



Background document

Expert Meeting

Biodiversity and ecosystem services approaches for climate change adaptation and disaster risk reduction: knowledge base, policies and practices at European, national and subnational level

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European Environment Agency

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In Europe climate change already causes wide-ranging impacts on different sectors of society. Natural hazards (e.g. heat waves, heavy precipitation, river floods, windstorms, landslides, droughts, forest fires, avalanches, hail and storm surges) have large direct impacts on European economy, human health and well-being, and the environment. Most of these hazards are expected to increase in frequency and/or severity in the coming decades across Europe, based on the projected changes in climate (see EEA reports published in 2017¹). Such climate change is affecting biodiversity and ecosystem services and it is expected to become one of the greatest threats to biodiversity during this century (see EEA report 'Mapping and assessing the condition of Europe's ecosystems: Progress and challenges'²). In addition, biodiversity and ecosystem services play an important role in regulating the climate, thus making key contributions to the climate change challenge, both mitigation and adaptation, (see EEA report 'Exploring nature-based solutions — The role of green infrastructure in mitigating the impacts of weather- and climate change-related natural hazard'³).

Climate Change Adaptation (CCA)⁴ and **Disaster Risk Reduction (DRR)**⁵ offer a range of complementary approaches for managing risks associated with extreme weather and climate related events. Although CCA and DRR address similar challenges, they are governed by different policy, institutional and legal frameworks and involve different communities. Because

¹ EEA, 2017, *Climate change, impacts and vulnerability in Europe — An indicator-based report*, EEA Report 1/2017 and EEA, 2017, *Climate change adaptation and disaster risk reduction in Europe - Enhancing coherence of the coherence of the knowledge base, policies and practices*. Report 15/2017.

² EEA, 2016, *Mapping and assessing the condition of Europe's ecosystems: Progress and challenges*, EEA Report No 3/2016.

³ EEA, 2015, *Exploring nature-based solutions — The role of green infrastructure in mitigating the impacts of weather- and climate change-related natural hazards*, EEA Technical report No 12/2015.

⁴ Climate Change Adaptation - The process of adjustment to actual or expected climate change and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.

⁵ Disaster Risk Reduction - Denotes both a policy goal or objective, and the strategic and instrumental measures employed for anticipating future disaster risk; reducing existing exposure, hazard, or vulnerability; and improving resilience.



of these differences, benefits can be obtained from a closer policy coordination and collaboration for CCA and DRR. This has been emphasised in an EEA 2017 report (see EEA report 'Climate change adaptation and disaster risk reduction in Europe - Synergies for the knowledge base, policies and practices'⁶) in which (subchapter 2.3) European case studies, showing some integration of CCA with DRR, have been analysed and good practices of CCA and DRR integration have been identified (chapter 5).

Recently, the use of **biodiversity and ecosystem services (BES)** in specific CCA and DRR measures (**Ecosystem-based adaptation (EbA)** and **ecosystem-based approaches to disaster risk reduction (eco-DRR)**) have emerged within multilateral frameworks such as the international **UN Framework Convention on Climate Change (UNFCCC)**, the **Convention on Biological Diversity (CBD)** and the **Sendai Framework for Disaster Risk reduction (SFDRR)**, and adopted as specific and effective practices for CCA and DRR, and have become relevant as well for the implementation of the **Sustainable Development Goals (SDGs)**. **IPCC WGII AR5 Report** (2014) concluded that practices that promote sustainable development in the present (i.e. by combining social justice, environmental health and economic productivity) can reduce future risks of climate change and are thus examples of adaptive actions.

At the present, different definitions of EbA are in literature, e.g.:

1. *'The use of BES as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change. EbA can generate significant social, economic and cultural co-benefits, contribute to the conservation of biodiversity and build on the traditional knowledge and practices of indigenous peoples and local communities'* (CBD, 2009⁷).
2. *'Policies and practices that are based on the premise that ecosystem services protected or restored reduce the vulnerability of society to climate change'* (Vignola et al., 2009⁸).
3. *'The use of natural capital by people to adapt to climate change impacts, which can also have multiple co-benefits for mitigation, protection of livelihoods and poverty alleviation'* (Munang et al., 2013⁹).
4. *'The use of BES into climate change adaptation strategies, taking into account the multiple social, economic, and cultural co-benefits for local communities'* (Shaw et al., 2014¹⁰).
5. *'Practices that promote socio-ecological resilience by fostering ecosystem services, through ecosystem management that enable people to adapt to the impacts of climate change and reduce their vulnerability'* (Ojea, 2015¹¹).

⁶ EEA, 2017, *Climate change adaptation and disaster risk reduction in Europe - Synergies for the knowledge base, policies and practices*, EEA Report No 15/2017

⁷ CBD – Convention of Biological Diversity, 2009. *Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change*. CBD Technical Series 41, Montreal, Canada.

⁸ Vignola, R., Locatelli, B., Martinez, B., et al., 2009. *Ecosystem-based adaptation to climate change: what role for policy makers, society and scientists?* *Mitig. Adapt. Strateg. Glob. Change* 14, 691–696.

⁹ Munang, R., Thiaw, I., Alverson, K., et al., 2013. *Climate change and ecosystem-based adaptation: a new pragmatic approach to buffering climate change impacts*. *Curr. Opin. Environ. Sustain.* 5, 67–71.

¹⁰ Shaw, M.R., Overpeck, J.T., Midgley, G.F., 2014. *Cross-chapter box on ecosystem-based approaches to adaptation – emerging opportunities*. In: Field, C.B., et al. (Eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, pp. 35–94.

¹¹ Ojea, E., 2015. *Challenges for mainstreaming ecosystem-based adaptation into the international climate agenda*. *Curr. Opin. Environ. Sustain.* 14, 41–48.



As now, the most widely adopted EbA definition is the one used by the CBD (CBD, 2009). On the other hand, the definition of Eco-DRR is more recent and is seen as the '*sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim of achieving sustainable and resilient development*' (Renaud et al., 2016¹²; Estrella and Saalismaa, 2013¹³; IUCN¹⁴).

EbA and Eco-DRR approaches have potential overlaps. e.g.:

- Provide responses to climate change challenges by increasing the resilience, i.e. reduce disaster risk, and reducing the vulnerability of ecosystems, society and people with the aim of achieving sustainable and resilient development;
- Sustain ecosystem functions in the long term, often bringing multiple benefits at comparatively low cost.

In 2012, the EU adopted the **EU Biodiversity Strategy to 2020**¹⁵, which sets out an EU vision on biodiversity policy also addressing climate change by aiming to halt the loss of biodiversity and ecosystem services in the EU, and help stop global biodiversity loss by 2020. This should protect species and their habitats, help to combat climate change and adapt to its impacts and contribute to meeting the goals of the EU's resource-efficient Europe initiative.

The **EU Strategy on Adaptation to Climate Change**, adopted in 2013, aiming at contributing to a more climate-resilient Europe (EC, 2013¹⁶) recognises multiple benefits of ecosystem-based approaches to climate change adaptation.

In 2013 the EU adopted a **Strategy on Green Infrastructure**¹⁷ 'to promote the deployment of green infrastructure in the EU in urban and rural areas', with a direct reference to the EU Strategy on Adaptation to Climate Change to converge actions on green infrastructure, ecosystem-based approaches to adaptation and disaster risk reduction. **Green Infrastructure (GI)** is defined as '*a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services such as water purification, air quality, space for recreation and climate mitigation and adaptation. Green infrastructure planning is a successfully tested tool to provide environmental, economic and social benefits through **natural solutions** and help reduce dependence on '**grey**' infrastructure that is often more expensive to build and maintain.*'¹⁸ The GI concept and approach has synergies with environmental policies (e.g. land use, water and the marine environment) and with policies of agriculture and forestry, climate change (mitigation and adaptation) and disaster prevention.

In 2015, the EC published the **mid-term review of the EU Biodiversity Strategy to 2020**¹⁹, which describes progress made in implementing the actions and achieving the targets set out in

¹² Renaud, Fabrice G., Sudmeier-Rieux, Karen, Estrella, Marisol and Nehren (Eds.), 2016, *Ecosystem-Based Disaster Risk Reduction and Adaptation in Practice*. Springer International Publishing, Switzerland

¹³ Estrella, M. and N. Saalismaa. 2013. *Ecosystem-based Disaster Risk Reduction (Eco-DRR): An Overview*, In: Renaud, F., Sudmeier-Rieux, K. and M. Estrella (eds.), *The role of ecosystem management in disaster risk reduction*. Tokyo: UNU Press.

¹⁴ <https://www.iucn.org/commissions/commission-ecosystem-management/our-work/cems-thematic-groups/eco-disaster-risk-reduction>

¹⁵ http://ec.europa.eu/environment/nature/biodiversity/strategy/index_en.htm

¹⁶ EC, 2013, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 'An EU Strategy on adaptation to climate change'* (COM(2013) 216 final of 16 April 2013), Brussels.

¹⁷ http://ec.europa.eu/environment/nature/ecosystems/strategy/index_en.htm

¹⁸ http://ec.europa.eu/environment/nature/ecosystems/index_en.htm

¹⁹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0478>



the strategy. The report demonstrates that action on the ground, supported by adequate financing, can protect and restore nature and the benefits it provides.

Also in 2015, the EC published **The State of Nature in the European Union**²⁰, reporting on the status of and trends for habitat types and species covered by the Birds and Habitats Directives. As a contribution to policy discussions in the context of the EU 2020 Biodiversity Strategy, the EEA published a report on the state of nature in the EU in 2015²¹, and various relevant SOER2015 briefings (*Biodiversity*²², *Biodiversity - protected areas*²³).

In 2017 the European Commission (EC) has adopted the **Action Plan for nature, people and the economy**²⁴ to improve the implementation of **Nature Directives**²⁵ (Birds and Habitats Directives) and provide contribution towards reaching the EU's biodiversity targets for 2020 (e.g. halting and reversing the loss of biodiversity and ecosystem services²⁶, including in relation to climate resilience and mitigation). The Action Plan deals with measures to be taken at EU level, and possibly at EU Member State level as well, in the period 2017-2019.

The EU has established, through the Birds Directive and the Habitats Directive, a worldwide unique network of **Protected Areas (PAs)**²⁷, the **Natura 2000 network**²⁸, which aims primarily to ensure the conservation of targeted species and habitats of European interest. European policy regarding protected areas is mostly the product of initiatives from two main sources: the **United Nations Convention on Biological Diversity (CBD)**²⁹ and the European Union itself.

Green infrastructure³⁰ also contribute to the coherence of the Natura 2000 network by improving landscape permeability and thus adding to the resilience of ecological networks to climate change. The loss of organic soil matter and soil biodiversity also contributes to a decreasing resilience of ecosystems to climate change and this issue is addressed by the **Thematic Strategy for Soil Protection**³¹, including a ten-year work programme for the European Commission.

Several research projects supported by the EU programmes (e.g. FP7, H2020, Interreg programmes) have enhanced knowledge on biodiversity vulnerability, CCA for biodiversity and

²⁰ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015DC0219&from=EN>

²¹ <https://www.eea.europa.eu/publications/state-of-nature-in-the-eu>

²² <https://www.eea.europa.eu/soer-2015/europe/biodiversity>

²³ <https://www.eea.europa.eu/soer-2015/countries-comparison/biodiversity>

²⁴ http://ec.europa.eu/environment/nature/legislation/fitness_check/action_plan/communication_en.pdf

²⁵ Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) — OJ L 206 of 22.7.1992, p. 7 and Directive 2009/147/EC on the conservation of wild birds (Birds Directive) — OJ L 20 of 26.01.2010, p.

²⁶ Communication from the Commission: Our life insurance, our natural capital: an EU Biodiversity Strategy to 2020 (COM(2011) 244).

²⁷ A **Protected Area** is a clearly defined geographical space that is recognised as and dedicated to achieving the long-term conservation of nature — with its associated ecosystem services and cultural values — and is managed, through legal or other effective means, to do so. This is the essence of the definition provided by the International Union for Conservation of Nature (IUCN).

²⁸ http://ec.europa.eu/environment/nature/natura2000/index_en.htm

²⁹ <https://www.cbd.int/>

³⁰ The concept of Green Infrastructure describes **ecological networks** in their wider context (beyond protected areas) and emphasizes the importance of maintaining and restoring the provision of ecosystem goods and services for society and the value of multi-functional ecosystems. Green infrastructure planning is a successfully tested tool to provide **environmental, economic and social benefits through natural solutions** and help reduce dependence on 'grey' infrastructure that is often more expensive to build and maintain. (Source: http://ec.europa.eu/environment/nature/ecosystems/index_en.htm)

³¹ http://ec.europa.eu/environment/soil/three_en.htm



CCA-DRR integration (e.g. **MACIS**³², **BRANCH**³³, **ATEAM**³⁴, **Ecologic**³⁵, **Habit-change**³⁶, **MIRACLE**³⁷, **BIO-C3**³⁸, **BAMBI**³⁹, **ATLAS**⁴⁰, **MPA-ADAPT**⁴¹, **EKLIPSE**⁴², **EMBRACE**⁴³, **ESMERALDA**⁴⁴, **OPENNESS**⁴⁵, **PLACARD**⁴⁶).

Recently EU is further enhancing specific research on the **Nature-Based Solutions (NBS)**, which are defined *‘as solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience.’*⁴⁷ For this reason, the evidence base for the effectiveness of NBS needs to be developed and then used to implement solutions in Europe. The EU Research and Innovation agenda on **Nature-Based Solutions and Re-Naturing Cities**⁴⁸ aims to enable Europe to become a world leader both in research and innovation and in the growing market for nature-based solutions. Several recent H2020 projects started aimed to conduct innovative research on different aspect of NBS such as **OPERANDUM**⁴⁹, **PHUSICOS**⁵⁰, **proGireg**⁵¹, **RECONNECT**⁵² and **URBINAT**⁵³. Important to mention also the H2020 **EKLIPSE** project⁵⁴ aiming to set up a sustainable and innovative entry point to knowledge on biodiversity and ecosystem services for decision-makers in Europe. Furthermore, the EC (under the lead of DG R&I) is currently elaborating a working paper on EU ecosystem-based initiatives in the European Commission

³² <https://climate-adapt.eea.europa.eu/metadata/projects/minimisation-of-and-adaptation-to-climate-change-impacts-on-biodiversity>

³³ <http://www.greeninfrastructurenw.co.uk/climatechange/doc.php?docID=167>

³⁴ <https://climate-adapt.eea.europa.eu/metadata/projects/advanced-terrestrial-ecosystem-analysis-and-modelling>

³⁵ https://www.ecologic.eu/sites/files/project/2013/2345_eba_ebm_cc_finalreport_23nov2011.pdf

³⁶ <https://climate-adapt.eea.europa.eu/metadata/projects/adaptive-management-of-climate-induced-changes-of-habitat-diversity-in-protected-areas>

³⁷ <https://climate-adapt.eea.europa.eu/metadata/projects/mediating-integrated-actions-for-sustainable-ecosystem-services-in-a-changing-climate>

³⁸ <https://climate-adapt.eea.europa.eu/metadata/projects/biodiversity-changes-2013-investigating-causes-consequences-and-management-implications>

³⁹ <https://climate-adapt.eea.europa.eu/metadata/projects/baltic-sea-marine-biodiversity-addressing-the-potential-of-adaptation-to-climate-change>

⁴⁰ <https://climate-adapt.eea.europa.eu/metadata/projects/a-trans-atlantic-assessment-and-deep-water-ecosystem-based-spatial-management-plan-for-europe>

⁴¹ <https://climate-adapt.eea.europa.eu/metadata/projects/guiding-mediterranean-mpas-through-the-climate-change-era-building-resilience-and-adaptation>

⁴² <http://www.eclipse-mechanism.eu/>

⁴³ <http://www.embrace-eu.org/>

⁴⁴ <http://www.esmeralda-project.eu/>

⁴⁵ <http://www.openness-project.eu/>

⁴⁶ <https://www.placard-network.eu/>

⁴⁷ <https://ec.europa.eu/research/environment/index.cfm?pg=nbs>

⁴⁸ http://publications.europa.eu/resource/cellar/fb117980-d5aa-46df-8edc-af367cddc202.0001.04/DOC_2

⁴⁹ <https://site.unibo.it/operandum/en>

⁵⁰ <https://phusicos.eu/>

⁵¹ <http://www.progireg.eu/>

⁵² <http://www.reconnect.eu/>

⁵³ <https://urbinat.eu/>

⁵⁴ <http://www.eclipse-mechanism.eu/>



It is important to take into consideration also the growing support at international and European level for integrating ecosystem-based or hybrid approaches (ecosystem-based with engineering-based) into infrastructure planning as evidence of their effectiveness and their potential for generating multiple benefits, e.g. addressing future multiple weather- climate related hazards.

Current established **web-based knowledge portals** and **multi-stakeholder coordination platforms** are relevant to communicate consistent knowledge on policy, data, research and case studies of GI, NBS, EbA and eco-DRR to stakeholder mainly at EU level (see Table 1).

The **European Climate Adaptation Platform (Climate-ADAPT)**⁵⁵, managed jointly by DG CLIMA and EEA with the support of **European Topic Centre on Climate Change impacts, vulnerability and Adaptation (ETC/CCA)**⁵⁶, is a key element for improving informed decision-making in the framework of the EU Adaptation Strategy. Climate-ADAPT ensures also linkages and synergies across Commission/EEA activities on various platforms and networks. In its recent renovation project, Climate-ADAPT has included a new section for “Ecosystem-based approaches”⁵⁷ within the list of EU policy areas and sectors. The new webpage includes information on the policy framework, an overview of the linked concepts of EbA, eco-DRR, GI, natural water retention measures (NWRM), GI and NBS, references to the main relevant platforms and websites on ecosystem-based approaches and related concepts, and information on funding opportunities to develop adaptation actions in this field.

The **Disaster Risk Management Risk Knowledge Center (DRMKC)**⁵⁸, managed from DG JRC, aims to improve and deepen communication between policymakers and scientists in the field of DRM and has developed EU guidance for recording and sharing disaster damage and loss data. In 2017, the DRMKC released the first report in the series “Science for disaster risk management” (Poljanšek et al., 2017⁵⁹). The second one is under preparation and is planned to be published in 2020.

The **Biodiversity Information System for Europe (BISE)**⁶⁰, managed from EEZ, is a single entry point to strengthen the knowledge base in support of the implementation of the EU biodiversity strategy and the assessment of progress in achieving the 2020 targets by bringing together facts and figures on policies, data and knowledge base on biodiversity and ecosystem services.

The **Natural Water Retention Measures (NWRM)**⁶¹ platform gathers information on NWRM (which are GI applied to the water sector) to support GI at EU level.

Oppla⁶² is an open platform started as a joint activity between the OPERA and OpenNESS projects, (funded by the EC FP7 Programme), which now include about 1000 members

⁵⁵ <http://climate-adapt.eea.europa.eu/sat>

⁵⁶ <https://cca.eionet.europa.eu/>

⁵⁷ <https://climate-adapt.eea.europa.eu/eu-adaptation-policy/sector-policies/ecosystem>

⁵⁸ <https://drmkc.jrc.ec.europa.eu/>

⁵⁹ Poljanšek, K., Marin Ferrer, M., De Groeve, T., Clark, I., (Eds.), 2017, Science for disaster risk management 2017: knowing better and losing less. EUR 28034 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92- 79-60678-6, doi:10.2788/688605, JRC102482.

⁶⁰ <https://biodiversity.europa.eu/>

⁶¹ <http://nwrn.eu/>

⁶² <https://oppla.eu/>



(universities, research institutes, agencies and enterprises) dealing with all aspects of NBS, natural capital and ecosystem services at EU but also global level.

The **Thinknature Platform**⁶³ is a communication multi-stakeholders platform developed by the H2020 ThinkNature project⁶⁴, which aims to support the understanding and the promotion of successful NBS Nature-Based Solutions at EU level.

It is important to recall as well the **Partnership for Environment and Disaster Risk Reduction (PEDRR)**⁶⁵, a global thematic platform of the **International Strategy for Disaster Reduction (ISDR)**⁶⁶, which aims to promote and scale-up implementation of eco-DRR and ensure it is mainstreamed in development planning at global, national and local levels, in line with the SFDRR.

Table 1: Established portals and platforms related to EbA, eco-DRR, GI and NBS for CCA/DRR relevant at EU level.

Policy	Key EU mechanism	Ecosystem-based initiative	Web-based knowledge portals and multi-stakeholder coordination platforms
Climate change adaptation	EU Strategy on Adaptation to Climate Change	EbA	ClimateAdapt
Disaster risk	EU Action Plan on SFDRR 2015-2020 European Union Civil Protection Mechanism EU Floods Directive	Eco-DRR	DRMKC, PEDRR
Biodiversity	EU Biodiversity Strategy to 2020 EU Strategy on Green Infrastructure	GI and, ecosystem restoration	BISE
Water retention	EU Water Framework Directive	Natural water retention measures	NWRM platform
Research and innovation	FP7 and H2020	NBS	Oppla, ThinkNature

⁶³ <https://platform.think-nature.eu/>

⁶⁴ <https://www.think-nature.eu/>

⁶⁵ <http://pedrr.org/>

⁶⁶ <https://www.preventionweb.net/english/hyogo/isdr/>