for preventive action and EIA in a transboundary context. • Projects related to the transport, capture and storage of carbon dioxide (CO2) are included in Annex I and Annex II.
Biodiversity	• 'Fauna and flora' and interactions with other factors to be assessed (Article 3 and Annex IV(3)). • Reference to the Habitats Directive and the Birds Directive (Annex III(2)(V)).	• Paragraph (14) of the recital acknowledges the value of ecosystems and highlights the need to take them into account when the effects of a project on the environment are assessed. • Annex III (screening criteria) refers to the regenerative capacity of natural resources and the absorption capacity of the natural environment.

2.2 Benefits of integrating climate change and biodiversity in EIA

For many types of project, EIA is the only legally-required tool for including environment issues at an early stage, when alternatives are still open and opportunities exist. Including climate change and biodiversity in EIA helps to, for example:

- achieve climate and biodiversity objectives;
- comply with EU and national legislation and policies;
- improve project reputation;
- increase a project's resilience to climate change;
- manage conflicts and potential synergies between climate change, biodiversity and other environmental issues;
- support the ecosystem services used by the project.

2.2.1 Achieving climate and biodiversity objectives

EIA provides a way of assessing key issues effectively and transparently and highlights opportunities to achieve wider environmental objectives, in particular those related to climate change (including disaster risk management) and biodiversity. For climate change this might include, for example, exploring the possible synergies and conflicts between climate change mitigation and adaptation and therefore avoiding [redacted] For biodiversity, it might include, for example, assessing how the objectives and measures of the *EU 2020 Biodiversity Strategy*[10] can be integrated into the EIA process.

[10] Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of Regions, Our life insurance, our natural capital: an EU biodiversity strategy to 2020 (EC, COM(2011) 244 final).

2.2.2 Compliance with EU and national legislation and policies

Addressing climate change and biodiversity in EIA makes it easier to comply with the EIA Directive and relevant national laws. This is useful, since climate change and biodiversity are the subjects of many recent pieces of EU legislation, policies and strategies, including national binding targets.

Member States (see box right) are also likely to have a suite of legislative instruments relevant to climate change and biodiversity (e.g. building codes that promote energy efficiency, planning policies that avoid developing flood-prone areas, species and site protection).

Climate and energy requirements in Austrian EIA procedures

In Austria, a 2009 amendment to the EIA act requires project developers to provide information on how the proposed project has considered energy demand and flow, energy efficiency, GHG emissions and measures to reduce emissions and improve efficiency. This provision is accompanied by a guiding document to help project developers and EIA practitioners better understand and comply with the requirement.

2.2.3 Project reputation

Aside from meeting public policy requirements, projects also have to address pressure from developers, local authorities and the general public and show that the project has a positive effect on the environment, or only a minimal negative effect. Environmental impact affects a project's and project developer's reputation. This is particularly true for greenhouse gas (GHG) emissions, in part due to climate change concerns, but also because reducing GHGs can improve energy efficiency and reduce costs.

2.2.4 Resilience of projects to a changing climate

A number of recent studies on the [redacted] of the EU and specific sectors and territories to the changing climate (see [redacted] for further reading on this subject) have shown that Europe's infrastructure needs to be adapted to better cope with natural phenomena caused by climate change. This means considering that the design parameters identified at a project's inception may no longer be valid at the end of its potentially long lifespan. It represents a shift in thinking, from the traditional assessment of environmental impact to taking possible long-term risks into account. Insurance firms, for instance, are already recognising the value of this way of thinking and including it in their risk assessments of natural hazards. EIA can help projects to adapt to this shift through the concept of [redacted] A project needs to be assessed against an evolving environmental baseline. EIA should show an understanding of how the changing baseline can affect a project and how the project may respond over time. The EIA process is particularly important since it can help set the context for projects; taking potential climate change impact (including disaster risks) into consideration in EIA can make projects more resilient. More information on how resilience can be built into EIA is presented in [redacted]

2.2.5 Managing conflicts and potential synergies between climate change, biodiversity and other environmental issues

Considering climate change mitigation and adaptation, biodiversity and other environmental issues together has many benefits and is cost-effective. For example, it creates win-win situations when

ecosystem-based approaches are applied to climate mitigation and adaptation and helps avoid mitigation actions that either don't have any adaptive capacity or reduce the resilience of other factors. Managing these conflicts and potential synergies is one of the roles of EIA.

2.2.6 Supporting ecosystem services

The [redacted] provided by biodiversity also need to be considered as part of a project's development, as they can support its objectives and help in its implementation. For instance, a project could aim to reduce flood risk in a specific area and ensure the safety of and demand for local property; such a project may depend on a local wetland area to reduce flood risk or store water. Another example is a local green space that adds value to a residential development by providing a recreation area and temperatures cooler than in the local urban environment.

Acknowledging a project's reliance on ecosystem services, and hence on biodiversity, can make it more effective, as well as supporting biodiversity and biodiversity policy objectives. However, the degree to which a project can use these services depends on the local and wider environmental limits affected by it and by other projects, as well as by wider drivers for change. EIA can play an important role in helping to understand these relationships and the broader context.

2.3 Challenges of addressing climate change and biodiversity in EIA

It is the main characteristics of climate change and biodiversity that are most likely to pose significant challenges to addressing climate change and biodiversity in EIA. They are:

- the long-term and cumulative nature of effects;
- complexity of the issues and cause-effect relationships;
- uncertainty.

This section explains these aspects in more detail and tackles the question of how to deal with them more effectively throughout the EIA process. Table 2 (below) summarises ways of approaching them.

Table 2: Tips on how to approach the challenges of integrating climate change and biodiversity into EIA

Key challenges	Tips on how to approach them
Long-term and cumulative nature of effects	• Avoid 'snapshot' analyses (i.e. at a single point in time) and consider trends, *with* and *without* the proposed project; • Work with the notion of absorption capacity/environmental limits.
Complexity of the issues and cause-effect relationships	• Analyse the impact of proposed projects on key climate change and biodiversity trends and their drivers; • Work with worst-case and best-case scenarios.
Uncertainty	• Acknowledge assumptions and the limitations of current knowledge; • Base recommendations on the precautionary principle; • Prepare for adaptive management.

2.3.1 Long-term and cumulative nature of effects

The long-term nature of climate change – both mitigation and adaptation – makes it more difficult to consider within EIA, but doing so is crucial to the long-term viability of projects. Major long-term infrastructure projects are most likely to be vulnerable to progressively more significant climate

change (including the increasing number of weather-related disasters). This influences the baseline environment against which projects should be assessed as part of EIA.

Effects on biodiversity are cumulative and once species or habitats are completely lost they cannot be replaced or recovered. This means that we need to avoid negative impact wherever possible and do more to enhance and better manage existing biodiversity and to help maximise ecosystem services.

EIA should therefore **avoid 'snapshot' analyses** (i.e. at a single point in time) and instead consider trends and scenarios with and without the proposed project (and its reasonable alternatives). It should also **work with the notion of** [redacted] which define an ecosystem's capacity to cope with change without losing its core attributes or functions.

2.3.2 Complexity of the issues and cause-effect relationships

Both climate change and biodiversity involve complex systems and interact with other environmental aspects and with people. Since we cannot fully understand all aspects of complex systems at the point in which we make decisions, we need to be able to use what we have. For example, we can **analyse trends** — the general direction in which things seem to move — based on available studies, reports and other sources of information.

2.3.3 Uncertainty

Uncertainty exists within any decision-making system, but it increases with complexity and timescale and is particularly likely to affect long-term projects. Uncertainty related to the long-term effects of a project on biodiversity and climate change, and to the effects of climate change on the project, is therefore very likely. Working with uncertainty requires **a qualitative approach**, as quantitative data are often either unavailable or unreliable in predicting impact.

3. Understanding climate change and biodiversity

This section provides background information on climate change and biodiversity in the EU. It starts by explaining the terms 'climate change' and 'biodiversity' and then provides an overview of the current status, trends, drivers and policy responses for climate change mitigation, adaptation and biodiversity.

The purpose of this section is to highlight the importance and complexity of climate change and biodiversity to those involved in EIA: authorities, project developers, EIA practitioners, regulators and other stakeholders. For those undertaking EIA, it also provides a starting point for identifying some of the key information sources and issues, policy objectives and targets that need to be considered to successfully integrate climate change and biodiversity into the process.

Depending on the scale of the project, an EIA may also need to consider the national, regional and local levels. However, for practical reasons, this document focuses on the international/EU context and should be considered a starting point. The information presented here will need to be supplemented with what is available in the Member States and from environmental authorities and other institutions.

3.1 Introduction to climate change

Responses to climate change can be divided into two aspects:

Mitigation — the term used to describe the process of reducing GHG emissions that contribute to climate change. It includes strategies to reduce GHG emissions and enhance GHG sinks.

Adaptation — is a process, or set of initiatives and measures, to reduce the [redacted] of natural and human systems against actual or expected climate change effects. Adaptation can also be thought of as learning how to live with the consequences of climate change. The first consequences of climate change can already be seen in Europe and worldwide, and these impacts are predicted to intensify in the coming decades. Temperatures are rising, rainfall patterns are shifting, glaciers are melting, sea levels are getting higher and extreme weather resulting in hazards such as floods and droughts is becoming more common.

Climate change adaptation and mitigation are closely interrelated. While they are often considered as separate topics or policy fields, it is critical to consider the links between them. Certain adaptation responses have clear mitigation benefits, but some actions can result in [redacted] — i.e. instead of reducing vulnerability to climate change, they actually increase it or reduce the [redacted] Some actions can also distribute the benefits of adaptation unequally across society (for example, the prevention of climate-change-induced diseases only for affluent people).

One of the roles of EIA is to seek to manage these conflicts and potential synergies. This can be done by comprehensively assessing the synergies between climate change mitigation, adaptation and other environmental issues and policy concerns, in order to avoid negative synergies and missed opportunities for promoting positive synergies.

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

Current status, trends and key drivers

Many studies have been carried out into how to assess the current status, trends and key drivers for GHG emissions, and they provide a useful background. See *Mitigating climate change — SOER 2010 thematic assessment* (EEA, 2010)[11] and other documents listed in [redacted] of this guidance for an overview.

Policy response

In March 2007,[12] the EU Heads of State and Government endorsed an integrated approach to climate and energy policy that aims to combat climate change and increase the EU's energy security while strengthening its competitiveness. They set a series of demanding climate and energy targets to be met by 2020, known as the '20-20-20' targets (see box right).

'20-20-20' climate and energy targets

- A reduction in **EU GHG emissions** of at least **20%** below 1990 levels;
- **20%** of **EU energy consumption** to come from renewable resources;
- **20%** reduction in **primary energy use** compared with projected levels, to be achieved by improving energy efficiency.

With its Roadmap for moving to a competitive low-carbon economy in 2050, the European Commission has looked beyond these short-term objectives and set out a cost-effective pathway for reducing domestic emissions by 80 to 95 % by mid-century. The Roadmap identifies milestones and provides guidance on how to move to a climate-friendly, low carbon economy in the most efficient way.

The key aspects of international and EU climate change mitigation policy are summarised in Table 3 below.

Table 3: Key aspects of climate change mitigation policy

Policy response	Objectives and targets
United Nation Framework Convention on Climate Change (UNFCCC)	• UNFCCC seeks to reduce international GHG emissions by setting national level targets based on the concept of 'common but differentiated responsibility'. This means that nations which have emitted the majority of GHGs up to now should seek to reduce GHGs at a greater rate.
UNFCCC's Kyoto Protocol	• Under the UNFCCC's Kyoto Protocol, 15 Member States of the EU ('EU-15') decided on a collective target of reducing GHG emissions by 8% relative to 1990 levels between 2008 and 2012 (Member State emission targets are differentiated under an EU burden-sharing decision). The other Member States have similar targets, with the exception of Cyprus and Malta. • The EU-15 are well on track to meeting their target. Preliminary EEA estimates indicate that they reduced their emissions by 14.1% below base-year levels by 2011.[13]

[11] [redacted]
[12] European Council, 8/9 March 2007.
[13] Approximated EU GHG inventory, [redacted]

EU Climate and Energy Package	• To meet the EU's obligation under international law and in line with European ambition. Member States are required to: • Collectively reduce their combined GHG emissions in 2020 by at least 20% compared to 1990 levels. Note: the EU has offered to take on a 30% target for 2020 if other major emitters contribute adequately to global mitigation efforts. • Produce 20% of their combined energy from renewable sources. • Improve energy efficiency to reduce primary energy use by 20% compared with projected levels. • The collective EU target of reducing emissions by 20% by 2020 is to be achieved by: o The EU Emissions Trading System, the backbone of the EU mitigation effort, which sets a cap on emissions from the most polluting sectors, including over 11000 factories, power plants and other installations, including airlines. By 2020, the cap should result in a 21% reduction relative to 2005 levels. The EU ETS covers about 40% of all EU emissions. o The 'effort sharing decision', which operates outside the EU ETS and establishes annual binding GHG emission targets for individual Member States for the 2013-2020 period. These concern emissions from sectors such as waste, agriculture, buildings, etc. • The '20-20-20' targets are supported by the long-term target of 85-90% reduction in GHG emissions against 1990 levels by 2050.
Roadmap for moving to a low-carbon economy in 2050	• The Roadmap looks beyond the 2020 targets and sets out a plan to meet the long-term target of reducing EU emissions by 80-95% by 2050. The strategy takes a sectoral perspective, looking at how the 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.
Energy Roadmap 2050	• In the *Energy Roadmap 2050*, the EU explores the challenges posed by delivering the EU's decarbonisation objective, while at the same time ensuring security of energy supply and competitiveness.
Flagship initiative for a resource-efficient Europe	• It supports the shift to a resource-efficient, low-carbon economy to achieve sustainable growth. It provides a long-term framework for action to factor in resource efficiency in a balanced manner in many policy areas, including climate change, energy, transport, industry, agriculture, biodiversity and regional development.

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

Current status, trends and key drivers

Regardless of the success of mitigation action, some degree of climate change is already 'locked in' and we are feeling the effects of our changing climate already. One of the most important consequences of climate change will be the increased frequency and magnitude of extreme events such as floods, droughts, windstorms and heat waves. Climate change may also trigger other hazards in which climate or weather conditions play a fundamental role, such as snow avalanches, landslides and forest fires.

Several studies have assessed the current status, trends and key drivers for climate change and provide a useful background. See *Adapting to climate change — SOER 2010 thematic assessment* (EEA, 2010)[14] and the *European Climate Adaptation Platform: CLIMATE-ADAPT,*[15] as well as other documents listed in [redacted] to this Guidance.

Policy response

Adaptation involves adjusting our behaviour to limit harm and exploiting the beneficial opportunities arising from climate change. However, our level of preparedness, resilience and vulnerability are not

[14] [redacted]

easily quantifiable, making it difficult to set hard and fast targets. But climate change mitigation targets are more tangible. In the EU, the focus is on integrating ('mainstreaming') adaptation into all relevant policies and instruments and facilitating effective, consistent adaptation actions at national, regional and local levels.

Many European countries, as well as some regions and cities, have adopted adaptation strategies. The European Environment Agency (EEA) keeps an overview of adaptation strategies in its 32 member countries.[16] It also hosts the European Climate Adaptation Platform: CLIMATE-ADAPT.

The key aspects of international and EU climate change adaptation policy are summarised in Table 4 below.

Table 4: Key aspects of climate change adaptation policy

Policy response	Objectives and targets
EU Strategy on Adaptation to Climate Change	• The European Commission adopted a *White Paper on Adapting to Climate Change* in 2009, leading to an EU Adaptation Strategy in 2013. • The *Adaptation Strategy* will: o recognise how important impact assessment is for climate proofing (this guidance supports the Strategy's key objectives and actions) o identify the key priorities for action and how EU policies can encourage effective adaptation action o highlight the issue of adapting infrastructure to climate change and include a separate document on this topic o encourage creating green infrastructure and applying ecosystem-based approaches. • Guidance on how to mainstream adaptation into the Common Agricultural Policy and Cohesion Policy will be developed after the Adaptation Strategy is adopted.
European Climate Adaptation Platform: CLIMATE-ADAPT	• A publicly accessible, web-based platform designed to support policy-makers at EU, national, regional and local levels in the development of climate change adaptation measures and policies. • It has been developed to help users to access, disseminate and integrate information on: o expected climate change in Europe o the vulnerability of regions, countries and sectors now and in the future o information on national, regional and transnational adaptation activities and strategies o case studies of adaptation and potential future adaptation options o online tools that support adaptation planning o adaptation-related research projects, guideline documents, reports information sources, links, news and events.

3.2 Introduction to biodiversity

Biodiversity — or biological diversity — 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).

The Natura 2000 network of protected areas, created on the basis of the Habitats and the Birds Directives, is the backbone of the EU's biodiversity policy. At present, the network covers almost 18% of the EU's land surface and more than 145000 km² of its seas. However, it is important to

[16] Available from: [redacted]

remember that the concept of biodiversity is not limited to the Natura 2000 network, it is much broader:

- The Birds and Habitats Directives also cover species and habitats outside Natura 2000 sites.
- Under Article 6(3) of the Habitats Directive, an 'appropriate assessment' – is required for any plan or project likely to have a significant effect on Natura 2000 site, even if it is implemented outside these sites.
- Article 10 of the Habitats Directive recognises the importance of ensuring the ecological coherence of the Natura 2000 sites.
- Finally, the *EU 2020 Biodiversity Strategy* as endorsed by the Council and European Parliament covers the whole territory and emphasises the benefits that ecosystems give us. It provides a package of actions needed to halt the loss of biodiversity and the degradation of ecosystem services by 2020 and to restore them in so far as feasible.

It is recommended that an EIA takes into account all of these aspects of biodiversity.

3.2.1 Current status, trends and policy responses

Current status, trends and key drivers

Several studies have assessed the current status, trends and key drivers for biodiversity, and provide a useful background. See *Biodiversity — SOER 2012 thematic assessment* (EEA, 2010),[17] the *EU 2010 Biodiversity Baseline* (EEA, 2010),[18] and the other documents listed in [redacted] to this guidance for an overview.

These studies have found that the rate of biodiversity loss is accelerating all over Europe. Although there are some positive signs, they recognise five main pressures and drivers of biodiversity loss: (i) habitat loss and fragmentation; (ii) overexploitation and unsustainable use of natural resources; (iii) pollution; (iv) invasive alien species, and (v) climate change.

The aim of the Natura 2000 network and the sites designated under it is to slow down the rate of biodiversity loss, by establishing a system to protect key species and habitats. However, many Natura 2000 sites remain in an unfavourable state and require improved management.

Policy response

Biodiversity has been a core part of EU policy for over 20 years. Nevertheless, the overall trends are still negative and recent policy has been considered ineffective. This is shown by the EU's failure to achieve the target of halting biodiversity loss by 2010.

In 2011, the European Commission adopted a new Biodiversity Strategy[19] with its 2020 headline target — 'Halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss.'

[17] [redacted]
[18] [redacted]
[19] Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of Regions, Our life insurance, our natural capital: an EU biodiversity strategy to 2020 (EC, COM(2011) 244 final).

Target 2 of this Strategy is that 'by 2020, ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15% of degraded ecosystem'. This target is broken down into accompanying actions, two of which seek to influence planning practices:

- set priorities to restore and promote the use of green infrastructure (Action 6); and
- ensure 'no-net-loss' of biodiversity and ecosystem services (Action 7).

These provide a good policy basis for preserving ecosystem services and using [redacted] and [redacted] within EIA. In the climate change context, ecosystem-based approaches can maintain existing carbon stocks, regulate water flow and storage, maintain and increase resilience, reduce vulnerability of ecosystems and people, help to adapt to climate change impacts, improve biodiversity conservation and livelihood opportunities and provide health and recreational benefits.[20]

The key aspects of international and EU biodiversity policy are summarised in Table 5 below.

Table 5: Key aspects of biodiversity policy

Policy response	Objectives and targets
[redacted]	• The Habitats Directive and the Birds Directive seek to protect sites of particular importance for biodiversity— these sites form a network referred to as [redacted] • Member States are required to designate and manage Natura 2000 network sites within their borders. This includes habitat and species conservation, and reducing the impact of building new infrastructure and of other human activities. This is achieved in part by applying Article 6(3) on 'appropriate assessments'. • The two directives create provisions for the protection of certain species of flora and fauna when they occur in the wider natural environment. • Article 10 of the Habitats Directive recognises the importance of ensuring the ecological coherence of Natura 2000 sites.
[redacted]	• The CBD is the main international agreement governing biodiversity policy. The EU and its Member States are all parties to the convention. Article 14 of the CBD, on Impact Assessment and Minimising Adverse Impacts, requires that a project's potential adverse impact on biodiversity be taken into account.
[redacted]	• The *Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation to the Convention on Biological Diversity* (adopted in Nagoya, October 2010) is a legally binding agreement that addresses two issues: o How states provide access to genetic resources and/or associated traditional knowledge under their jurisdiction; and o What measures they take to ensure that benefits of using such resources and/or knowledge are shared with provider countries, including indigenous and local communities?
[redacted]	• The *Strategic Plan for Biodiversity 2011-2020* (adopted in Nagoya, October 2010) aims to inspire action in support of biodiversity by all countries and stakeholders over the next decade. • The *Strategic Plan* includes 20 headline targets, collectively known as the *Aichi Targets*. They are organised under five strategic goals that address the underlying causes of biodiversity loss, reduce the pressures on biodiversity, safeguard biodiversity at all levels, enhance its benefits, and provide for capacity-building.
[redacted]	• *Our life insurance, our natural capital: an EU biodiversity strategy to 2020* is in line with the two commitments made by EU Heads of State and Government in March 2010 — halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU

[20] Assessment of the potential of ecosystem-based approaches to climate change adaptation and mitigation in Europe (EC study, Ecologic Institute and Environmental Change Institute, 2011).

	contribution to averting global biodiversity loss. • The long-term goal states that 'by 2050, European Union biodiversity and the ecosystem services it provides — its natural capital — are protected, valued and appropriately restored for biodiversity's intrinsic value and for their essential contribution to human wellbeing and economic prosperity, and so that catastrophic changes caused by the loss of biodiversity are avoided.' • The Strategy is also in line with the global commitments world leaders made in Nagoya in October 2010, when, in the context of the CBD, they adopted a package of measures addressing global biodiversity loss over the next decade (described above). • 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. This represents a significant change in approach for the impact assessment process, from reducing impact to actively improving (restoring) biodiversity as a whole and ensuring 'no-net-loss'. • The main targets of the Strategy cover: o full implementation of EU legislation on protecting biodiversity; o better protection for ecosystems and more use of green infrastructure; o more sustainable agriculture and forestry; o better fish stock management; o tighter controls on invasive alien species, including adopting new legislation to fill existing policy gaps; o a more significant EU contribution to averting global biodiversity loss.
[redacted]	• BAPs provide details on how the Biodiversity Strategy is to be achieved. They are present at European level (for example, the 2006 BAP now superseded by the 2020 Biodiversity Strategy), but also exist across the EU and worldwide under the CBD (as National Biodiversity Strategy and Action Plans, NBSAPs). In Member States, they are sometimes aligned with the EU 2006 BAP. • BAPs form the wider implementation framework for biodiversity, beyond Natura 2000. At Member State level, they list identified species and habitats, assess their status within the ecosystem, create conservation and restoration targets and establish the budgets and timelines needed to achieve said targets. • BAPs can also require the protection of certain species where they occur outside of protected areas.

3.3 Interactions between climate change and biodiversity

There are clear links between many environmental issues, just like there are connections in the natural environment. This section describes the link between climate change and biodiversity. It does not attempt to fully describe the relationship, but focuses on the key interactions directly relevant to EIA.

Examples of interactions between biodiversity and climate change are listed 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 suggests that healthy natural habitats such as soil, wetlands, and forests can sequester significant amounts of carbon. Damaging the biodiversity or physical environment of these areas can release the stored carbon, even indirectly, contributing to climate change, as well as reducing biodiversity.
- Biodiversity and the natural environment provide services that increase our resilience to the impacts of climate change and disasters. For example, well-functioning green spaces can regulate storm water flow, reducing the risk of flooding. Ecosystems and their services can be successfully used in many PPs as cost-effective alternatives to building infrastructure, or, for example, to manage flood risk (see box overleaf). Green spaces and vegetation also have a cooling effect and reduce the impact of heat waves in cities, lessening the urban heat island effect. Plants stabilise soil, reducing the risk of landslides and erosion (in fact, it is deforestation that can contribute to mudslides).

The relationship between biodiversity and climate change goes both ways — 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 of biodiversity loss next to land-use change.[21] Climate change affects biodiversity because species tend to evolve to a specific range of environmental factors such as temperature, moisture, etc. As these factors alter due to climate change, species need to migrate to stay in their optimum environment. Some species are more adaptive, but, for others, a changing environment is a threat to their ability to survive and therefore 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-use 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.

Using green infrastructure for flood risk management

The EU Floods Directive establishes a framework for the management of flood risks. It gives the EU Member States the choice of measures to put in place to reduce the adverse consequences related to floods.

Article 7 requires Member States to set their own flood management objectives. These objectives should also, if appropriate, focus on 'non-structural' measures (ranging from early-warning to natural water retention measures) and/or on reducing the likelihood of flooding.

These are cost-effective alternatives to constructing or reinforcing dykes and dams. They also often have many additional benefits.

Examples include:

- restoring natural flows by realigning coastal areas or re-connecting rivers with their floodplain;
- restoring wetlands, which can store flood water and help slow down their flow;
- urban green infrastructure such as green spaces or green roofs.

Source: [redacted]

[21] Millennium Ecosystem Assessment (2005) Synthesis Report.

4. Integrating climate change and biodiversity into EIA

This section provides guidance on integrating climate change and biodiversity throughout the EIA process. It focuses on the EIA areas where climate change and biodiversity have the most impact.

It is divided into the following sub-sections:

- identifying climate change and biodiversity concerns in EIA (useful for screening and scoping);
- analysing evolving baseline trends;
- identifying alternatives and mitigation measures;
- assessing effects (cumulative effects and uncertainty);
- monitoring and adaptive management.

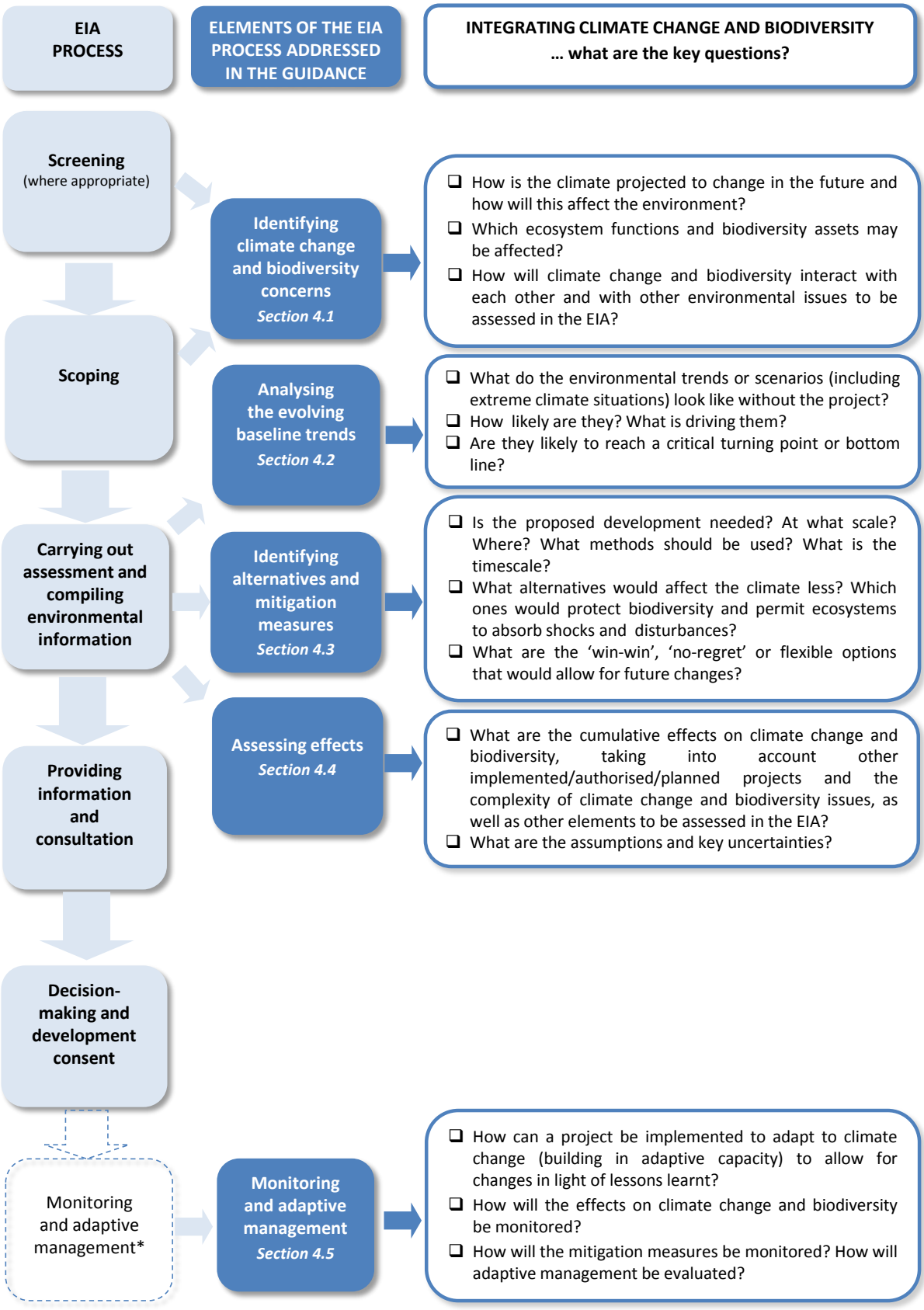
Each sub-section looks at the EIA elements for which climate change (including disaster risks in the context of climate change adaptation) and biodiversity considerations are most relevant, and gives some examples. You can use these as a starting point for more in-depth work.

This section pays particular attention to climate change adaptation, which is a relatively new issue in the context of EIA. The advice and examples provided could serve as a basis for developing tailored approaches to a wide range of infrastructure projects (e.g. power plants, motorways/roads, pipelines, industrial plants, overhead electrical power lines, installations for storage of petroleum, ports, waste disposal facilities, urban development projects, etc.) covered by the EIA Directive. Such tailored approaches fall outside the scope of this guidance, however.

Addressing climate change and biodiversity in the EIA process (see [redacted] brings new challenges for the EIA practitioner. There will be situations in which the EIA practitioner will have to make a judgement, preferably in consultation with stakeholders, to avoid unnecessarily extending the EIA procedure or to leave enough time to properly assess complex information. Taking a practical, common sense approach to EIA will sometimes be best.

Figure 2 (overleaf) shows the scope of this guidance and includes a set of questions related to specific topics addressed in it.

Figure 2: Integrating climate change and biodiversity into EIA



*Monitoring is not obligatory under the EIA Directive, but is nevertheless used in some Member States.

4.1 Identifying climate change and biodiversity concerns in EIA

This section looks at how climate change and biodiversity issues could be better factored into EIA. It can be useful in the screening and scoping stages of EIA. Of course, the issues and impacts relevant to a particular EIA will depend on the specific circumstances and context of each project (e.g. the sector concerned, location and scale, characteristics of the receiving environment, etc.).

The section is structured around four key recommendations:

- identifying **key issues early on**, with input from **relevant authorities and stakeholders**;
- determining whether the project may significantly change GHG emissions and defining the scope of any necessary GHG assessments (**climate mitigation concerns**);
- being clear about climate change scenarios used in the EIA and identifying the key **climate change adaptation concerns** and how they interact with the other issues to be assessed in EIA;
- identifying the key **biodiversity concerns** and how they interact with the other issues to be assessed in EIA.

4.1.1 Identifying key issues early on, with input from relevant authorities and stakeholders

Identifying key climate change and biodiversity issues early on ensures that they are recognised by all involved and followed-up throughout the EIA process. Involving relevant authorities and stakeholders at an early stage (at the latest at the scoping stage for Annex I projects or prior to the issuing of a screening decision for Annex II projects) will improve compliance with the EIA Directive. It will also make it possible to capture the most important issues and establish a consistent approach to assessing impact and looking for solutions. Making use of the knowledge and opinions of environmental authorities and stakeholders can help to:

- highlight potential areas of contention and areas of improvement in a timely and effective way;
- provide information on relevant forthcoming projects, policies and legislative or regulatory reforms, other types of assessments (including Article 6(3) of the Habitats Directive on 'appropriate assessment' — see box left) that should be considered when analysing evolving baseline trends (see [redacted];
- collect suggestions for building climate change mitigation and adaptation measures and/or biodiversity enhancement schemes into the proposed project from the very beginning.

The relationship between EIA and Article 6(3) of the Habitats Directive

Article 6(3) of the Habitats Directive requires an 'appropriate assessment' when any project, either individually or in combination with other plans and projects, is likely to have a significant effect on a Natura 2000 site (a Special Protection Area — SPA — under the Birds Directive, or Special Area of Conservation — SAC — under the Habitats Directive). There is therefore a clear link to EIA, but EIA has a wider environmental remit, as it should consider all biodiversity and not just impact related to Natura 2000 sites.

In some cases, the EIA and Article 6(3) assessments can be combined, or data and information from the Article 6(3) assessment of the Natura 2000 site can be used in the EIA and *vice-versa*. The extent of iteration between EIA and any Article 6(3) assessment will depend on the nature and scale of the project and site(s) concerned.

The main climate change and biodiversity concerns are listed in Table 6, below. They can help you define a set of questions on climate change mitigation, adaptation and biodiversity. These could then be asked in the screening and/or scoping stages of EIA.

Table 6: Examples of main climate change and biodiversity concerns to consider as part of EIA

Climate change mitigation	Climate change adaptation	Biodiversity
• direct GHG emissions caused by the construction, operation, and possible decommissioning of the proposed project, including from land use, land-use change and forestry; • indirect GHG emissions due to increased demand for energy; indirect GHG emissions caused by any supporting activities or infrastructure which is directly linked to the implementation of the proposed project (e.g. transport, waste management).	• heat waves (including impact on human health, damage to crops, forest fires, etc.); • droughts (including decreased water availability and quality and increased water demand); • extreme rainfall, riverine flooding and flash floods; • storms and high winds (including damage to infrastructure, buildings, crops and forests); • landslides; • rising sea levels, storm surges, coastal erosion and saline intrusion; • cold spells; • freeze-thaw damage[22].	• degradation of ecosystem services; • loss of habitats, fragmentation (including the extent or quality of the habitat, protected areas, including Natura 2000 sites, habitat fragmentation or isolation, as impact on processes important for the creation and/or maintenance of ecosystems) • loss of species diversity (including species protected under the Habitats Directive and the Birds Directive) • loss of genetic diversity.

For climate change in particular, both the impact of the project on climate and climate change (i.e. mitigation aspects) and the impact of climate change on the project and its implementation (i.e. adaptation aspects) should be considered early on in the EIA process.

Note that this list is not comprehensive and should be adapted. The issues and impacts relevant to a particular EIA should be defined by the specific context of each project and by the concerns of the authorities and stakeholders involved. Flexibility is therefore needed. This table (and other tables in this section) should be used only as a starting point for discussion.

[redacted] provides additional sources of information that can help you identify key issues and effects.

4.1.2 Understanding key climate mitigation concerns

When it comes to mitigation, the main concerns focus on GHG emissions. Implementing a project may lead to, for example:

- a direct increase in GHG emissions;
- an increase in energy demand leading to an indirect increase in GHG emissions;
- embedded GHG emissions, e.g. due to energy use in material production, transport, etc.;
- loss of habitats that provide carbon sequestration, (e.g. through land-use change).

This guidance does not include any specific methodologies for calculating GHG emissions as part of the EIA procedure. However, [redacted] provides links to carbon calculators and other methodologies, including to the [redacted] piloted by the European Investment Bank (EIB).

[22] Freeze-thaw weathering is a form of physical weathering, common in mountains and glacial environments, caused by the expansion of water as it freezes. This process also applies to infrastructure materials, e.g. concrete. Climate change is projected to bring more unpredictable winter weather in some parts of the world, increasing the frequency of freeze-thaw cycles. As this happens, roads, railways, water networks, etc. will suffer problems and increased maintenance costs. (adapted from: [redacted] and [redacted] (Auld H., Klaassen J., Comer N., 2007)

Table 7 (below) provides examples of basic questions that could be asked by EIA practitioners when identifying major climate change mitigation concerns.

Table 7: Examples of key questions that could be asked when identifying key climate change mitigation concerns

Main concerns related to:	Key questions that could be asked at the screening and/or scoping stage of the EIA
Direct GHG emissions	• Will the proposed project emit carbon dioxide (CO_2), nitrous oxide (N_2O) or methane (CH_4) or any other greenhouse gases part of the UNFCCC? • Does the proposed project entail any land use, land-use change or forestry activities (e.g. deforestation) that may lead to increased emissions? Does it entail other activities (e.g. afforestation) that may act as emission sinks?
Indirect GHG emissions due to an increased demand for energy	• Will the proposed project significantly influence demand for energy? • Is it possible to use renewable energy sources?
Indirect GHG caused by any supporting activities or infrastructure that is directly linked to the implementation of the proposed project (e.g. transport)	• Will the proposed project significantly increase or decrease personal travel? Will the proposed project significantly increase or decrease freight transport?

4.1.3 Understanding key climate change adaptation concerns

Both a project's impact on climate change (i.e. mitigation aspects) and the impact of climate change on the project and its implementation (i.e. adaptation aspects) should be considered early on in the EIA process. **How might implementing the project be affected by climate change? How might the project need to adapt to a changing climate and possible extreme events?**

When addressing climate change adaptation concerns as part of EIA, you should not only consider the historical data on climate, but also clearly identify and present the climate change scenario that should be considered in the assessment process. A clear description of the climate change scenario facilitates discussion on whether the expected climatic factors should be considered in the project design and how they may affect the project's environmental context. EIA practitioners, in particular, should outline extreme climate situations to be considered as part of the environmental baseline analysis.

You should also review any existing adaptation strategies, risk management plans and other national or sub-regional studies on the effects of climate variability and climate change, as well as proposed responses and available information on expected climate-related effects relevant to the project.

Table 8 provides examples of basic questions that you could ask when identifying major climate change adaptation concerns.

Table 8: Examples of key questions that could be asked when identifying climate change adaptation concerns

Main concerns related to:	Key questions that could be asked at the screening and/or scoping stage of the EIA
Heat waves (take into account that heat waves are usually associated with water scarcity — see also the suggestions for droughts)	• Will the proposed project restrain air circulation or reduce open spaces? • Will it absorb or generate heat? • Will it emit volatile organic compounds (VOCs) and nitrogen oxides (NO_x) and contribute to tropospheric ozone formation during sunny and warm days? • Can it be affected by heat waves? • Will it increase energy and water demand for cooling? • Can the materials used during construction withstand higher temperatures (or will they experience, for example, material fatigue or surface degradation)?
Droughts due to long-term changes in precipitation patterns (also consider possible synergistic effects with flood management actions that enhance water retention capacity in the watershed)	• Will the proposed project increase water demand? • Will it adversely affect the aquifers? • Is the proposed project vulnerable to low river flows or higher water temperatures? • Will it worsen water pollution — especially during periods of drought with reduced dilution rates, increased temperatures and turbidity? • Will it change the vulnerability of landscapes or woodlands to wild fires? Is the proposed project located in an area vulnerable to wildfires? • Can the materials used during construction withstand higher temperatures?
Extreme rainfall, riverine flooding and flash floods	• Will the proposed project be at risk because it is located in a riverine flooding zone? • Will it change the capacity of existing flood plains for natural flood management? • Will it alter the water retention capacity in the watershed? • Are embankments stable enough to withstand flooding?
Storms and winds	• Will the proposed project be at risk because of storms and strong winds? • Can the project and its operation be affected by falling objects (e.g. trees) close to its location? • Is the project's connectivity to energy, water, transport and ICT networks ensured during high storms?
Landslides	• Is the project located in an area that could be affected by extreme precipitation or landslides?
Rising sea levels	• Is the proposed project located in areas that may be affected by rising sea levels? • Can seawater surges caused by storms affect the project? • Is the proposed project located in an area at risk of coastal erosion? Will it reduce or enhance the risk of coastal erosion? • Is it located in areas that may be affected by saline intrusion? • Can seawater intrusion lead to leakage of polluting substances (e.g. waste)?
Cold spells and snow	• Can the proposed project be affected by short periods of unusually cold weather, blizzards or frost? • Can the materials used during construction withstand lower temperatures? • Can ice affect the functioning/operation of the project? Is the project's connectivity to energy, water, transport and ICT networks ensured during cold spells? • Can high snow loads have an impact on the construction's stability?
Freeze-thaw damage	• Is the proposed project at risk of freeze-thaw damage (e.g. key infrastructure projects)? • Can the project be affected by thawing permafrost?

4.1.4 Understanding key biodiversity concerns

For biodiversity, key concerns should focus on ensuring 'no-net-loss' and should outline how EIA can support this goal. The project may result in, for example:

- changes in the provision of ecosystem services as a result of loss of species and habitats;
- habitat loss and degradation, e.g. the destruction of wetlands, grasslands and forests for housing, etc.;

- 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;
- changes in natural environmental processes, such as continued river flow, water purification, coastal sediment transport, and erosion control, which can have long-term impact on habitats and species;
- direct impacts, for example birds colliding with power lines or wind turbines;
- the spread of invasive alien species that can transform natural habitats and disrupt native species;
- effects of pollution on ecosystems and species.

Table 9 (below) provides examples of basic questions you could ask when identifying major biodiversity concerns.

Table 9: Examples of key questions that could be asked when identifying biodiversity concerns

Main concerns related to:	Key questions that could be asked at the screening and/or scoping stage of the EIA
Degradation of ecosystem services (including impact on processes important for creating and / or maintaining ecosystems)	• Will the proposed project directly or indirectly lead to serious damage or total loss of ecosystem or land-use type, thus leading to a loss of ecosystem services? Will it affect the exploitation of ecosystems or land-use type so that the exploitation becomes destructive or unsustainable? • Will the proposed project damage ecosystem processes and services, particularly those on which local communities rely? • Is the project in any way dependent on ecosystem services? • Can increased supply of ecosystem services contribute to the project's objective(s)? • Will the proposed project result in emissions, effluents, and/or other means of chemical, radiation, thermal or noise emissions in areas providing key ecosystem services? As regards processes important for creating and/or maintaining ecosystems: • Will the proposed project change the food chain and interactions that shape the flow of energy and the distribution of biomass within the ecosystem? • Will the proposed project result in significant changes to water level, quantity or quality? • Will the proposed project result in significant changes to air quantity or pollution?
Loss and degradation of habitats (including the Natura 2000 network, habitat fragmentation and isolation)	• If habitats are lost or altered, are there alternatives available to support the species populations concerned? • Will the proposed project adversely affect any of the following: protected areas; threatened ecosystems outside protected areas; migration corridors identified as being important for ecological or evolutionary processes; areas known to provide important ecosystem services; or areas known to be habitats for threatened species? • Will the proposed project involve creating linear infrastructure and lead to habitat fragmentation in areas providing key and other relevant ecosystem services? • How seriously will this affect habitats and corridors, considering that they can also be adversely affected by climate change? • Are there opportunities to establish or further develop green infrastructure as a part of the project to support the project's non-environmental and environmental goals (e.g. adaptation to climate change or increasing connectivity of protected sites)?

Loss of species diversity[23] (including species protected under the Habitats Directive and the Birds Directive)	• Will the proposed project have direct or indirect negative impact on the species of Community interest listed in Annex II and/or Annex IV or V, in particular, priority species from Annex II[24] of the Habitats Directive or on the species covered by the Birds Directive? • Will the proposed project cause a direct or indirect loss of a population of a species identified as priority in National Biodiversity Strategies and Action Plans[25] (NBSAPs) and/or other sub-national biodiversity plans? • Will the proposed project alter the species-richness or species-composition of habitats in the study area? • Will the proposed project affect sustainable use of a population of a species? • Will the proposed project surpass the maximum sustainable yield, the carrying capacity of a habitat/ecosystem or the maximum allowable disturbance level of populations, or ecosystem? • Will the proposed project increase the risk of invasion by alien species?
Loss of genetic diversity[26]	• Will the proposed project result in the extinction of a population of a particularly rare species, declining species or a species identified as one of Community interest, in particular of priority species from Annex II of the Habitats Directive? • Will the proposed project result in the extinction of a population of a particularly rare species, declining species or those identified as priorities in NBSAPs and/or sub-national biodiversity plans? • Will the proposed project result in the fragmentation of an existing population leading to (genetic) isolation?

4.2 Analysing the evolving baseline trends

The evolution of the baseline — how the current state of the environment is expected to change in the future — is critical to understanding how the proposed project might impact that changing environment.

The baseline environment is a moving baseline. This is especially true for large-scale projects, which might only become fully operational after many years. During this time, the biodiversity in the project's area may change and the area may be subject to different climatic conditions, such as storms, increased flooding, etc. For long-term projects or those with long-lasting effects (timescales exceeding 20 years), you should ideally use climate scenarios based on climate model results. Such projects may need to be designed to withstand very different environmental conditions from current ones. For short-term projects, scenarios need to represent only 'near future' or 'present-day' climates.[27]

Environmental outlooks and scenario studies that analyse trends and their likely future directions can provide useful information. If data are unavailable, it may be useful to use proxy indicators. For example, if air quality monitoring data are not readily available for an urban area, perhaps there are data outlining trends in traffic flow/volumes over time, or trends in emissions from stationary sources.

[23] Definition: The number and variety of species found in a given area in a region [redacted]

[24] Priority species are indicated by an asterisk (*) in Annex II of the Habitats Directive.

[25] National Biodiversity Strategies and Action Plans (NBSAPs) are the principal instruments for implementing the Convention at national level (Article 6). The Convention requires countries to prepare a national biodiversity strategy (or equivalent instrument) and to ensure that this strategy is mainstreamed into the planning and activities of all sectors whose activities can have an impact (positive or negative) on biodiversity.

[26] The potential loss of natural genetic diversity (genetic erosion) is extremely difficult to determine, and does not provide any practical clues for formal screening/scoping. The issue would probably only come up in dealing with highly-threatened, legally-protected species that are limited in numbers and/or have highly separated populations, or when complete ecosystems become separated and the risk of genetic erosion applies to many species (the reason for constructing so-called eco-ducts across major line infrastructure), COP 6 Decision VI/7, Annex: Guidelines for incorporating biodiversity-related issues into environmental impact assessment legislation and/or process and in strategic environmental impact assessment, [redacted]

[27] Adapted from [redacted]

Spatially explicit data and assessments, potentially using Geographical Information Systems (GIS), are likely to be important for analysing the evolving baseline trends and also to understand distributional effects. There are several such European sources of data, including data repositories and online digital datasets, for example the [redacted] or the [redacted] provides a comprehensive overview and links to sources of information on biodiversity and climate change.

When looking at the evolving baseline, you should consider:

- **Trends in key indicators over time,** for example GHG emissions, indices of vulnerability, frequency of extreme weather events, disaster risk, key species such as farmland birds and the status of habitats or protected areas. Are these trends continuing, changing, or levelling out? Are there environmental outlooks or scenario studies available that have looked at their likely future direction? If data are unavailable for certain indicators, can you use [redacted]

- **Drivers of change** (both direct and indirect), which may cause a particular trend. Identifying drivers facilitates future projections, especially if some existing drivers are expected to change or new drivers are about to come into play and will significantly affect a given trend (e.g. already approved developments that have not been implemented yet; changes in economic incentives and market forces; changes in the regulatory or policy frameworks; etc.). Identifying drivers should not become a complex academic exercise — it is only important to recognise drivers that will significantly change the trend and take them into account when outlining the expected future state of the environment.

- **Thresholds/limits,** e.g. have thresholds already been breached or are limits expected to be reached? The EIA may determine whether the given trend is already approaching an established threshold or if it is coming close to certain tipping points that can trigger significant changes in the state or stability of the local ecosystem.[28]

- **Key areas that may be particularly adversely affected by the worsening environmental trends** including, in particular, protected areas, such as areas designated pursuant to the Birds Directive and the Habitats Directive. The Institute of Ecology and Environment Management (IEEM) in the UK recommends several considerations when establishing the baseline from the point of view of biodiversity (see box left).

Biodiversity considerations

Designated sites

- Are there any sites designated for nature conservation or the distribution of protected species 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?

Source: [redacted]

[28] See examples of environmental limits relevant to climate change and biodiversity at [redacted]

- **Critical interdependencies,** for example water supply and sewage treatment systems, flood defences, energy/electricity supply, communication networks, etc.
- **Benefits and losses brought by these trends and their distribution** may determine who benefits and who doesn't. Beneficial and adverse impacts are often not proportionally distributed within society — changes in ecosystems affect some population groups and economic sectors more seriously than others.
- **Climate change vulnerability** assessment needs to be built into any effective assessment of the evolution of the baseline environment, as well as of alternatives. Major infrastructure projects, in particular, are likely to be vulnerable (see box right).

When developing the baseline against which the project is to be evaluated it is also important to acknowledge uncertainty — depending on the timescale and spatial scale some uncertainty is inevitable and will increase for large-scale projects. Uncertainty can be communicated using terms such as 'strongly suspected', 'suspected', etc., used for instance by IPCC in their *Fourth Assessment report* (2007). More detailed guidance on expressing uncertainty is provided in [redacted]

Climate change vulnerability of major infrastructure projects

Major infrastructure projects may be particularly vulnerable to:

- 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.

When assessing vulnerability, it is important to consider critical interdependencies, as they can lead to 'cascade failure', where the failure of one aspect, such as flood defences, can lead to other failures, e.g. flooded power stations leading to power cuts which in turn affect telecommunications networks.

Source: [redacted]

4.3 Identifying alternatives and mitigation measures

In the early stages of the process, alternatives are essentially different ways in which the developer can feasibly meet the project's objectives, for example by carrying out a different type of action, choosing a different location or adopting a different technology or design for the project. The zero option should also be considered, either as a specific alternative or to define the baseline. At the more detailed level of the process, alternatives may also merge into mitigating measures, where specific changes are made to the project design or to methods of construction or operation to 'prevent, reduce and where possible offset any significant adverse effects on the environment'.[29]

Note that many alternatives and mitigation measures important from the point of view of biodiversity and climate change should be addressed at strategic level, in a Strategic Environmental Assessment (SEA). For example, to avoid problems associated with flood risk, planners should prevent projects from being developed on flood plains or areas of flood risk, or promote land management to increase water retention capacity. To avoid or minimise effects on Natura 2000 sites located near motorway or railway projects, it is necessary to assess the siting of the whole corridor before leaving it to the level of individual sections, as this would limit the choice of alternative locations, etc.

[29] Annex IV of the EIA Directive.

4.3.1 Climate change mitigation

For **climate change mitigation,** it is important to investigate and use options to eliminate GHG emissions as a precautionary approach in the first place, rather than having to deal with mitigating their effects after they have been released. Mitigation measures identified and introduced as a result of an EIA, e.g. construction and operational activities that use energy and resources more efficiently, may contribute to climate change mitigation as well. However, this does not always mean that the project will have overall positive impacts as regards GHG emissions. Impact may be less negative in terms of quantity of emissions, but still have overall negative impact, unless the carbon used in development and transport is unequivocally equal to zero.

Bear in mind that some EIA mitigation measures that address climate change can themselves have significant environmental impact and may need to be taken into account (e.g. renewable energy generation or tree planting may have adverse impacts on biodiversity).

Table 10: Examples of alternatives and mitigation measures related to climate change mitigation concerns

Main concerns related to:	Examples of alternatives and mitigation measures
Direct GHG emissions	• Consider different technologies, materials, supply modes, etc. to avoid or reduce emissions; • Protect natural carbon sinks that could be endangered by the project, such as peat soils, woodlands, wetland areas, forests; • Plan possible carbon off-set measures, available through existing off-set schemes or incorporated into the project (e.g. planting trees).
GHG emissions related to energy	• Use recycled/reclaimed and low-carbon construction materials; • Build energy efficiency into the design of a project (e.g. include warmcel insulation, south facing windows for solar energy, passive ventilation and low-energy light bulbs); • Use energy-efficient machinery; • Make use of renewable energy sources.
GHG emissions related to transport	• Choose a site that is linked to a public transport system or put in place transport arrangements; • Provide low-emission infrastructure for transport (e.g. electric charging bays, cycling facilities).

4.3.2 Climate change adaptation

In terms of **climate change adaptation**, different types of EIA alternatives and mitigation measures (see box overleaf) are available for decision-makers to use in planning the adaptation of projects to climate change. The most appropriate mix of alternatives and/or mitigation measures will depend on the nature of the decision being made and the sensitivity of that decision to specific climate impacts and the level of tolerated risk. Key considerations include:[30]

- [redacted]or `low-regret` options that yield benefits under different scenarios;
- `win-win-win` options that have the desired impacts on climate change, biodiversity and ecosystem services, but also have other social, environmental or economic benefits;

[30] Adapted from [redacted]

- favouring reversible and flexible options that can be modified if significant impacts start to occur;
- adding 'safety margins' to new investments to ensure responses are resilient to a range of future climate impacts;
- promoting soft adaptation strategies, which could include building adaptive capacity to ensure a project is better able to cope with a range of possible impacts (e.g. through more effective forward planning);
- shortening project times;
- delaying projects that are risky or likely to cause significant effects.

If, based on an assessment of specific risks and constraints, alternatives and mitigation measures are considered impossible or too expensive, the project may have to be abandoned.

Types of EIA mitigation measures for climate change adaptation and risk management

- Measures that strengthen the project's capacity to adapt to increasing climate variability and climate change (e.g. building in early warning or emergency/disaster preparedness);
- Risk reduction mechanisms (e.g. insurance);
- Measures that control or manage certain identified risks (e.g. choice of project location to reduce exposure to natural disasters);
- Measures that improve the project's ability to operate under identified constraints (e.g. choice of most water-efficient or energy-efficient options);
- Measures that better exploit certain opportunities offered by the natural environment.

Source: [redacted]

Table 11: Examples of alternatives and mitigation measures related to climate change adaptation concerns

Main concerns related to:	Examples of alternatives and mitigation measures
Heat waves	• Ensure that the proposed project is protected from heat exhaustion; • Encourage design optimal for environmental performance and reduce the need for cooling; • Reduce thermal storage in a proposed project (e.g. by using different materials and colouring).
Droughts	• Ensure that the proposed project is protected from the effects of droughts (e.g. use water-efficient processes and materials that can withstand high temperatures); • Install livestock watering ponds within animal-rearing systems; • Introduce technologies and methods for capturing storm water; • Put in place state-of-the-art wastewater treatment systems that make reusing water possible.
Wildlife fires	• Use fire-resistant construction materials; • Create a fire-adapted space around the project (e.g. use fire-resistant plants).
Extreme rainfall, riverine flooding and flash floods	• Consider changes in construction design that allow for rising water levels and ground water levels (e.g. build on pillars, surround any flood-vulnerable or flood-critical infrastructure with flood barriers that use the lifting power of approaching floodwater to automatically rise, set up backwater valves in drainage-related systems to protect interiors from flooding caused by backflow of wastewater, etc.); • Improve the project's drainage.
Storms and winds	• Ensure a design that can withstand increased high winds and storms.
Landslides	• Protect surfaces and control surface erosion (e.g. by quickly establishing vegetation — hydroseeding, turfing, trees); • Put in place designs that control erosion (e.g. appropriate drainage channels and culverts).
Rising sea levels	• Consider changes in construction design to allow for rising sea levels (e.g. building on pillars, etc.).
Cold spells and snow	• Ensure that the project is protected from cold spells and snow (e.g. use construction materials that can withstand low temperatures and make sure the design can resist

	snow build-up).
Freeze-thaw damage	• Ensure that the project (e.g. key infrastructure) is able to resist winds and prevent moisture from entering the structure (e.g. by using different materials or engineering practices).

4.3.3 Biodiversity

For **biodiversity**, EIA should focus on ensuring 'no-net-loss' (see box below) and avoiding effects from the start, before considering mitigation, with compensation being used as a last resort.

Key messages for promoting 'no-net-loss' of biodiversity

1. Avoid irreversible biodiversity loss, for example by improving the spatial arrangement of a project;
2. Seek alternative solutions that minimise biodiversity loss, in particular consider and prioritise maintaining habitats that 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. Look for ways of optimising environmental benefits, for example by facilitating connection of fragmented environments or creating beneficial high biodiversity habitats.

Source: [redacted]

EIA mitigation measures for biodiversity can also help to mitigate and adapt to climate change. For example, creating new habitats, green spaces, green corridors, green and brown roofs (enhancement) can help maintain and enhance biodiversity, aid species in adapting to long-term climate change, and 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.

As a last resort, [redacted] can be used to compensate for significant negative impacts arising from a project, after appropriate prevention and mitigation measures have been taken. For example, Article 6(4) of the Habitats Directive provides a compensation system specifically for Natura 2000 sites. However, compensation will not always be possible: there are cases where a development proposal can be rejected on grounds of irreversible damage to, or irreplaceable loss of, biodiversity.

You should apply the precautionary principle when considering risks and adjust your proposal, rather than try to defend it against significant biodiversity effects.

Table 12: Examples of alternatives and mitigation measures related to biodiversity concerns

Main concerns	Examples of alternatives and mitigation measures
Degradation of ecosystem services	• Restore degraded ecosystems on the site to enhance ecosystem services.
Habitats, (including Natura 2000 network, habitat fragmentation and isolation)	Use an ecosystem services approach, ecosystem-based approaches and green infrastructure: • Green bridges and eco-ducts (elements of green infrastructure) re-connect natural areas divided by linear developments (e.g. roads or railway lines). They reduce accidents involving wild animals and cars, allow animals to move easily and safely from one area to another, and help plant species to spread. This gives animals more space to find food and shelter, and allows populations of the same species to interact, improving the overall resilience of the species.
Species diversity	• Introduce design alternatives to avoid adverse effects on bird species (e.g. size, height, spacing, lighting and visibility of wind turbines); • Consider timing of construction, maintenance and decommissioning; • Deliver 'smart conservation', e.g. by promoting well-designed parks, walking paths, green roofs and walls that can contribute to species diversity and to tackling climate change related to urban infrastructure projects.

4.4 Assessing significant effects

Many assessment approaches used in the EIA process have the capacity to address biodiversity and climate change. [redacted] lists several tools and approaches that are being used or piloted to support EIA assessment. There are, however, three fundamental issues that you should consider when addressing climate change and biodiversity: the **long-term and cumulative nature of effects**, **complexity of the issues and cause-effect relationships** and **uncertainty of projections**.

4.4.1 Long-term and cumulative nature of effects

As shown in [redacted] climate change and biodiversity are generally complex issues with long-term impacts and consequences. EIAs that aim to properly address biodiversity and climate should take this into account and assess the combined impact of any number of different effects. This requires an understanding of evolving baseline trends and an assessment of the cumulative effects of the project on the changing baseline.

There are a number of tips and approaches to be considered when assessing the cumulative effects of climate change and biodiversity in EIA:

- **Recognise cumulative effects early on in the EIA process,** in the scoping stage if possible. Talking to the right stakeholders as early as possible can give the wide overview needed to better understand how seemingly insignificant individual effects can have greater consequences when considered together.
- **Pay attention to the evolving baseline** when assessing the cumulative effects of climate change and biodiversity impacts. 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. Moreover, both the climate and the species that make up the natural world are in a constant state of flux. A changing climate may mean that the design and operational management of a project meant for a certain climate scenario 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 to a project. Considering potential impacts such as these is a unique challenge of climate change within EIA.
- **Distinguish between magnitude and significance and use significance criteria** — 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. Significance criteria can 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 ecosystem-based approach by identifying the valued ecosystem services and how these will be affected by drivers of change over time.
- **Where possible, use causal chains or network analysis** to understand the interactions and associated cumulative effects between specific elements of the project and aspects of the environment. The point is not to be comprehensive, but to understand which cumulative effects might be most significant. These can often be identified with stakeholders who can help work through potential pathways in causal chains.

4.4.2 Complexity of the issues and cause-effect relationships

Many of the recommendations regarding assessing a project's long-term and cumulative effects addressed in [redacted] will also help address the complexity of climate change and biodiversity and understand the cause-effect relationship they have with each other, as well as with other issues assessed within an EIA.

The complexity of climate change and biodiversity should not deter you from analysing direct and indirect impacts the proposed project could have on trends in key issues. At times, this will require simplified models that give best estimates of emissions and impacts, e.g. using best-case and worst-case scenarios to illustrate different future states under various assumptions.

Judging an impact's magnitude and significance must be context-specific. For an individual project — e.g. a road project — the contribution to GHGs may be insignificant on the global scale, but may well be significant on the local/regional scale, in terms of its contribution to set GHG-reduction targets.

Communicating uncertainty

Quantifying uncertainty can be very valuable in decision-making. It cannot eliminate uncertainty, but it can help to understand the levels of uncertainty we are dealing with. To do this well, uncertainty has to be well explained and communicated.

There are two types of probability, subjective and objective. Subjective or inductive probability gives an estimate based on the available information and strength of evidence. Objective or statistical probability presents information where all uncertainties are accounted for.

Irrespective of the type of probability, it is important to be consistent in how terms are used and how they relate to the probability they represent. The IPCC provides a guide, reproduced below:

Likelihood scale	Likelihood of the outcome
Term	
Virtually certain	99 – 100% probability
Very likely	90 – 100% probability
Likely	66 – 100% probability
About as likely as not	33 – 66% probability
Unlikely	0 – 33% probability
Very unlikely	0 – 10% probability
Exceptionally unlikely	0 – 1% probability

Source: [redacted]

Biodiversity impacts will also depend on geographical and temporal scales of impact and the sensitivity of the habitat or species concerned. For instance, a project's implementation could have possible negative effects on a species that is relatively common at global level, but is the only viable population of that species at local level.

As described in [redacted] using casual chains or network analysis should help to understand the complexity of the issues and cause-effect relationships.

4.4.3 Uncertainty

One of the tasks of describing expected impacts is to help audiences understand what is known with a high degree of confidence and what is relatively poorly understood.

Decision-makers and stakeholders are used to dealing with uncertainty all the time (e.g. economic growth, technological change) and they will able to use such information. It will be important to reassure them that considering a range of possible uncertain futures and understanding the uncertainties is part of good EIA practice and permits better and more flexible decisions.

The key principle in communicating uncertainty is avoiding complex or obscure language. Those undertaking EIA should describe the sources of uncertainty, characterise its nature and explain the meaning of phrases used. Using everyday language to describe uncertainty can makes the concept more accessible, but there is a risk of misunderstanding, as people may have personal and

differing interpretations of terms like 'high confidence'. Using the IPCC terms (see box above) may help here.

The [redacted] offers [redacted] which aims to help decision-makers to understand the sources of uncertainty in climate information that are most relevant for adaptation planning. It also provides further suggestions for dealing with uncertainty in adaptation planning and for communicating uncertainty.

4.5 Monitoring and adaptive management

Although monitoring is not required by the EIA Directive, it can be identified and implemented as a mitigation measure. For example, such monitoring measures could be linked to the environmental conditions set in development consent as a result of the EIA procedure (e.g. adherence to agreed flights schedules in order to avoid increasing noise or GHG emissions levels for airports). Moreover, generating recommendations for monitoring the impact of implementing a project, in order to identify any unforeseen adverse effects and take appropriate remedial action, is good EIA practice.

This guidance emphasises the importance of analysing long-term trends related to climate change and biodiversity, assessing direct and indirect impacts of proposed projects on these trends, acknowledging assumptions and uncertainty in the assessment process and ideally choosing a project design and implementation that allows for changes in light of lessons learnt. If project implementation does allow for changes to be made, EIA practitioners may find it useful to consider the principles of [redacted]

A key feature of adaptive management is that decision-makers seek development strategies that can be modified once new insights are gained from experience and research. Learning, experimenting and evaluation are key elements of this approach. Adaptive management requires the flexibility to change decisions as new information becomes available. While this may not always be possible, project development designs and permits should increasingly allow for changes in project structure and operation, if changes in the environmental context make them necessary (e.g. increasing severity of flooding, droughts, heat waves, changes in habitats and migration corridors, need for changes in buffers of areas important for protection of biodiversity, etc.).

EIA may facilitate adaptive management by clearly acknowledging assumptions and uncertainty and proposing practical monitoring arrangements to verify the correctness of the predictions made and bring any new information to the attention of decision-makers. When designing such systems, EIA practitioners will need to expand project owners' and stakeholders' knowledge and awareness, ensure their commitment and propose approaches to project implementation that provide for flexibility.

Annexes

Annex 1: Further reading

The international, European, and Member State level policy documents, reports and guidelines described below include documents referred to within this guide and other sources of information potentially useful for integrating climate change and biodiversity into EIA. This section includes only reference documents publicly available on the internet. The table below provides the title, hyperlink (status as of November 2012) and short description of each source. The icons below are used to distinguish the different topics covered in the table.

Key:

 Climate change

 Mitigation

 Adaptation

 Biodiversity

 Environmental Impact Assessment

 Strategic Environmental Assessment

Reference/further reading (links active as of March 2013)	Comments on relevance
Climate change — general	
[redacted] (EEA, 2012)	• This report presents information on past and projected climate change and related impacts in Europe, based on a range of indicators. It also assesses the vulnerability of society, human health and ecosystems in Europe and identifies those regions most at risk from climate change.
[redacted]	• This review contributes to assessing the evidence and building an understanding of the economics of climate change. It first examines the evidence on the economic impacts of climate change and explores the economics of stabilising GHGs in the atmosphere. The second half of the document considers the complex policy challenges involved in managing the transition to a low-carbon economy and in ensuring that societies can adapt to the unavoidable consequences of climate change.
[redacted]	• This report provides an introduction to climate change, including scientific background, policy context, possible risks and impacts, policy actions and current targets and goals.
[redacted]	• This website provides information on latest developments made through the United Nations Conference of Parties (COP) process. • It includes links detailing international requirements (such as Kyoto, Bali Action Plan, Copenhagen Accord and Cancun Agreement), including likely developments. • It is also a good source of supra-national GHG data.
Climate change — mitigation	
[redacted]	• This report summarises the EU's progress towards GHG reduction targets. • It considers global and European GHG trends and associated challenges.
Climate change — adaptation	
[redacted]	• This report is a good source of European climate change impact analysis, with descriptions and analyses of current and possible future policy actions.
[redacted]	• The IPPC Chapter on the impact of climate change across

[redacted]	Europe considers key vulnerabilities and possible policy responses.
[redacted]	• The Communication sets out the EU's approach to preventing natural and man-made disasters and includes ways of mainstreaming prevention in existing legislative and financial instruments.
[redacted]	• A leaflet describing the benefits of forests (parks and green spaces) in urban environments as an adaptation approach to climate change.
[redacted]	• Information regarding global climate change science, split into a range of working groups and sectoral reports.
[redacted]	• This document considers the higher-level principles of adapting to climate change, with an introduction to the concept and supporting principles.
[redacted]	• Extreme weather and climate events, interacting with exposed and vulnerable human and natural systems, can lead to disasters. This report explores the challenge of understanding and managing the risks of climate extremes, to advance climate change adaptation.
[redacted]	• The report assesses the occurrence and impacts of disasters and the underlying hazards such as storms, extreme temperatures, forest fires, water scarcity and droughts, floods, snow avalanches, landslides, earthquakes, volcano eruptions and technological accidents in Europe in the 1998-2009 period. It is useful for assessing potential vulnerability.
[redacted]	• These EU guidelines focus on the processes and methods used in the prevention, preparedness and planning stages of national risk assessments and mapping, as carried out within the broader framework of disaster risk management.
[redacted]	• The White Paper setting out the EU's approach to adapting to climate change, based on the concept of mainstreaming. • It refers to the resilience of biodiversity and natural systems.
Biodiversity	
General	
[redacted] 2010)	• The report provides information on the status of European biodiversity with a focus on designated areas and progress towards the EU's biodiversity targets.
[redacted]	• The report summarises the EEA's biodiversity assessments as part of the State of the Environment Report 2010.
[redacted] 2010)	• The report provides a comprehensive assessment of the state of and trends in Europe's biodiversity.
[redacted]	• Provides a series of specific assessments based on Europe's bio-geographic regions and the relationship between climate change and biodiversity.
[redacted]	• The report provides an assessment of the status of and trends in Europe's biodiversity.
[redacted] final)	• The new Biodiversity Strategy aims to halt the loss of biodiversity and ecosystem services in the EU by 2020. There are six main targets and 20 actions to help Europe reach its goal.
[redacted]	• This report provides a foundation for environmental monitoring and protective measures for those landscapes that are not yet fragmented. It also makes it clear that fragmentation analysis must be integrated into transport and regional planning so that cumulative effects are considered more effectively in the future.
[redacted]	• A report that considers the status of and trends in global biodiversity and the services it provides.

[redacted]	• A document that sets out the World Association for Waterborne Transport (PIANC) management plans to integrate ecosystem services into its activities. It is based on the general principle of integrated planning.
[redacted]	• This paper was prepared by the BBOP to help auditors, developers, conservation groups, communities, governments and financial institutions that wish to consider and develop best-practice related to biodiversity offsets.
[redacted] (TEEB, 2010)	• A report on the current provision of ecosystem services and the tools that can support their integration into policy and decision-making.
[redacted]	• A report that considers the concept of environmental limits and how they may be usefully applied within environmental agencies.
Green infrastructure	
[redacted] study, 2012)	• A study that assesses the effectiveness and efficiency of policy initiatives supporting green infrastructure across Europe. • It identified the main existing policy measures that can help to support green infrastructure initiatives and their implementation, including seven in-depth case studies on thematic issues.
[redacted]	• A report that explores the concept of green infrastructure, with illustrative examples of green infrastructure initiatives and analyses of integrating green infrastructure into policy sectors.
[redacted]	• A booklet that presents the basics of green infrastructure and explains a number of approaches.
Article 6 of the Habitats Directive guidance documents	
[redacted]	• A document that describes the policy context for reconciling environmental requirements with port development.
[redacted]	• This guidance document shows how the needs of extractive industries can be met while avoiding adverse effects on wildlife and nature. • It examines how the potential impacts of extraction activities on nature and biodiversity can be minimised or avoided altogether.
[redacted]	• This guidance document aims to explain the protection regime (defined under Article 6 of the Habitats Directive) that applies to Natura 2000 sites in the specific context of estuaries, fairway channels and coastal zones, with particular attention paid to port-related activities, including dredging and industry (e.g. shipyards).
[redacted]	• The purpose of this document is to provide guidance on how to best ensure that wind energy developments are compatible with the provisions of the Habitats Directive and the Birds Directive.
[redacted]	• This document clarifies the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, Opinion of the Commission.
[redacted] 2001)	• A methodological guidance document on the provisions of Articles 6(3) and (4) of the Habitats Directive.
[redacted]	• This document provides Member States with guidelines on how to interpret certain key concepts used in Article 6 of the Habitats Directive.

Biodiversity and climate change	
[redacted]	• A detailed description and analysis of environment-based interventions that increase adaptive capacity with regard to climate change.
[redacted]	• A study that addresses current knowledge gaps concerning the implementation of ecosystem-based approaches and aims to gain a better understanding of their role and potential in climate change adaptation and mitigation in Europe.
[redacted]	• A technical note on how the 2020 targets as set out in the CBD will be achieved, considering the problems caused by climate change and biodiversity loss.
[redacted]	• A summary report exploring and describing the main issues surrounding climate change and biodiversity in Europe.
[redacted]	• A report that discusses the role of European regions in responding to climate-change-related issues, including adaptation and mitigation.
[redacted]	• A summary report that provides an overview of the likely impact of climate change on biodiversity in the EU and includes indications as to how the design and implementation of current policy might need to be adapted in order to ensure that the EU respects its commitment to reducing biodiversity loss.
[redacted]	• A report on the potential role of nature and ecosystem services in mitigating and responding to climate change.
EIA	
[redacted]	• A collection of the most important rulings of the European Court of Justice related to key articles of the EIA Directive.
[redacted]	• A report that reviews the application and effectiveness of the EIA Directive in the EU. • It gives an overview of the link between EIA and other legislation and includes a section on the link between EIA, biodiversity and climate change.
EIA and biodiversity	
[redacted]	• An IAIA Wiki webpage that provides a range of overarching principles, case studies, possible tools, links, etc. on biodiversity, ecology and ecosystem services in the context of impact assessment considerations/approaches.
[redacted]	• A publication that reviews key strategic and operational issues linked to integrating biodiversity-related considerations into impact assessment practices.
[redacted]	• Assessment guidelines that seek to incorporate the requirements of the CBD into PPs (via SEA) and projects (via EIA). • They deal with high-level principles and provide relevant case studies.
[redacted]	• Guidelines that include examples of how biodiversity could be included in assessment methodologies (although not directly applicable to EIA).
[redacted]	• No-net-loss of biodiversity (and net-gain wherever possible) is a principle that must be applied in the environmental assessment system that is used in the wider countryside. • This paper considers how this can be achieved through EIA, SEA and impact assessment of the European Commission's own policies and other initiatives. It proposes reforms to

	each of these forms of environmental assessment as a means of achieving the EU's biodiversity goals.
[redacted]	• A report that promotes standards and data publishing tools that can be used to collect and publish primary biodiversity data on the internet.
[redacted]	• A technical guidance document based on the CBD guidelines described above. It contains RAMSAR-specific additions that seek to include wetlands.
[redacted]	• This report considers how EIA and SEA could include ecosystem services.
[redacted]	• This paper calls for an important shift in our approach, towards navigation development projects that help deliver mutually beneficial 'win-win' solutions. • It focuses on achieving the project objectives in an ecosystem context rather than assessing the consequences of a predefined project design. It also identifies win-win solutions rather than simply minimising ecological harm.
 **EIA and climate change**	
[redacted]	• A guidance document that sets out overarching principles related to assessment, reporting and follow-up.
[redacted]	• Guidelines covering EIA and SEA, with specific reference to climate change, adaptation and risk management in international development funding and projects.
[redacted]	• A document that sets out principles, and provides checklists and examples to help include climate change adaptation in EIA.
[redacted]	• A guidance document that assesses the current state of including adaptation in EIA, with examples of current approaches.
[redacted]	• A document with links to presentations on various aspects of climate change.
[redacted]	• A document with links to presentations on various aspects of climate change.

Annex 2: Sources of information on climate change and biodiversity

This annex outlines the different types and sources of information that are available and can be used to support the integration of climate change and biodiversity into EIA. Additional sources of information are listed in Annex I. This information will be particularly useful in the EIA screening, scoping and assessment stages, as well as for 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: e.g. Natura 2000 sites, national designations;
- GHG emission inventories, etc.;
- climate projections: IPCC, etc.;
- future climate and socio-economic scenarios.

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

Sources of information

The strategic documents that provide the context in which a project must be considered will serve as the starting point for sources of information on climate change and biodiversity. 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, risk assessment or risk management plans, or vulnerability assessment studies.

Other assessments may also be relevant, such as SEAs carried out for higher-level plans and programmes under the SEA Directive, or assessments carried out under the Habitats Directive.

For biodiversity, specialist sources include:

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

For climate change, specialist sources include:

- species distribution;
- trend data, e.g. loss of species/habitats;
- protected area status: Natura 2000 sites, national designations, etc.;
- GHG emission inventories etc.;
- climate projections: IPCC , etc.;
- future climate and socio-economic scenarios.

Key European sources of data

The table below summarises some of the key sources of data available at European level, including data repositories and datasets, online tools and key reports and documents. The table is organised by different topics and types of data, using the icons below.

Key:

 Climate change

 Biodiversity

 Mitigation

 Adaptation

 Databases, data repositories and online tools

 Organisations and research projects

 Reports and other documents

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

	Source	Description	Links (March 2013)
	**Climate change**		
	**Climate Change Data Centre (EEA)**	Repository of a wide range of climate change relevant data and information. It includes all the latest climate change relevant developments within the EEA. It is a good meta-source of developments across European climate policy and reporting.	[redacted]
	**Climate Change Knowledge Portal, CCKP (the World Bank Group)**	The portal provides online access to comprehensive global, regional, and country data related to climate change and development. The portal provides development practitioners with a resource that helps them explore, evaluate, synthesise, and learn about climate-related vulnerabilities and risks, in various levels of detail.	[redacted]
	**Intergovernmental Panel on Climate Change (IPPC)**	The IPCC is the leading international body for the assessment of climate change. Its website includes the fourth assessment report on climate change (2007) and other global climate change science findings, split by working groups and sectors.	[redacted]
	**Climate change — mitigation**		
	**European Topic Centre for Air Pollution and Climate Change Mitigation, ETC/ACM (EEA)**	The ETC/ACM assists the EEA in supporting EU policy in the fields of air pollution and climate change mitigation. The ETC/ACM provides reports and databases relevant to climate change mitigation.	[redacted]
	**Greenhouse Gas Emission Viewer (EEA)**	The EEA GHG viewer provides easy access and analysis of the data contained in the Annual EU GHG inventories. The EEA GHG data viewer shows emission trends for the main sectors and allows for comparisons of emissions between different countries and activities.	[redacted]
	**Climate change — adaptation**		
	**CLIMATE-ADAPT: European Climate Adaptation Platform (EEA)**	CLIMATE-ADAPT is an interactive, publicly accessible web-based tool on adaptation to climate change. It is designed to support policy-makers at EU, national, regional and local levels in the development of climate change adaptation measures and policies.	[redacted]
	**CLIMSAVE**	CLIMSAVE is a research project that is developing a user-friendly, interactive web-based tool that will allow stakeholders to assess climate change impacts and vulnerabilities for a range of sectors, including agriculture, forestry, biodiversity, coasts, water resources and urban development. Linking models relating to different sectors will enable stakeholders to see how interactions could affect the European landscape.	[redacted]

	EmDAT	International disaster database that provides information helpful for natural disaster preparation and decision-making. It can be useful for scoping vulnerability to climate change.	[redacted]
	ERA-NET ROAD — Coordination and Implementation of Road Research in Europe	ERA-NET ROAD was a Coordination Action funded by the EU Sixth Framework Programme for European Research and Technological Development. Eleven National Road Administrations participated. A call entitled [redacted] was launched as part of this Coordinated Action. Four projects relevant to climate change adaptation were funded within the call: IRWIN — Improved local winter index to assess maintenance needs and adaptation costs in climate change scenarios; P2R2C2 — Pavement Performance and Remediation Requirements following Climate Change; RIMAROCC — Risk Management for Roads in a Changing Climate; SWAMP — Storm Water prevention — Methods to predict damage from water stream in and near road pavements in lowland areas. The project is being continued as ERA-NET Road II within an enlarged consortium and with funding from the EU Seventh Framework Programme for Research and Technological Development.	[redacted]
	European Severe Weather Database	Database of severe weather events across Europe. It can be useful for indicating general vulnerability of projects.	[redacted]
	NatCatSERVICE	Insurance-based database analysing approximately 1000 events per 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.	[redacted]
	National Adaptation Strategies (EEA)	Up-to-date database of EU Member State progress on the EU's Adaptation White Paper. It is a good source of country-specific actions.	[redacted]
	National Climate Research The Netherlands	The joint website of the Dutch Climate Changes Spatial Planning Programme and the Knowledge for Climate Research Programme. The Climate Changes Spatial Planning Programme enhances joint-learning between communities and people in practice within spatial planning, on several themes: climate scenarios, mitigation, adaptation, integration and communication. The Knowledge for Climate Research Programme develops knowledge and services and focuses on eight hotspots, enabling the climate proofing of the Netherlands.	[redacted]
	Urban adaptation to climate change in Europe and Interactive maps from the Report on Eye on Earth (EEA)	This Report provides information on challenges and opportunities specific to cities and related national and European policies. It is accompanied by a range of interactive maps from the Eye on Earth report, including on the heat wave risk to European cities; coastal flooding; and the share of green and blue areas.	[redacted]
	Biodiversity		
	ALARM	ALARM (**A**ssessing **LA**rge Scale **R**isks for Biodiversity with Tested **M**ethods) is a research project that developed and tested methods and protocols for the assessment of large-scale environmental risks, in order to minimise negative direct and indirect human impacts.	[redacted]
	Biodiversity Data Centre (EEA)	Repository of a wide range of biodiversity-relevant data and information. It includes all the latest biodiversity-relevant developments within the EEA and is a good meta-source of	[redacted]

		developments across European biodiversity policy and reporting.	
	Birdlife Datazone	Updated site that provides species- and habitat-specific information for sites across the EU (and beyond).	[redacted]
	Biodiversity Information System for Europe, BISE (EEA)	Database of all relevant European biodiversity data sources. It is a good source of indicators and maps collated from across European institutions.	[redacted]
	European Topic Centre on Biological Diversity, ETC/BC (EEA)	The ETC/BD is an international consortium working with the EEA under a framework partnership agreement. It presents expert knowledge and reporting in a series of reports and databases.	[redacted]
	Global Biodiversity Information Service	Publicly accessible biodiversity data, including species occurrence and taxonomic information. It is a very detailed species-specific data source and a good indicator of potential species presence across Europe for use in scoping. It is likely to require site investigation to confirm occurrences.	[redacted]
	Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)	The IPBES goal is to be an interface between the scientific community and policy makers and to build capacity for and strengthen the use of science in policy making. IPBES set up a mechanism to address the gaps in the science policy interface on biodiversity and ecosystem services.	[redacted]
	MACIS	MACIS (**M**inimisation of and **A**daptation to **Cl**imate Change **I**mpacts on Biodiver**S**ity) is a research project that summarises what is already known about the impacts of climate change on biodiversity and developed methods to assess potential impacts in the future.	[redacted]
	Natura2000 Viewer (EEA)	Information on the Natura2000 network across EU Member States.	[redacted]
	RESPONSES	The objective of the RESPONSES research project is to identify and assess integrated EU climate-change policy responses that achieve ambitious mitigation and environmental targets and, at the same time, reduce the EU's vulnerability to inevitable climate change impacts.	[redacted]
General			
	Data and Maps (European Environment Agency)	Access to the EEA's maps, indicators, databases and graphs.	[redacted]
	EUROSTAT	Database with a huge range of environmental, economic and social data.	[redacted]
	EUROSTAT Country profiles	Country-specific data on a range of issues including climate change emissions and sectoral activity.	[redacted]
	EUROSTAT Sustainable development indicators	The Sustainable Development Indicators are used to monitor the EU Sustainable Development Strategy in a report published by Eurostat every two years. They are organised into ten themes, including climate change and natural resources, and include Member State-level information.	[redacted]
	Group on Earth Observatories (GEO)	Database of global data components on a range of environmental aspects, including climate change and biodiversity.	[redacted]
	Indicators (EEA)	Indicators and factsheets about Europe's environment.	[redacted]

Annex 3: Tools for integrating climate change and biodiversity in EIA

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 EIA. This is not an exhaustive list and many other tools may also be relevant.[31] 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), whilst others can be more generally applicable. Some apply to specific stages of EIA and others to the whole EIA process.

The tools and approaches that will be relevant and useful for your EIA will depend on the specific circumstances of the project (e.g. the type of project, its location, 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 EIA and therefore which tools may be relevant. The decision about whether to use any of these tools for the EIA should be taken early in the process, most likely at the scoping stage.

Name	Description	Application Comments	Source of further information
Biodiversity offsetting	Biodiversity offsetting is an approach that seeks to compensate for unavoidable loss of habitats and species due to development. Though not formalised in every Member State, there are specific provisions for offsetting within the Environmental Liability Directive and Habitats Directive — Article 6.4.	The practice is developing across Europe. Recent examples include the 2011 Biodiversity Strategy, which makes reference to the Commission acting in line with previous studies. It is likely that, within the context of European policy, Member States will develop this area as they see fit.	Business-led offsetting programme: [redacted] BirdLife International position on offsetting: [redacted] European Commission feasibility study: [redacted] A source of news, data, and analytics on markets and payments for ecosystem services: [redacted]
Biodiversity screening map	Screening maps are a form of spatial analysis that requires the identification of the habitats sited around a particular project. Based on these, habitats are assessed on their relative worth, considering wider trends and likely impacts of the project. Information on potentially significant effects needing consideration should be part of the screening decision.	Screening maps are useful during the screening and scoping stages, for identifying potential areas of higher-value biodiversity that may be used as alternatives.	Some of the information sources presented in Annex 2 could be useful, but expert judgment and the experience of other stakeholders are more relevant here.

[31] The IAIA wiki is a useful resource for more general tools and concepts for the practice of EIA: [redacted]

(Pilot) Carbon footprint exercise (EIB)	The European Investment Bank (EIB) developed a sector-specific methodology to assess the carbon footprint of projects it finances. Most EIB projects emit GHGs into the atmosphere, either directly (e.g. fuel combustion or production-process emissions) or indirectly through purchased electricity and/or heat. In addition, many projects result in emission reductions or increases when compared to what would have happened if the project didn't exist, referred to as the baseline. The objective of the draft methodology is twofold: • to assess the absolute GHG emissions of the projects financed by the EIB; and • to assess any emission variations compared to a baseline, referred to as the relative emission.	A comprehensive practical guide for EIB staff working on the pilot footprint calculations.	[redacted]
Confidence levels	Confidence levels are an effective approach to communicating uncertainty and may be useful when considering potential climate change impacts.	Increasingly, climate change impacts are being shown in probabilistic scenarios that can be presented in terms of confidence levels.	Confidence levels vary between different climate scenarios — e.g. the IPPC provides information as to specific confidence levels within different assessments.
Disaster risk management	The systematic process of using administrative directives, organisations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.	This term is an extension of the more general term 'risk management' and addresses the specific issue of disaster risks. Disaster risk management aims to avoid, lessen or transfer the adverse effects of hazards through activities and measures that focus on prevention, mitigation and preparedness	
Ecological surveys	Undertaken by expert ecologists, site surveys can identify and describe the ecosystems, habitats and species present on site. This enables the identification of protected species or habitats and informs project designers of the need to reduce avoidable damage to higher-value areas of biodiversity and to look for areas of potential enhancement.	The scale and type of expertise required will vary hugely between projects and should be defined based on local circumstances. An early ecological survey can save time and effort at later stages of the project 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 States' legal requirements based on the Birds Directive and Habitats Directive.	There is a wide range of consultants available to undertake ecological surveys.

Ecosystem-based approaches	Managing, restoring and protecting biodiversity and ecosystem services provide multiple benefits to human society. These ecosystem-based approaches contribute to protecting and restoring natural ecosystems by conserving or enhancing carbon stocks, reducing emissions caused by ecosystem degradation and loss, and providing cost-effective protection against some of the threats that result from climate change.	Ecosystem-based approaches can be used as cost-effective alternatives to infrastructure projects or their elements.	Relevant information from the DG Environment website, including the following reports: • Towards a Strategy on Climate Change, Ecosystem Services and Biodiversity [redacted] • Assessment of the potential of ecosystem-based approaches to climate change adaptation and mitigation in Europe [redacted] Relevant information from the CBD website: [redacted]
Ecosystem services approach	Ecosystem services potentially offer a new tool to use in EIA, using the concepts developed by the Millennium Ecosystem Assessment.	Ecosystem services could be used in particular when considering alternatives and mitigation measures in EIA.	Millennium Ecosystem Assessment (MEA) (2005) Ecosystems and Human Well-Being: Synthesis. Island Press, Washington. [redacted] World Resources Institute (2008) Ecosystem Services: A Guide for Decision Makers [redacted] Sheate W, Eales R, Daly E, Murdoch A, and Hill C (2008), Case study on developing tools and methodologies to deliver an ecosystem-based approach: Thames Gateway Green Grids, Project report NR0109, London, Defra, 2008, available at [redacted]

Ecosystem services valuation	The economic valuation of ecosystem services has significantly developed as a potential tool within impact assessment. Recent analysis within the TEEB and various Member States indicates that this approach has the potential to make the economic value of biodiversity clear. In theory, this 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 demonstrating that the environment is important to us rather than 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 limited. It is possible to relate existing valuation studies to a different project but this is difficult and the results are generally for illustrative purposes only, due to the contextual nature of the environment of different projects. However certain ecosystem services (i.e. provisioning services) can be relatively simply valued and may add value to certain assessments.	Chapter 6 of TEEB for Local and Regional Policy makers considers economic valuation as part of EIA (and SEA) practice: [redacted] [redacted] valuing ecosystem services (UK): [redacted]
GHG conversion factors	Managed by the UK Department for Food, Environment and Rural Affairs (Defra), this resource provides a useful excel-based tool for considering the total GHG emissions of a range of materials and activities. Activities include fuel, electricity, processes, transport and refrigeration.	The tool was developed for the UK but is useful elsewhere because of its wide range of parameters that can be populated with whatever data are available. It is useful for scoping and when considering alternatives.	Sheet available from here: [redacted]
GHG emission calculators	Emission calculators quantify the total GHG (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. Various calculators exist and are generally based on GHG equivalents for certain indicators, such as energy consumption.	Depending on the scale of your project, it may be appropriate to hire consultants; online tools can be used for smaller projects. Note that some of these focus on transport emissions and may not always be relevant for all projects.	A number of consultancies operate or provide GHG emissions calculators that can be used for individual projects. Examples include: [redacted] [redacted] The World Resource Institute and World Business Council for Sustainable Development have developed and maintain the [redacted] website, which includes a wide range of sectoral GHG calculators and related tools/case studies.
GIS and spatial analysis	Geographic Information Systems (GIS) and their use as a form of spatial analysis have proven to be valueable in communicating and identifying environmental impacts of projects. There is a huge spectrum of possible GIS methods and uses and these can be tailored depending on individual project scales and resources.	The nature of the GIS required will vary depending on the scale of the project and its intended purpose. GIS is a broad technique and can be used to undertake analysis of various morphological or technical factors or only to support consultation exercises.	GIS is largely dependent on available data; potentially useful sources of pan-European information and data are presented in Annex 2.

GRaBS Adaptation Action Planning Tool	GRaBS (Green and blue space adaptation for urban areas and eco towns) is an online toolkit (developed within the INTERREG IV C programme) 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.	It is a useful tool for the scoping stage and for identifying regional trends for certain climate hazards. However, its current scope covers only a limited number of locations (GRaBS partners).	[redacted]
Green infrastructure	'Green infrastructure' refers to ecosystem-based approaches in a spatial context. It can be defined as a strategically planned and delivered network of high- quality green spaces and other environmental features. It should be designed and managed as a multifunctional resource capable of delivering a wide range of benefits and services. Green Infrastructure includes natural and semi-natural areas, features and green spaces in rural and urban, terrestrial, freshwater, coastal and marine areas. Areas protected as Natura 2000 sites are at the core of green Infrastructure. The underlying principle of Green Infrastructure is that the same area of land can frequently offer multiple benefits. By enhancing Green Infrastructure, valuable landscape features can be maintained or created, which is valuable not only for biodiversity, climate change mitigation and adaptation, but also contributes to ecosystem services such as clean water, productive soil and attractive recreational areas. In addition, Green Infrastructure can sometimes be a cost-effective alternative or be complementary to grey infrastructure and intensive land use change.	It is useful when considering alternatives and mitigation measures.	[redacted]
Integrated Biodiversity Assessment Tool (IBAT) for Business	The tool offers up-to-date biodiversity information to support impact assessment.	For business use, subscription required.	[redacted]

Integrated Biodiversity Assessment Tool (IBAT) for Research and Conservation Planning	IBAT for Research and Conservation Planning is an innovative tool designed to facilitate access to a range of global and national data layers, such as protected area boundaries, biological information about habitat and species diversity indices, and key areas for biodiversity, which can be useful for research and conservation planning purposes.	To be used by the academic and conservation research communities.	[redacted]
Life Cycle Assessment (LCA)	LCA is a technique that seeks to consider all the environmental impacts of particular actions over their lifetimes. This is particularly relevant to climate change as GHG 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 than steel and 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, but certain elements of a project may already be subject to LCA so the information can be used by EIA 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.	Online repository of LCA tools: [redacted] Introduction on LCA and the LCA Resource Centre are available through the European Commission's Joint Research Centre: [redacted]
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 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.	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 chain of causation. It is best undertaken during the scoping stage, but may be extended into the later stages of assessment.	Network analysis is generally dependent on the use of expert knowledge and judgment and the accurate identification and linking of drivers and impacts.

Risk management	When considering climate change, it is particularly useful to frame potential impacts in terms of their probability and magnitude. These two components make up risk. Such framing can be achieved for example by considering the probability of impact (how likely is it that rising sea levels will affect a project) in relation to the magnitude of the impact (what would be the likely impact of rising sea levels on a project). Understanding these two elements is essential to reducing vulnerability and increasing resilience.	Thinking in terms of probability and magnitude within an EIA can inform stakeholders about a project's vulnerability and the need for adaptation measures — what alternatives are available and what monitoring is required.	Vulnerability and climate change (Vancouver sewerage area infrastructure): [redacted] IAIA's risk management advice: [redacted]
Robust Decision Making (RDM)	RDM is a decision-making concept that seeks to consider the vulnerability and adaptability of a project rather that solely predicting the impact of that project. An example of RDM could be looking at a road system and considering what climate circumstances would cause the road to cease to operate (for instance floods, temperature changes, etc.). Having identified the vulnerability, the project supported by EIA can then consider potential alternatives that may reduce this vulnerability. This will include an assessment of other elements such as cost and the potential impacts on other EIA issues, including biodiversity.	RDM is particularly useful when considering the impacts of climate change on a project and should be integrated into the alternative stage of project design and EIA. RDM approaches are commonly used within project design but EIA offers the potential to make this link to climate change more explicit and effective.	RDM and climate change: [redacted] Related publications: [redacted]
Scenarios	Scenarios relate to climate change (e.g. IPCC scenarios) and socio-economic/alternative futures scenarios and assess the resilience of projects and the environment in the long term. The use of scenarios is a response to uncertainty.	Scenarios are effective for 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. Scenarios can also support assessing alternatives.	Potential European resources include the information on the EEA's website: [redacted] http://www.eea.europa.eu/themes/scenarios/intro [redacted]

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. 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 at how changing water abstraction will impact downstream systems; how increased dust will affect the turbidity of downstream environments; how removing one habitat type will affect neighbouring habitats.	This concept is particularly useful for the screening and scoping stages and for identifying indirect and secondary effects. It requires an understanding of possible impacts and causal chains. Network analysis is a related tool. It may also be useful when considering alternatives and their impacts.	Some information sources presented in Annex 2 may be helpful, but expert judgment and the experience of other stakeholders are more relevant.
Technical data	Technical data and parameters provided by equipment manufacturers may include information on emissions per production unit; energy use/demand, etc.	Data from process and equipment suppliers could be used to assess the magnitude and significance of a project's overall GHG emissions and how GHG emissions can be mitigated.	Many potential sources of such data and comparative data exist for different types of common equipment, see for example: [redacted]
Vulnerability assessment	A vulnerability assessment is the process of identifying, quantifying, and prioritising (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. It needs to be built into any effective assessment of the evolution of the baseline environment and of alternatives to investigate how the environment will change if the plan or programme is not implemented, and in relation to different alternatives. It can therefore be used to evaluate alternatives and to help identify and select the most resilient one(s).	Climate change Clearing House. Technical Briefings on Climate Vulnerability Assessment: [redacted] Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment (National Wildlife Federation, Washington, D.C., 2011): [redacted]

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