Compilation of existing guidance on ecosystem restoration

Reference document for Member States to inform nature restoration planning

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Background and aim

Member States (MS) will have to adopt, through an open, transparent and inclusive process, national restoration plans (NRPs) detailing how they intend to achieve the Nature Restoration Law (NRL) targets. This document compiles useful sources for MS to inform nature restoration planning. It aims to support MS in the contextualization, design and planning of nature restoration measures in their NRPs and includes links to established:

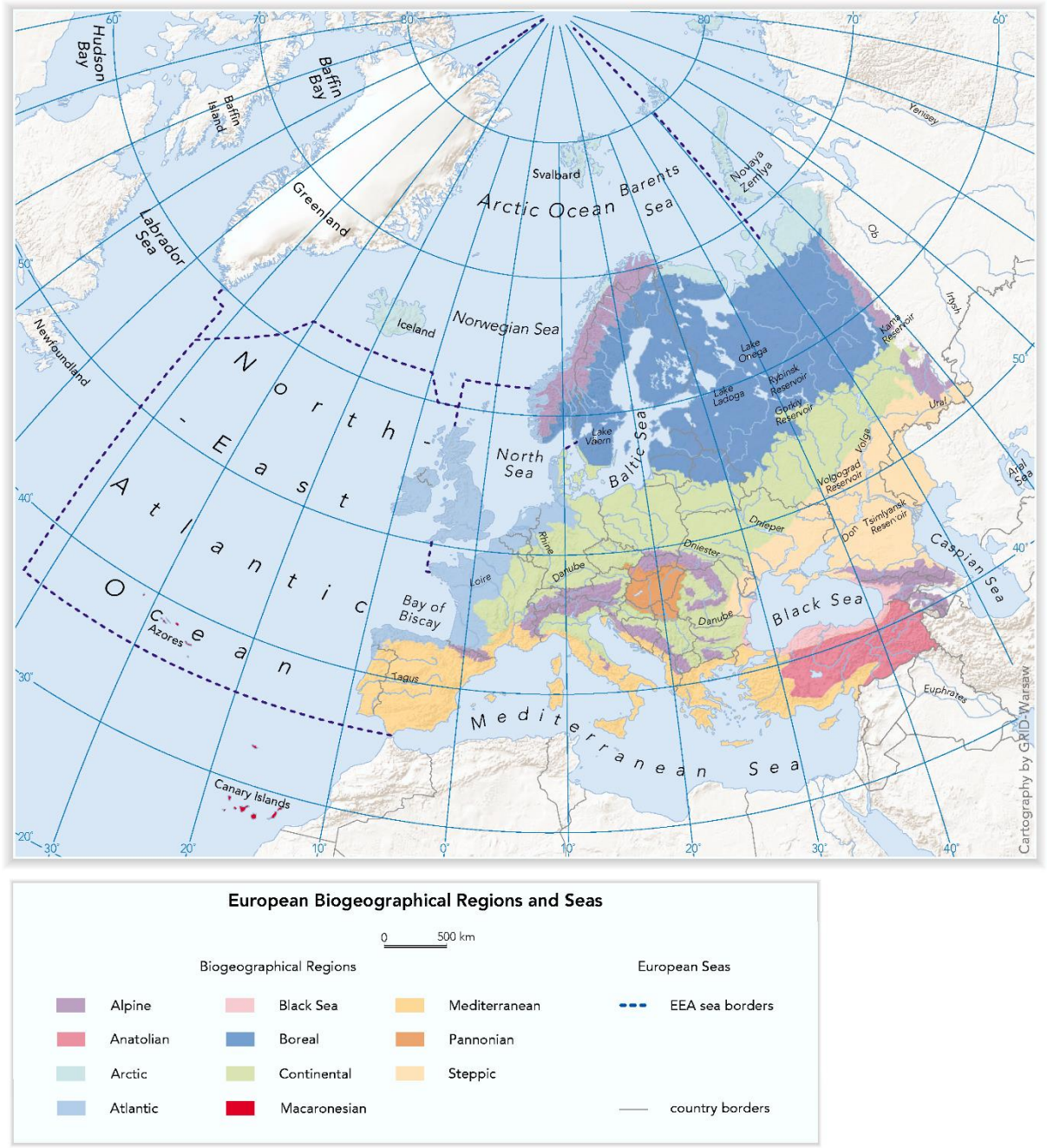
- Guidelines and standards,
- Key platforms and networks,
- Databases.

Reading Guide

Chapter 1 contains a compilation of **general resources** including guidelines, databases and expert networks that are relevant for all MS to inform restoration across ecosystem types and within different phases of the restoration process. Chapters 2 – 8 compiles information with relevance to **articles 4 – 10** of the NRL articles and the ecosystems and habitats listed in the articles and annexes, respectively. Chapter 9 lists important **national restoration guidelines** provided by MS.

Each source includes (a) a short description, (b) link to the established platform, and (c) index criteria to allow to search for more specific information (e.g. addressed region, Restoration Target, type of source and restoration stage).

Index criteria are tagged for each resource and can be addressed using the “Find” function. Although certain guidelines and projects may originate from specific locations, the methodologies and techniques they propose are frequently transferrable and adaptable to diverse contexts, with due regard for local environmental variables. Moreover, restoration initiatives are sometimes viewed within broader European or even global frameworks. For each resource information on document type (e.g., guideline, database, policy brief), applicable stage of restoration (planning, implementation, monitoring), and relevance to other NRL articles are provided. For Articles 4 and 5 habitat codes were added whenever applicable.



European Environment Agency 2012.

(https://www.eea.europa.eu/data-and-maps/figures/european-biogeographical-regions-and-seas)

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1. General Resources

This chapter provides an overview of general resources related to ecosystem restoration. It also provides links to relevant databases and expert networks, including online courses and course material.

1.1. Restoration Guidelines

1.1.1. Gann G.D., McDonald T., Walder B., Aronson J., Nelson C.R., Jonson J., Hallett J.G., Eisenberg C., Guariguata M.R., Liu J., Hua F., Echeverria C., Gonzales, E.K., Shaw N., Decleer K., Dixon K.W. (2019). **International principles and standards for the practice of ecological restoration.** Second edition. Restoration Ecology S1-S46. https://www.ser.org/page/SERStandards

This is a guidance on the practice of ecological restoration, clarifies the breadth of ecological restoration and allied environmental repair activities, and includes ideas and input from a diverse international group of restoration scientists and practitioners. It addresses restoration challenges including effective design and implementation, accounting for complex ecosystem dynamics and navigating trade-offs associated with land management priorities and decisions.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	General Guidance	General Guideline	Planning, Implementation	N/A

1.1.2. Nelson, C.R., Hallett, J.G., Romero Montoya, A.E., Andrade, A., Besacier, C., Boerger, V., Bouazza, K., Chazdon, R., Cohen-Shacham, E., Danano, D., Diederichsen, A., Fernandez, Y., Gann, G.D., Gonzales, E.K., Gruca, M., Guariguata, M.R., Gutierrez, V., Hancock, B., Innecken, P., Katz, S.M., McCormick, R., Moraes, L.F.D., Murcia, C., Nagabhatla, N., Pouaty Nzembialela, D., Rosado-May, F.J., Shaw, K., Swiderska, K., Vasseur, L., Venkataraman, R., Walder, B., Wang, Z., & Weidlich, E.W.A. (2024). **Standards of practice to guide ecosystem restoration – A contribution to the United Nations Decade on Ecosystem Restoration 2021–2030.** Rome, FAO, Washington, DC, SER & Gland, Switzerland, IUCN CEM. https://doi.org/10.4060/cc9106en.

The Standards of practice to guide ecosystem restoration provide key recommendations for all phases of restoration projects. These recommendations are applicable to the broad array of restorative activities included as ecosystem restoration under the UN Decade, across all types of ecosystems (urban, production, cultural, semi-natural and natural) and restoration projects, from voluntary community member-led efforts to highly resourced, nationally funded projects.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	General Guidance	General Guideline	Planning, Implementation, Monitoring	N/A

1.1.3. FAO & IUCN & SER (2021). **Principles for ecosystem restoration to guide the United Nations Decade 2021–2030.** https://www.decadeonrestoration.org/publications/principles-ecosystem-restoration-guide-united-nations-decade-2021-2030.

To support the implementation of the UN Decade on Ecosystem Restoration and help achieve its goals, there is a need for a shared vision of ecosystem restoration. A key step in creating a shared vision of ecosystem restoration is to adopt principles that underpin the full set of ecosystem restoration activities. To this end, this brochure presents ten principles for ecosystem restoration including a first principle that orients restoration in the context of the UN Decade, followed by nine best-practice principles. These best-practice principles detail the essential tenets of ecosystem restoration that should be followed to maximize net gain for native biodiversity, ecosystem health and integrity, and human health and well-being, across all biomes, sectors and regions.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	General Guidance	General Guideline	Planning	N/A

1.1.4. FAO & IUCN & SER (2021). **Standards of practice to guide ecosystem restoration: A contribution to the United Nations Decade on Ecosystem Restoration.** https://www.decadeonrestoration.org/publications/standards-practice-guide-ecosystem-restoration-summary-report.

To facilitate application of the principles to restoration projects (described in the previous document, chapter 1.3), the Standards of practice to guide ecosystem restoration (hereafter, Standards of practice) provides key recommendations for the entire restoration process, which can be applicable across all sectors of society, land or sea uses, ecosystems and regions, and to the broad array of ecosystem restoration activities under the UN Decade. The goal of this document is to provide an overview of the Standards of practice.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	General Guidance	General Guideline	Planning	N/A

1.1.5. Cairns, S., Dudley, N., Hall, C., Keeneleyside, K., Stolton, S. (2012). **Ecological restoration for protected areas: principles, guidelines and best practices.** IUCN Publication. https://www.iucn.org/resources/publication/ecological-restoration-protected-areas-principles-guidelines-and-best.

This publication provides guidance for terrestrial, marine, and freshwater protected area managers at both system and site levels on the restoration of natural and associated values of protected areas. As this sometimes necessitates restoration beyond protected area borders (e.g., to address ecosystem fragmentation and maintain well-connected protected area systems), this guide uses the term Restoration for protected areas for activities within protected areas and for activities in connecting or surrounding lands and waters that influence protected area values. It provides information on principles and best practice, with examples, and advice on the process of restoration, but is not a comprehensive restoration manual and does not give detailed methodologies and techniques.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	General Guidance	General Guideline	Planning	N/A

1.1.6. Chapter B.I: Decleer, K. & Bijlsma, R.J. (2021). **Guidance and tools for effective restoration measures for species and habitats.** In: Van der Sluis, T., Schmidt, A.M. (2021). E-BIND Handbook (Part B): Scientific support for successful implementation of the Natura 2000 network. https://www.ecologic.eu/sites/default/files/publication/2021/B1_Restoriation-measures.pdf

This chapter gives an overview of standards of good practice for planning and implementing ecological restoration projects. Successful restoration will largely depend on skilled ecological judgment and knowledge exchange between scientists and practitioners. Carefully considered criteria and use of tools can increase this success. This chapter provides introductory treatments of criteria, concepts and tools, based on principles and standards for the practice of ecological restoration agreed by the SER.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	General Guideline	Planning, Implementation	N/A

1.1.7. IEEP and Ecologic Institute (2023). **Benefits of nature restoration: A new series of policy briefs.** https://ieep.eu/publications/benefits-of-nature-restoration-a-new-series-of-policy-briefs/, https://ieep.eu/publications/nature-restoration-what-it-means-for-farmers-and-other-land-managers/.

A series of policy briefs which explore the benefits of nature restoration in the context of the EU. The briefs cover topics including mitigation and adaptation, river connectivity, marine areas, increased resilience of European cities, food security, sustain jobs and has economic benefits, human health and the funding available to match the implementation of the Nature Restoration Law.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	General Guideline	Planning, Implementation	N/A

1.1.8. Interreg (2022). **Mediterranean ecosystem restoration sites.** https://planbleu.org/wp-content/uploads/2022/11/catalogue_Mediterranean-ecosystem-Restoration.pdf.

The case studies in this report highlight successful restoration activities implemented in the Mediterranean at various scales (between 5ha and 50000 ha of restored areas) in several Mediterranean forest, wetland, and coastal and marine ecosystems. The selected best practices provide insights into the processes followed, lessons learned and conditions to make them transferable to other areas where restoration work might be foreseen.

Region	Restoration target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Mediterranean	Forests, Wetlands, Coastal Ecosystems, Marine Ecosystems	General Guideline	Planning, Implementation	4, 5, 10

1.1.9. United Nations Environment Programme (2021). **Becoming #GenerationRestoration: Ecosystem restoration for people, nature and climate.** Nairobi. ERPNC.pdf (unep.org)

After declaring the UN Decade on Ecosystem Restoration, the UNEP released this report details the current state of a variety of ecosystems, including farmlands, forests, freshwater, grasslands, shrublands and savannahs, mountains, oceans and coasts, peatlands, and urban areas; why restoration is necessary; and approaches, guides, and tools for ecosystem restoration. This report synthesises evidence of the state of degradation of the world's ecosystems and details the economic, environmental and social rewards that restoration can bring. The report shows that, far from being a 'nice to have', ecosystem restoration is needed on a large scale in order to achieve the sustainable development agenda. Over-exploitation of natural resources is embedded in economies and governance systems, and the resulting degradation is undermining hard-won development gains and threatening the well-being of future generations.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	General Guidance	General Guideline	Planning	4, 6, 7, 9, 10

1.1.10. Szabó-Major B., dr. Standovár T., dr. Szmorad F., Németh T., Zoltán L., Kun A., Kun R., Rév Sz., Bartha S., Kálmán N., Horváth S., Baranyai Zs., Bérces S. (2021). **Guideline for proper integrated nature conservation management planning.** Interreg CENTRAL EUROPE project Centralparks "Building management capacities of Carpathian protected areas for the integration and harmonisation of biodiversity protection and local socio-economic development", Output O.T2.3 Danube-Ipoly National Park Directorate, Budapest, 65pp. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiNjtnPkMaDAxWZ9AIHHUdCDsk4ChAWegQIAhAB&url=https%3A%2F%2Fprogramme2014-20.interreg-central.eu%2FContent.Node%2FCentralparks%2FD.C.2.3-Guidelines-for-proper-integrated-nature-conservation.pdf&usg=AOvVaw0g_DXqpLDS16E1iO5Gmd6t&opi=89978449.

This guideline is based on the experience exchange and innovative methods introduced and developed under the WPT2 of the Centralparks Interreg CE1359 project, led by the Danube-Ipoly National Park Directorate. It refers to the Hungarian situation especially in the case of Danube-Ipoly National Park Directorate. The aim of the document is to showcase effective and innovative management tools and methodologies invented and tested within the framework of this project to serve as a guideline for other Carpathian Protected Area managers.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Pannonian	General Guidance	General Guideline	Planning, Implementation	4, 10

1.1.11. JCR (2022). Velázquez, J., Gülçin, D., Vogt, P., Rincón, V., Hernando, A., Gutiérrez, J., Özcan, A.U. and Çiçek, K. (2022). **Planning restoration of connectivity and design of corridors for biodiversity conservation.** FORESTS, ISSN 1999-4907, 13 (12), p. 2132, JRC130290. https://publications.jrc.ec.europa.eu/repository/handle/JRC130290.

To improve quality habitats and maintain ecological connectivity, elements that improve the connectivity of habitats need to be identified. To meet this goal, finding optimal pathways locations plays a key role for designing corridors for biodiversity conservation. The findings of this paper can be used for extensive planning and interpretation in biodiversity conservation.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Mediterranean	General Guidance	General Guideline	Planning	N/A

1.1.12. European Commission (2023). Naumann, S., Burgos Cuevas, N., Davies, C., Bradley, S., Mahmoud. I.H., Arlati, A. (2023). **Harnessing the power of collaboration for nature-based solutions: New ideas and insights for local decision-makers**. Publications Office of the European Union, 2020, https://data.europa.eu/doi/10.2777/954370.

This briefing paper gives practical examples and inspiration for local decision-makers on utilising co-governance approaches to promote participatory processes and collaborative creation of Nature-based Solutions. Nature-based solutions present a credible means to address key societal issues, such as biodiversity loss, climate change, and disaster risk reduction. One part of the EU's ambition to support the uptake of nature-based solution on a large scale is the Nature-based Solutions Research Policy.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed

Europe	General Guidance	General Guideline	Planning	N/A

1.1.13. European Commission (2012). **Commission Note on Setting Conservation Objectives for Natura 2000 Sites.** https://circabc.europa.eu/sd/a/68834981-033a-4d8e-b306-54dd8b6f48fa/Commission%20note%20on%20setting%20conservation%20objectives.pdf.

This guidance document provides assistance for Member States in setting conservation objectives for Natura 2000 sites. Conservation objectives for Natura 2000 sites need to be as clear and straightforward as possible and allow to put in place operational conservation measures in practice.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Europe	General Guidance	General Guideline	Planning	N/A

1.1.14. European Commission (2018). **Commission Staff Working Document on the establishment of conservation measures under the Common Fisheries Policy for Natura 2000 sites and for Marine Strategy Framework Directive purposes.** https://ec.europa.eu/transparency/documents-register/detail?ref=SWD(2018)288&lang=en.

The aim of this document is to describe good practices on the elements to be considered by the Member States when preparing joint recommendations for the adoption of conservation measures under the Common Fisheries Policy (CFP) to comply with their obligations pertaining to Article 6 of the Habitats Directive, Article 4 of the Birds Directive and Article 13(4) of the Marine Strategy Framework Directive (MSFD). It aims to recall the rules and procedures relating to the submission of a joint recommendation by the Member States, in order for the Commission to adopt conservation measures by means of a delegated act pursuant to Articles 11(2) and 11(3) of the CFP.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Europe	Marine Ecosystems	General Guideline	Planning	5

1.1.15. CIRCABC (2022). **Guidance on a strategic framework for further supporting the deployment of EU-level green and blue infrastructure.** https://circabc.europa.eu/ui/group/3f466d71-92a7-49eb-9c63-6cb0fadf29dc/library/dc48dc2a-b87f-4e54-9852-a18c7239260e/details?download=true.

This strategic framework lists supporting tools and instruments and provides a list of case studies of green and blue infrastructure projects that aim to enhance and conserve the benefits that nature provides. This guidance contributes to establishing a strategic framework to support EU-level green and blue infrastructure projects to maximise the benefits provided. It should contribute to restoring and better connecting functional ecosystems and to improving the connectivity of the Natura 2000 network and other areas of high value for biodiversity that are fragmented or isolated. It should also contribute to fostering the integration of ecosystem services in EU policies and supporting funding instruments, and it complements the dedicated guidance on integrating ecosystems and their services in planning and decision-making also foreseen under the Action Plan.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	General Guideline	Planning	N/A

1.1.16. European Commission (n.d.). **Green Infrastructure.** https://environment.ec.europa.eu/topics/nature-and-biodiversity/green-infrastructure_en.

This website of the European Commission (EC) on Green Infrastructure does not only give general information but also provides past EC guidance documents on EU-level Green Infrastructure and integrating ecosystems and their services in decision-making.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	General Guideline	Planning	N/A

1.1.17. European Commission (n.d). **Floods.** https://environment.ec.europa.eu/topics/water/floods_en.

This website by the European Commission on floods gives an overview of EU measures to manage the risk of floods. Flood risk management can go hand in

hand with nature protection and restoration and deliver benefits for both people and nature. This website also links relevant studies and publications.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	General Guideline	Planning	4, 7

1.1.18. INTERREG (2022). **Preserving and restoring biodiversity.** A policy Brief from the Policy Learning Platform on Environment and resource efficiency. https://www.interregeurope.eu/sites/default/files/2022-04/Policy%20Brief%20Preserving%20biodiversity.pdf.

This policy brief provides an overview of the EU Biodiversity Strategy for 2030 and lists EU financial support for the protection and restoration of biodiversity. It also lists successful ecosystem restoration examples, including afforestation and sustainable forestry, pollinators and tackling light pollution. Key recommendations include biodiversity in local policies, raise citizen and stakeholder awareness, plant more trees, improve the conditions for pollinators and monitor the results, tackle light pollution, create ecological corridors and restore rivers and wetlands.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance, Forests, Pollinators	Policy Brief	Planning	4, 7, 8, 10

1.1.19. Ballarin, C. S., Amorim, F. W., Watson, D. M., Fontúrbel, F. E. (2023). **The use and abuse of keystone plant species in restoration practices of terrestrial ecosystems.** Restoration Ecology, Vol. 32, No. 1. https://doi.org/10.1111/rec.14030. *(not open access).*

This paper explores the negative consequences of overusing keystone plant species in sites undergoing restoration and provides specific guidelines for practitioners to maximise the benefits of keystone plants in restoration initiatives.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed

Europe	General Guidance	Academic Article	Planning	4

1.1.20. Dudley, N., Baker, C., Chatterton, P., Ferwerda, W.H., Gutierrez, V., Madgwick, J., (2021). **The 4 Returns Framework for Landscape Restoration**. UN Decade on Ecosystem Restoration Report published by Commonland, Wetlands International Landscape Finance Lab and IUCN Commission on Ecosystem Management. https://commonland.com/wp-content/uploads/2021/08/4-Returns-Framework-For-Landscape-Restoration.pdf.

The 4 Returns Framework for landscape restoration that is presented here is a practical method that brings people together within landscapes and enables others outside those landscapes to participate. The 4 Returns Framework for landscape restoration is a practical and tested system-change framework used by stakeholders to undertake a landscape approach. It seeks to balance competing stakeholder demands in a mosaic of different management approaches, to supply a full range of natural, social and economic returns.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Global	General Guidance	General Guideline	Planning	4

1.1.21. WILDCARD (2024-2027). **Effects of Rewilding in Forests and Agricultural Lands on Carbon Sequestration and Diversity**. https://cordis.europa.eu/project/id/101081177.

Reaching net zero Greenhouse Gas (GHG) emissions by 2050 is key to limit global warming to 1.5 °C and achieve the targets set out in the Paris Climate Agreement. Mitigation approaches such as renewable energy sources, improved energy efficiency and forest preservation, need to be combined with active carbon dioxide (CO2) removal (CDR). Low-cost nature-based solutions need to be identified, assessed and promoted on a large scale for both CO2 sequestration and biodiversity conservation. WILDCARD will, for the first time in Europe, assess the overall potential impact of natural rewilding of abandoned agricultural land and proforestation on carbon sequestration and biodiversity at multiple spatial and temporal scales. Combining field observations, remote sensing, and vegetation modelling with economic, societal and political analyses, WILDCARD will inform national and European policy makers on the contribution potential of nature-based solutions to achieve net zero emissions by 2050. The project will investigate the regulatory, cultural and economic barriers to natural rewilding and proforestation, and identify which social innovation mechanisms, models and incentives can better support our CDR approach. WILDCARD will use a dedicated cross-scale analysis, linking site-based in-depth knowledge on rewilding impacts and socio-economic consequences to a European-scale assessment, embedded in the current EU policy context and informed

by global scenarios from IAMs and ESMs. The final project's aim is to offer concrete and realistic policy options aimed at enhanced uptake of rewilding as a significant solution to achieve global climate objectives.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems, Forests	General Guideline	Planning, Implementation, Monitoring	9, 10

1.1.22. wildE (2023-2026). **Climate-smart rewilding: ecological restoration for climate change mitigation, adaptation and biodiversity support in Europe.** https://cordis.europa.eu/project/id/101081251.

Restoring natural processes and ecological communities is difficult but not impossible. Rewilding is one solution. This approach to land management involves removing human-made structures and allowing ecosystems to evolve without human intervention. In this context, the EU-funded wildE project will use a two-tier approach of local case studies and European-scale research to develop climate-smart rewilding as a nature-based solution to address the climate-biodiversity nexus. This will bring together experts from the environmental sciences, social sciences and economy to work on comparative data on rewilding trends and outcomes. wildE will also develop future land-use and climate-change projections and create decision-support and management guidelines for policymakers, conservation managers, communities and the private sector.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Project	Planning	N/A

1.1.23. NaturaConnect (2022-2026). **NaturaConnect – Designing a resilient and coherent Trans-European Network for Nature and People.** https://cordis.europa.eu/project/id/101060429.

The EU Member States have committed to legally protect a minimum of 30 % of the EU's land and sea area and to strictly protect at least a third of protected areas under the EU 2030 Biodiversity Strategy as a major contribution to the European Green Deal. In this context, the EU-funded NaturaConnect project will bring together a consortium of the top European scientists, policy experts and NGOs to produce and mobilise relevant data and knowledge. The aim will be to co-develop

knowledge, tools and capacity-building programmes to support Member States in implementing an ecologically representative, resilient and well-connected trans-European nature network (TEN-N).

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Project	Planning	N/A

1.1.24. Fernández, N., Torres, A., Wolf, F., Quintero, L., Pereira H. M. (2020). **Boosting Ecological Restoration for a Wilder Europe.** German Centre for Integrative Biodiversity Research (iDiv), Martin-Luther-Universität Halle-Wittenberg, Rewilding Europe, WWF European Policy Office, European Environmental Bureau, and Birdlife Europe and Central Asia.
https://dx.doi.org/10.978.39817938/57.

This document is one of the outputs of a wider project called 'Promoting and shaping the EU ecological restoration agenda, through mobilisation of rewilding principles to create a coherent Ecological Network in Europe' (2017–2020). The project has sought to (a) make the policy case for an EU-level ecological restoration strategy; (b) create the governance and financial framework for making investments in large-scale restoration; and (c) develop advice on priority areas and regions for such investments. Providing solutions to both the climate and biodiversity crises, large-scale restoration and the adoption of rewilding principles will help the EU meet its biodiversity and climate targets, while benefitting every European citizen. Two main outputs of this project are an Ecological Integrity Indicator for assessing the state of European terrestrial landscapes and a first version of a priority map for planning European Green Infrastructure, as presented and explained in this document. These provide practical tools for supporting large-scale ecological restoration and to ensure the recovery of nature at landscape-scale across Europe.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	General Guideline	Planning	N/A

1.1.25. Heywood, V. Shaw, K., Harvey-Brown, Y. and Smith, P. (Eds.). (2018). **BGCI and IABG's Species Recovery Manual.** Botanic Gardens Conservation International, Richmond, United Kingdom.
https://www.bgci.org/wp/wp-content/uploads/2019/04/Species_Recovery_Manual.pdf.

This manual is aimed specifically at conservation practitioners but also includes comprehensive bibliographic references, which enable more in depth reading on the topics covered in this publication. It is evident that species recovery is not well understood. It is a complex process involving many different disciplines and actors, and responsibility for it at a national level is often unclear, given that it cuts across different ministries and agencies. After various consultations, it was felt by BGCI and IABG that it would be valuable to produce a manual that would clarify the aims and purpose of species recovery, set out the various steps and processes involved, propose the necessary guidelines and indicate good practice.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	General Guideline	Planning, Implementation	N/A

1.1.26. Commonland, Landscape finance lab and Wetlands International (2022). **Recommendations on delivering the European Green Deal through landscape restoration.** https://www.decadeonrestoration.org/publications/delivering-european-green-deal-through-landscape-restoration.

EIT Climate-KIC worked together with Commonland, the World Resources Institute, Gold Standard Foundation, The Nature Conservancy, Landscape Finance Lab and others to offer guidance to EU institutions and Member States on why and how to leverage holistic landscape restoration to efficiently deliver the European Green Deal.

Region	Restoration target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	General Guideline	Planning, Implementation	N/A

1.1.27. Hering, D., Schürings, C., Wenskus, F., Blackstock, K., Borja, A., Birk, S., Bullock, C., Carvalho, L., Dagher-Kharrat, M. B., Lakner, S., Lovric, N., McGuinness, S., Nabuurs, G., Sánchez-Arcilla, A., Settele, J., & Peer, G. (2023). **Securing success for the Nature Restoration Law.** *Science*, 382(6676), 1248–1250. https://www.science.org/doi/10.1126/science.adk1658

The paper compiles options on how to use data generated for the Habitats Directive, the Birds Directive, the Water Framework Directive, the Marine Strategy

Framework Directive, the Biodiversity Strategy, the Forest Strategy, the Common Agricultural Policy and the Common Fisheries Policy for the NRL implementation.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	General Guideline	Planning	N/A

1.2. Databases

1.2.1. European Commission (n.d.). **LIFE Public Database.** https://webgate.ec.europa.eu/life/publicWebsite/search.

The LIFE Public Database provides an overview and descriptions of finished and ongoing projects. These projects often provide detailed descriptions of the planning process, the objectives the restoration methods used and the ways forward nd can be used as exemplary cases to plan future restoration and conservation project

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Database	Planning, Implementation, Monitoring	4, 5, 6, 7, 8, 9, 10

1.2.2. Climate ADAPT (n.d.). **Sharing Adaptation Knowledge for a Climate-Resilient Europe.** https://climate-adapt.eea.europa.eu/en/eu-adaptation-policy/sector-policies/biodiversity

This database links many relevant resources including general resources, relevant EU policies, EU projects, publications and reports, information portals, indicators, guidance, tools, research and knowledge projects, adaptation options, case studies and organisations.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed

Europe	General Guidance	Database	Planning, Implementation, Monitoring	4, 5, 6, 7, 8, 9, 10

1.2.3. Conservation Evidence (n.d.). **Providing Evidence to Improve Practice.** https://www.conservationevidence.com/.

This resource summarises the documented evidence for the effectiveness of conservation actions. It is aimed at anyone making decisions about how to maintain and restore biodiversity.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Europe	General Guidance	Database	Planning	N/A

1.2.4. OPPLA (n.d.). **Natural Capital – Ecosystem Services – Nature-based Solutions.** https://oppla.eu/about

OPPLA provides a database of nearly 600 case studies on nature-based solutions implemented in cities and rural areas in Europe and beyond.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Europe	General Guidance	Database	Planning, Implementation, Monitoring	N/A

1.2.5. European Commission – Joint Research Centre: **INCA (Integrated Natural Capital Accounting) Platform**. https://ecosystem-accounts.jrc.ec.europa.eu/

The INCA platform is an open knowledge hub on ecosystem services accounting, compliant with the UN System of Environmental Economic Accounts (SEEA EA), providing visualization tools, datasets, and maps. It also provides a free QGIS plugin to support the calculation of ecosystem services accounts.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**

Europe	General Guidance	Database	Planning, Implementation, Monitoring	N/A

1.2.6 UGA (n.d.). **Urban governance atlas (INTERLACE HUB).** https://interlace-hub.com/urban-governance-atlas.

The Urban Governance Atlas (UGA) is an interactive online database of over 250 good practice policy instruments that support nature-based solutions and ecosystem restoration. The first of its kind, the Atlas allows users to explore a diversity of different policy instrument types being applied across the world. The Atlas particularly focuses on the factors making the instruments successful, lessons learned in their design and implementation, and their approaches to governance, such as stakeholder involvement, institutional arrangements and participatory methods utilised. In parallel, the UGA also provides an opportunity for you and your city promote a selection of policy instruments that have worked well in your local context.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Europe	General Guidance	Database	Planning, Implementation	N/A

1.2.7 European Commission (n.d.). **Let nature help do the job: Rewilding landscapes for carbon sequestration, climate adaptation and biodiversity support.** https://cordis.europa.eu/programme/id/HORIZON_HORIZON-CL5-2022-D1-02-05/en.

The biodiversity crisis and the climate crisis are intrinsically linked and the contribution of Nature-based Solutions (NBS) to the global climate objectives is pivotal. A better understanding of how the use of ecosystems natural capacity, with minimal help from humans, can contribute to carbon sequestration and biodiversity conservation is urgently needed to make the use of NBS operational. This database provides information on all the projects funded under this programme or topic.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Europe	General Guidance	Database	Planning, Implementation, Monitoring	N/A

1.2.8 ELP (n.d.). **Endangered Landscapes Programme-funded Restoration Landscapes Projects.** https://www.endangeredlandscapes.org/projects/restoration-landscapes/.

Through its Restoration Landscapes Projects, the Endangered Landscapes Programme is funding large-scale restoration in marine and terrestrial habitats across Europe, reversing impacts of unsustainable use and creating places that deliver long-term benefits for nature and people.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Database	Planning, Implementation, Monitoring	N/A

1.2.9 ECR (n.d.)**. Ecosystem Restoration Communities.** https://www.ecosystemrestorationcommunities.org/community/.

ERC works together to restore ecological functionality, to build research, training and innovation centers for ecological restoration, to engage people in inquiry into ecological restoration, and train people in how to restore degraded lands in perpetuity. Their database shows the range of active projects from different stages i.e. conceptual phase, start-up phase and established phase.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Database	Planning, Implementation	N/A

1.2.10 BioCHANGE (2016-2018). **Biodiversity Change: an open access data resource supporting societal responses to the biodiversity crisis.** https://cordis.europa.eu/project/id/727440.

Biodiversity CHANGE is a major, but still underappreciated, threat to humanity. It arises when there is unprecedented turnover in the identities of species that comprise ecological assemblages. To understand, monitor and ameliorate this CHANGE, and to enable appropriate societal responses, policy makers and conservation managers urgently need access to the best possible data. At present the ability of practitioners to elucidate ecosystem responses to anthropogenic impacts is hampered by data availability. Building on ERC AdvG BioTIME, BioCHANGE will

provide a proof of concept that existing fragmented data can be assembled into an open access, authoritative database to form a crucial resource for addressing societal challenges arising from the biodiversity crisis.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Database	Planning	N/A

1.2.11 Network Nature (n.d.). **Nature-based solutions knowledge databases | NetworkNature**

NetworkNature, funded as a Horizon project, is a resource centre for the nature-based solutions community to maximise the impact and spread of nature-based solutions. It is gathering knowledge, tools and services from over 70 Horizon R&I projects and beyond.

Nature-based solutions resources – nearly 500 useful resources to co-create, implement, monitor and measure nature-based solutions. Produced by Horizon projects, international organisations and others.

NetworkNature also maintains 3 databases on further NBS knowledge resources, knowledge gaps and projects:

- NBS Knowledge Database - tools and guidance on NBS that can be filtered by societal challenges, specific themes and countries.
- Database of EU research and innovation projects on nature-based solutions
- Nature-based solutions knowledge gaps

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Database	Planning, Implementation, Monitoring	N/A

1.3. Expert Networks

1.3.1. Biogeoprocess (n.d.). **Natura 2000 Biogeographical Process.** https://biogeoprocess.net/

Natura 2000 is a network of nature conservation sites across Europe. However, in many sites the habitats are threatened. The EU Biodiversity Strategy to 2030 calls for significant improvements in the conservation status of species and habitats protected under the EU Birds and Habitats Directives. The Nature Restoration Law states that countries should give priority to areas located in Natura 2000 sites. In 2012, the European Commission launched the Natura 2000 biogeographical process. This multi-stakeholder cooperation process includes seminars, workshops and cooperation activities aimed at enhancing the effective implementation, management, monitoring, financing and reporting of the Natura 2000 network at a biogeographic level. The process assists Member States and key stakeholders to manage Natura 2000 as a coherent ecological network.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Europe	General Guidance	Expert Network	Planning	N/A

1.3.2 SER (n.d.). **Society for Ecological Restoration.** https://chapter.ser.org/europe/about/other-regional-and-european-restoration-networks/.

The Society for Ecological Restoration in an expert network that can be contacted to provide guidance and practical advice. There is a Europe Chapter, registered in Belgium, with 500 scientific and expert practitioner members across Europe, and globally, including restoration research centres, non-profit organizations and private companies. They operate as a ‘network of networks’ in collaboration with national restoration organisations across the EU. More of these relevant networks can be found using the link above.

SER developed a free e-learning course to introduce practitioners and professionals to the core components of restoration and how to implement the Standards on the ground. This course is currently being adapted to reflect updates from the second edition of the Standards.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Europe	General Guidance	Expert Network	Planning	N/A

1.3.3 Eurosite (n.d.). **Eurosite.** https://www.eurosite.org/about/.

Eurosite is the network for Europe's natural site managers, bringing together non-governmental and governmental organisations, as well as individuals and organisations. Founded in 1989, the network has grown to include members across Europe. The mission of Eurosite is to provide opportunities for practitioners to network and exchange experience on practical nature management. Eurosite organises and participates in many educational events, such as conferences, workshops, trainings and research projects.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Expert Network	Planning	N/A

1.3.4 IUCN (n.d.). **IUCN Expert Commission.** https://www.iucn.org/our-union/expert-commissions.

IUCN Commissions are broad and active networks of scientists and experts providing IUCN and its Members with sound know-how and policy advice to drive conservation and sustainable development. There are over 15,000 experts and scientists that provide their expertise as members of an IUCN Commission.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	General Guidance	Expert Network	Planning	N/A

1.3.5 **Horizon 2020 Green Deal – Restoration Cluster:** WaterLANDS, MERLIN, REST-COAST, SUPERB.
https://rea.ec.europa.eu/news/rea-projects-contributing-proposed-eu-nature-restoration-targets-2022-06-28_en

The Restoration Cluster represents a collective group of four very large restoration-focused projects, funded with a total of 80M EUR through the EU's Green Deal call on "Restoring biodiversity and Ecosystem Services". This network of experts represents 157 partner organisations and >1,000 experts, practitioners and stakeholders across wetlands, forests, rivers and coastal systems. The Cluster focuses particularly on creating the conditions for transformational change in restoration, across tangible restoration in the majority of EU Members States and the UK. Broader

networks link to international institutions through, for example, WWF, IUCN, Wetlands International, etc.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Expert Network	Planning	N/A

1.3.6 EUROPABON (n.d.). **The European Biodiversity Observation Network.** https://europabon.org/members/home.

EuropaBONs mission is to overcome existing data gaps and workflow bottlenecks by designing an EU-wide framework for monitoring biodiversity and ecosystem services. It strives to integrate data streams to support policy.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Expert Network	Planning	N/A

1.3.7 Biodiversa+ (n.d.) **BiodivRestore Knowledge Hub.** https://www.biodiversa.eu.

Under the umbrella of the European Biodiversity Partnership, Biodiversa+, the BiodivRestore Knowledge Hub will be launched in May 2024, as a thematic network consisting of selected researchers with expertise on nature restoration, and actively engaging with, and reaching out to stakeholders (including policy and practice). This BiodivRestore knowledge hub will contribute to the integration and sharing of knowledge, research and technological excellence to support countries in the development and implementation of their National Restoration Plans, to help ensure they can reach the targets set out in the EU Biodiversity Strategy 2030 and Global Biodiversity Framework. It will also improve communication and networking between researchers and stakeholders to enhance research impact and knowledge transfer towards policy and society, and feed the European research & innovation strategy on this topic.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Expert Network	Design, planning, restoration, and upscaling	N/A

1.3.8 Network Nature (n.d). **NetworkNature expert Task Forces**

NetworkNature **6 NBS Task Forces** bring together experts on the following topics:

- TF1: Data and Knowledge Sharing
- TF2: Monitoring Framework and Indicators
- TF3: Business Models and Financial Mechanisms
- TF4: Communication
- TF5: NBS Education
- TF6: Co-creation and Co-governance

In addition, NetworkNature organises **annual public events** that bring together experts and stakeholders of nature-based solutions to discuss challenges and solutions to mainstream NBS.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Expert Network	Planning	6

1.3.9 Gaia Education (n.d.). **Online learning resource (self-paced course) on ecosystem restoration design by Ecosystem Restoration Communities.** https://www.programmes.gaiaeducation.uk/ecosystem-restoration-design, https://www.ecosystemrestorationcommunities.org/learn/**.**

Presented in partnership with Gaia Education, this course is a two-part learning journey where you will learn from 18 of the world's top experts in the field of ecosystem restoration and regenerative agriculture. You will gain an introductory understanding of the restoration of many types of ecosystems and landscapes. You will learn the techniques, as well as the challenges and solutions in implementing them, and a range of business models you can apply to fund the work. At the end of the course you will have the chance to design your own restoration project for a real-life place close to your heart.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Expert Network	Planning	N/A

1.3.10 ECR (n.d.). **Online learning resource (self-paced course): an introduction to ecosystem restoration by Ecosystem Restoration Communities.** https://www.soilfoodweb.com/introduction-to-ecosystem-restoration/.

In partnership with Soil Food Web School, ERC has developed a brand-new series of courses! The first one – An Introduction to Ecosystem Restoration – has been designed to give you a strong foundational knowledge of the science and practice of Ecology, Ecological Restoration, and Ecosystem Restoration. Taught by a Restoration Ecologist, you will delve into the details of exactly how ecosystems work, and what a degraded ecosystem looks like, what constitutes ecological restoration, the different types of ecosystem restoration out there, and some examples.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Expert Network	Planning	N/A

1.3.11 Network Nature (n.d.). **NBS Regional and National Hubs.** https://networknature.eu/nbs-hubs.

NetworkNature and projects initiative UrbanByNature support a growing network of national and regional NBS hubs. The hubs bring researchers policymakers, businesses, and the public sector together to create long-lasting structures for NBS uptake, foster capacity building and knowledge exchange, build relationships and new partnerships, and create a nuanced understanding of NbS and address local specificities of barriers and opportunities for NbS.

- 5 NetworkNature NBS hubs

In addition:

- Flanders | UrbanByNature
- South Eastern Europe | UrbanByNature
- Spain | UrbanByNature

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	General Guidance	Expert Network	Design, planning, restoration, and upscaling	N/A

1.3.12 RÊVER (n.d.). **RÊVER: the French restoration experts network.** RÊVER or “Le Réseau d’Échanges et de Valorisation en Écologie de la Restauration”. https://www.reseau-rever.org/.

RÊVER has pretty much the same goals as SER Europe but is restricted to France. They organise national conferences and other activities that link the French restoration community. In 2014 REVER became affiliated member of SER Europe.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Atlantic, Continental (France)	General Guidance	Expert Network	Planning	N/A

1.3.13 FBER (n.d.). **FBER: the Finnish Board on Ecological Restoration.** www.metsa.fi/en/nature-and-heritage/habitats.

FBER is a national collaborative group consisting of managers, scientists, and experts working with habitat restoration and the management of cultural habitats. The group supports restoration and nature management actions both on state-owned and private land. Four expert groups work under the Steering Group: Peatland Restoration Expert Group, Forest Restoration Expert Group, Freshwater Habitats Restoration Expert Group and Semi-Natural Grassland Expert Group. The Restoration Board together with the expert groups e.g. prepares restoration handbooks and organizes seminars. The Restoration Board is coordinated by Metsähallitus and Finnish Environment Institute.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Boreal (Finland)	General Guidance	Expert Network	Planning	N/A

1.3.14 SIRF (n.d.). **Società Italiana di Restauro Forestale. The Italian Society of Forest Restoration**. https://www.restauroforestale.it/.

SIRF is based in the Department of Agriculture, Forestry, Nature and Energy (DAFNE) of Tuscia University (Italy). SIRF was established in 2012 and aims at: (1) showing the illegal or incorrect actions in forest systems, chief causes of forests and environmental degradation; (2) promoting the application of the principles of forestry and environmental restoration; (3) promoting biodiversity conservation and sustainable management of forest resources; (4) supporting the improvement of the quality of the forest and agricultural landscape. SIRF participates in research projects, provides consultancy, training and education and (co-)organises meetings and conferences. SIRF became an affiliated member of SER Europe in 2015.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Mediterranean (Italy)	General Guidance	Expert Network	Planning	N/A

1.3.15 AEET (n.d.). **Asociación Española de Ecología Terrestre. The Spanish Association for Terrestrial Ecology**. https://www.aeet.org/es/.

(AEET) is the largest ecological society in Spain and a member of the European Ecological Federation. Its working group on Ecological Restoration has promoted knowledge exchange on issues related to this topic over the last decade.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Mediterranean (Spain)	General Guidance	Expert Network	Planning	N/A

1.3.16 OBN (n.d.). **OBN: Dutch Knowledge Network for Restoration and Management of Nature**. OBN Knowledge Network - Het Kennisnetwerk Ontwikkeling en Beheer Natuurkwaliteit (OBN) (natuurkennis.nl).

The Dutch OBN Knowledge Network for Nature Restoration and Management is an independent and innovative platform where policymakers, site managers and scientists cooperate in the management and restoration of natural areas. Science and nature management jointly look for the most effective approaches to enhance sustainable conservation of important ecosystems in the Dutch landscape.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Atlantic (Netherlands)	General Guidance	Expert Network	Planning	N/A

1.3.17 GRN (n.d.). **Netzwerk Renaturierung – German Restoration Network (GRN)**. https://renaweb.standortsanalyse.net/.

The German Restoration Network (GRN) was founded in 2016 at the Freising Conference of the Society for Ecological Restoration Europe. The GRN has members coming from universities as well as from restoration practice in Germany, Austria

and Switzerland. A special feature of the network is the high and still increasing proportion of practitioners working in nature conservation authorities, NGOs, planning agencies or wild plant propagation companies. Learning from practical experiences and solving future challenges in ecological restoration is a focus of GRN.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Atlantic, Continental (Germany)	General Guidance	Expert Network	Planning	N/A

1.3.18 CIEEM (n.d.). **CIEEM: the UK Chartered Institute of Ecology and Environmental Management**. https://cieem.net/.

CIEEM is the leading professional membership body representing and sup - porting ecologists and environmental managers in the UK, Ireland and abroad. CIEEM was formed in 1991 as the Institute of Ecology and Environmental Management. From small beginnings, it has grown into an increasingly influential professional body – setting standards, sharing knowledge and providing sound advice to governments on all aspects of ecological and natural environmental management practice.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Atlantic (UK & Ireland)	General Guidance	Expert Network	Planning	N/A

1.3.19 ResECO (n.d.). **ResECO: Rede Portuguesa de Restauro Ecológico: The Portugese Network for Ecological Restoration**. https://www.speco.pt/reseco.

ResECO was created in 2019 and signed a memorandum of understanding with SER Europe on 02/08/2019 at the Faculty of Science of the University of Lisbon, at the occasion of the Congress of the European Ecology Federation.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Mediterranean	General Guidance	Expert Network	Planning	N/A

2 Article 4: Restoration of Terrestrial, Coastal and Freshwater Ecosystems

2.1 Wetlands (Coastal & Inland)

This chapter includes guidance o restoration for different wetlands including peatlands relevant for Article 9. The chapter starts with a list of general resources on wetland restoration and provides specific resources for inland wetlands (2.1.7) and coastal wetlands (2.1.8)

2.1.1 Biodiversity. Information System for Europe (n.d.). **Wetlands (coastal and inland).** https://biodiversity.europa.eu/europes-biodiversity/habitats-to-be-restored/wetlands.

Considering their high ecological value and climate mitigation contribution, wetlands are one of the priority habitats recognised for restoration actions. This website gives an overview of wetland habitats that need to be restored. It addresses the importance of preserving and restoring these ecosystems to support biodiversity. The site provides information on the current state of these habitats, threats they face, and potential restoration efforts.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Wetlands	Website	Planning	N/A	N/A

2.1.2 ENCA (2023). **Restoring Riverine and Coastal Wetlands in Europe.** https://www.encanetwork.eu/fileadmin/inhalte/enca/pdf/2023_enca-recommendations-wetlands.pdf.

This report summarises key recommendations for scaling up and accelerating the restoration of riverine and coastal wetlands in Europe, developed by and for policymakers, practitioners, and scientists. They summarise key findings of the 5th European Conference on Biodiversity and Climate Change “Riverine and Coastal Wetlands for Biodiversity and Climate – Linking Science Policy and Practice”, hosted by the German Federal Agency for Nature Conservation (BfN) and the European Network of Heads of Nature Conservation Agencies (ENCA) and held on 26th - 28th September 2023 in Bonn, Germany.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code

Europe	Wetlands, Coastal Ecosystems, Rivers	General Guideline	Planning, Implementation	N/A	N/A

2.1.3 Waters of LIFE (2024). **Resources.** https://www.watersoflife.ie/resources/.

The Waters of LIFE is an EU LIFE Integrated Project (IP) which aims to help reverse the deterioration of Ireland's most pristine waters. The overall objective of the Waters of LIFE IP is to support the implementation of measures to protect and enhance High-Status Waters and thus to support the work of the Blue Dot Catchments Programme. The resources listed include management plans, codes of practice, and guidance on forest, freshwater, wetlands, and woodland ecosystems.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Atlantic	Forests, Wetlands, Woodlands	Project	Planning	7, 10	N/A

2.1.4 Ramsar (2002). **Principles and guidelines for wetland restoration.** https://www.ramsar.org/sites/default/files/documents/pdf/guide/guide-restoration.pdf.

The principles and guidelines for wetland restoration were adopted by Resolution VIII.16 (2002) of the Ramsar Convention. Recognizing the importance of past experience in wetland restoration and the increasing interest in restoration among Contracting Parties, Recommendation 6.15 of the Ramsar Convention urged "the Scientific and Technical Review Panel [STRP], in collaboration with the Bureau and concerned Contracting Parties and partners, to define guidelines on principles for wetland restoration". The STRP was tasked with further developing these tools and guidelines by Resolution VII.17 concerning Restoration as an element of national planning for wetland conservation and wise use.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Global	Wetlands	General Guideline	Planning, Implementation	N/A	N/A

2.1.5 Ramsar (2017). **Wetlands for disaster risk reduction: Effective choices for resilient communities.** https://www.ramsar.org/sites/default/files/documents/library/rpb_wetlands_and_drr_e.pdf.

Degradation of wetlands reduces resilience against water-related hazards such as floods, droughts and storm surges. Integrating wetlands as natural infrastructure for disaster risk reduction (DRR), alone or in conjunction with traditional “hard” infrastructure, can mitigate hazards and increase the resilience of local communities and those living across entire river basins or coastal zones. This policy briefs gives recommendations how wetlands should be integrated in disaster risk reduction strategies and how ecosystem-based solutions can be addressed in combination with other risk management measures.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Wetlands	Policy Brief	Planning	9	N/A

2.1.6 SWOS (2015-2018). **Satellite-based Wetland Observation Service.** https://cordis.europa.eu/project/id/642088.

The objective of the project SWOS was to develop a monitoring and information service focussing on wetland ecosystems. Globally wetlands are the ecosystems with the highest rate of loss. This is alarming, considering their significance as biodiversity hotspots and ecosystems with a central role in the water cycle, including improving water quality and reducing water scarcity, in climate regulation and the economic benefit gained from using their services. SWOS has taken full advantage of the Sentinel satellites and integrate results from the ESA Globwetland projects. Status maps and indicators, as well as near real-time observations allowed the assessment of biodiversity and the monitoring of dynamic changes in an unmatched temporal and spatial resolution. SWOS contributed to establishing a Global Wetland Observing System, as requested by Ramsar, it facilitated local and EU monitoring tasks and input into international reporting obligations. SWOS aimed at positioning Europe in a leading role for wetland activities within the GEO ecosystem, biodiversity, water, land cover tasks. The direct involvement of users working at different scales and support of key user organizations ensured the usability and acceptance of the service, the harmonization with related activities and a long-term impact.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Wetlands	General Guideline	Planning	N/A	N/A

2.1.7 Inland Wetlands

2.1.7.1 Quintana, X. D., Cañedo-Argüelles, M., Nebra, A., Gascón, S., Rieradevall, M., Caiola, N., Sala, J., Ibànez, C., Sánchez-Millaruelo, N., Boix, D. (2015). **New Tools to Analyse the Ecological Status of Mediterranean Wetlands and Shallow Lakes.** In: Munné, A., Ginebreda, A., Prat, N. (eds) Experiences from Surface Water Quality Monitoring. The Handbook of Environmental Chemistry, vol 42. Springer, Cham. https://doi.org/10.1007/698_2015_391.

The efforts done in Catalonia (Spain) to assess the ecological status of Mediterranean wetlands and shallow lakes are described. The term wetland includes all shallow lentic waterbodies, temporary or permanent, where light reaches the bottom allowing the development of primary producers at the maximum water depth. Two water quality indexes and one habitat condition rapid assessment were developed. The first quality index (QAELSe 2010) is based on the sensitivity of microcrustaceans (cladocerans, copepods and ostracods) and the richness of crustaceans and insects found in these habitats; the second one (EQAT) uses the composition of Chironomidae pupal exuviae. Rapid assessment of habitat condition (ECELS index) considers wetland hydromorphological aspects, the presence of human pressures in the surroundings and the conservation status of the wetland vegetation. Some data of the current ecological status of Mediterranean wetlands in Catalonia are also provided. For more on lake restoration see chapter 2.3.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Wetlands, Lakes	Academic Article	Planning	N/A	N/A

2.1.7.2 Sayer, C.D., Biggs, J.,Greaves, H.M., & Williams, P. (2023). **Guide to the restoration, creation and management of ponds.** University College London, London, UK.
https://freshwaterhabitats.b-cdn.net/app/uploads/2024/01/UCL_FHT_pond_conservation_guide.pdf.

The guide, which is freely available, is designed to support landowners, farmers and other stewards of the land to create and manage ponds in all landscapes, from nature reserves to the wider countryside. Among other things, it highlights the importance of different pond types, such as seasonal ponds, and shows how to increase the number of clean water ponds in a region to boost freshwater biodiversity.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Wetlands, Ponds	General Guideline	Planning	9	N/A

2.1.7.3 Freshwater Habitats Trust (n.d.). **Pond Creation Toolkit.** https://freshwaterhabitats.org.uk/advice-resources/pond-creation-hub/pond-creation-toolkit/.

This website provides evidence-based advice on creating ponds. These include factsheets, species lists and case studies.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Wetlands, Ponds	Database	Planning	9	N/A

2.1.7.4 Biggs, J., Whitfield, M., Thorne, A., Bryant, S., Fox G., and Nicolet, P. (n.d.). **The Pond Book: a Guide to the Management and Creation of Ponds.** https://freshwaterhabitats.org.uk/advice-resources/buy-the-pond-book/.

Ideas about pond management have changed considerably in the last few decades: much more is now known about the needs of pond wildlife, the importance of protecting ponds for archaeology and the value of ponds for people. Using the latest research, the authors show why ponds are so valuable for people, landscape and for wildlife. They also take a fresh look at a wide range of management issues and assist with deciding on the best solutions for the respective pond.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Wetlands, Ponds	General Guideline	Planning	9	N/A

2.1.7.5 Ponderful (n.d.). **Ponds for Climate.** https://ponderful.eu/publications/.

Largely neglected and generally undervalued, ponds are actually remarkably important for biodiversity conservation. The EU-funded PONDERFUL project investigates how ponds can be used as nature-based solutions (NBS) for climate

change adaptation. The publications database includes scientific publications, deliverables/reports and other relevant documents derived from PONDERFUL.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Wetlands, Ponds	Database	Planning	9	N/A

2.1.7.6 WaterLANDS project (2023) - **D1.2 Drivers and Thresholds of Change for European Wetland Restoration**.
https://waterlands.eu/results-and-resources/deliverable-1-2-drivers-and-thresholds-of-change-for-european-wetlands/

Healthy wetlands provide essential ecosystem services to society including the regulation of carbon, water and natural hazards, the provisioning of food and drinking water, and by acting as spaces for cultural heritage and recreation. D1.2 was developed by the University of Leeds as part of WaterLANDS WP1 – Restoring Services and aims to assess the drivers of change in wetland functioning. D1.2 aims to improve understanding of the physical and chemical drivers of wetland functioning, determine how key drivers influence wetland functioning, discuss how wetland restoration is expected to influence driver effects and enhance wetland ecosystem services.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Wetlands	Project	Planning	9	N/A

2.1.7.7 WaterLANDS project (2023) - **D4.1 Review of Business and Finance Models and Market Demand for wetland restoration**. https://waterlands.eu/results-and-resources/deliverable-4-1-review-of-business-and-finance-models/

Deliverable 4.1 was developed by Wageningen University and the University of Venice as part of WP4 - Mobilising Finance. The overall objective of the report is to provide insights for WaterLANDS Action Sites and similar actors (restoration projects) who wish to explore opportunities for financial support beyond public grants or philanthropy. To this end, the report examines European and international experience to determine the business and financing options most relevant to the upscaling of wetland restoration in Europe and to achieve a transitioning of economic activity to more sustainable development.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Wetlands	Project	Planning	9	N/A

2.1.7.8 Bernal-Saukkonen L., Achilleos, E. (2014). **A guide to support the selection, design and implementation of Natural Water Retention Measures in Europe.** Directorate-General for Environment. DirectorateC - Quality of Life, Water & Air, Unit C1 - Water. European Commission. http://nwrm.eu/guide/files/assets/basic-html/index.html#2.

This guide is aimed at managers, decision makers, experts and stakeholders that are involved in the selection, design and implementation of Natural Water Retention Measures, which often includes ecosystem/wetland restoration.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Wetlands	General Guideline	Planning, Implementation	N/A	N/A

2.1.7.9 Silvia, J. (2023). **LIFE and peatlands - past, present and future.** Biogeographical Process in the Terrestrial Areas. https://biogeoprocess.net/wp-content/uploads/2023/12/3_T2_1-LIFE-IP-Peatlands-Sliva.pdf

This presentation gives an overview of lessons learned from LIFE project to conserve and restore peatlands, this includes suitable measures such as sufficient rewetting by closing drainage systems and damming. The presentation also lists challenges, changes and opportunities. Restoration techniques described include rewetting, paludiculture and wet/carbon farming, deforestation and/or woodland removal, conversion of afforestation and arable land on organic soils, reduction of peat mining, restoration and sustainable use of areas after peat exploitation, combat invasive alien species, re-establishment of mire species.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic, Continental	Wetlands, Peatlands, Mires, Bogs	Project	Planning	9	7110, 7120, 7130

2.1.7.10 Greifswald Mire Centre, Wetlands International (2020). **WaterLANDS: Q&A on Peatlands Rewetting and Restoration from Wetlands International and Greifswald Mire Centre.** https://waterlands.eu/results-and-resources/q-and-a-on-peatlands-rewetting-and-restoration-from-wetlands-international-and-greifswald-mire/.

This Q&A explains the differences between rewetting and restoration addressing the key questions raised in the European Parliament and the EU Council. It describes that the costs and benefits of rewetting and restoration, the availability of data on peatland distribution and condition, the compatibility of rewetting with productive land use and food security and the issue of methane emissions after rewetting.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic, Continental	Wetlands, Peatlands	Website	Planning	9	N/A

2.1.7.11 Convention on Wetlands. (2021). **Global guidelines for peatland rewetting and restoration.** Ramsar Technical Report No. 11. Gland, Switzerland: Secretariat of the Convention on Wetlands. https://www.ramsar.org/sites/default/files/documents/library/rtr11_peatland_rewetting_restoration_e.pdf.

This Ramsar Technical Report provides comprehensive technical guidance and background information on peatland rewetting and restoration for regional planners, site managers and policy makers. The Convention on Wetlands (The Convention) and other national, regional and global policy frameworks promote the restoration of degraded peatlands. Rewetting peatland to reduce greenhouse gas emissions is an important climate change mitigation strategy, and meeting the objectives of the Paris Agreement may require rewetting of virtually all drained peatland, a total of over 50 million hectares globally.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Wetlands, Peatlands	General Guideline	Planning	9	N/A

2.1.7.12 Mackin, F., Barr, A., Rath, P., Eakin, M., Ryan, J., Jeffrey, R. & Fernandez Valverde, F. (2017). **Best practice in raised bog restoration in Ireland. Irish Wildlife Manuals**. No. 99. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland. https://www.npws.ie/sites/default/files/publications/pdf/IWM99_RB_Restoration_Best%20Practice%20Guidance.pdf.

This guide provides restoration as well as monitoring measures for raised bogs in Ireland. Many of these measures have been carried out at raised bogs in Ireland, resulting in successful restoration of peat-forming conditions, and with no known impacts on adjacent agricultural land or property.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Wetlands, Peatlands, Bogs	General Guideline	Implementation, Monitoring	N/A	7120

2.1.7.13 LIFE Database (n.d.). **Restoring Active Raised Bog in Ireland's SAC Network 2016-2020**. LIFE14 NAT/IE/000032 Layman's Report. https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE14-NAT-IE-000032/restoring-active-raised-bog-in-irelands-sac-network-2016-2020.

The LIFE database gives an overview of the project including the result and the Layman report which can be downloaded at the end of the website describes the project in detail including methods used, the achievements and benefits and impacts of the study. The After-LIFE Conservation Plan which can also be downloaded at the end of the website gives an overview of monitoring but also provides a SWOT analysis. Restoration methods include working with landowners, installation & maintenance of water retaining structures within existing damaged bogs to raise water tables, controlling natural regeneration of trees and shrubs that had colonised the damaged bog and fencing to prevent livestock access to allow the bogs to regenerate naturally.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Wetlands, Peatlands, Bogs	Project	Planning, Implementation	9	7110

2.1.7.14 Thom, T., Hanlon, A., Lindsay, R., Richards, J., Stoneman, R. & Brooks, S. (2022): **Conserving Bogs - The Management Handbook.** Peatland ACTION. IUCN Peatland Programme. https://www.iucn-uk-peatlandprogramme.org/resources/restoration-practice/restoration-techniques.

This guide describes best practices, basic principles of peatland restoration and acts as a practical manual of methods and techniques. The guide identifies 'families' of techniques with shared restoration objectives and describes best practices associated with individual technique, conditions of applications, machinery requirement, intended outcomes and practical issues likely to impact on their success. It also gives an overview of restoration of peatland hydrology. Restoration techniques fall under the overarching themes of hydrology (including dams, sluices & weirs, bunds, ditch infilling and pumping), Revegetating bare surfaces, eroding gullies & hags (including natural recolonisation and assisted revegetation), managing scrubs & trees (including cutting & felling, scrub control with & without herbicides and waste disposal), grazing, burning and access provision.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Wetlands, Peatlands, Bogs	General Guideline	Planning, Implementation	N/A	7110, 7120, 7130

2.1.7.15 European Commission (2023). **Green Deal Project Success Stories - Merging Arts and Science to Increase Public Engagement**. WaterLANDS. https://waterlands.eu/results-and-resources/a-waterlands-success-story-merging-arts-and-science-to-increase-public-engagement/.

WaterLANDS (Water-based Solutions for Carbon-storage, People, and Wilderness) aims to restore damaged wetlands across Europe and lay the foundations for protection across larger areas. This briefing describes how WaterLANDS successfully included artists in restoration work increasing the engagement with the project.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Wetlands	Project	Planning	N/A	N/A

2.1.7.16 MERLIN Project. (2022). **D1.2 New framework for monitoring systemic impacts of freshwater and wetland restoration actions.** https://project-merlin.eu/deliverables.html.

This deliverable from the MERLIN Project highlights the importance of case studies for managerial learning, emphasizes scaling-up nature-based solutions across Europe, and provides evidence to support transformation agendas. The document offers guidance and indicators to implement successful monitoring programmes.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Wetlands, Rivers	Project	Monitoring	7	N/A

2.1.8 Coastal Wetlands

2.1.8.1 Hudson, R., Kenworthy, J. and Best, M. (eds) (2021). **Saltmarsh Restoration Handbook: UK and Ireland.** Environment Agency, Bristol, UK. https://catchment-basedapproach.org/learn/saltmarsh-restoration-handbook/.

This Saltmarsh Habitat Restoration Handbook aims to provide practical guidance on restoring and creating saltmarsh habitat across the UK and Ireland. It brings together advice on planning and implementing such schemes with case studies and lessons from previous examples.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Wetlands, Saltmarsh, Coastal Ecosystems	General Guideline	Planning, Implementation	9	1330

2.1.8.2 Billah, M., Bhuiyan, M.A., Islam, M.A. et al. (2022). **Salt marsh restoration: an overview of techniques and success indicators.** Environmental Science and Pollution Research Vol.29, 15347–15363. https://doi.org/10.1007/s11356-021-18305-5.

This paper proposes a model for restoring degraded salt marsh, as well as tracking their success. The information presented here will assist the marine ecosystem restoration practitioners in getting a comprehensive understanding of salt marsh restoration success evaluation.

Region	Restoration target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Wetlands, Saltmarsh, Coastal Ecosystems, Marine Ecosystems	Academic Article	Planning, Implementation	N/A	N/A

2.1.8.3 LIFE SALLINA (2018-2024). **Sustainable Actions on Loire Lagoons for Improvement and Assessment.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE17-NAT-FR-000519/sustainable-actions-on-loire-lagoons-for-improvement-and-assessment.

The LIFE SALLINA project will restore around 400 ha of salt marshes in three targeted Natura 2000 sites; of which 290 ha is coastal lagoons and Atlantic salt meadows, two habitats listed in the Habitats Directive. The project will initiate a range of conservation actions aimed at ensuring appropriate long-term management of these habitats.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Wetlands, Saltmarsh, Coastal Ecosystems, Marine Ecosystems	Project	Planning, Implementation	N/A	1150, 1330

2.1.8.4 Sánchez-Arcilla, A., Cáceres, I., Le Roux, X., Hinkel, J., Schuerch, M., Nicholls, R.J., Otero, d.M., Staneva, J., de Vries, M., Pernice, U., Briere, C., Caiola, N., Gracia, V., Ibáñez, C., Torresan, S. (2022). **Barriers and enablers for upscaling coastal restoration**. Nature-Based Solutions, Volume 2. https://www.sciencedirect.com/science/article/pii/S2772411522000246?via%3Dihub.

The authors propose a systemic restoration, which integrates Nature based Solutions (NbS) building blocks, to provide climate-resilient ecosystem services and improved biodiversity to curb coastal degradation. The result should be a reduction of coastal risks from a decarbonised coastal protection, which at the same time increases coastal blue carbon. The authors discuss barriers and enablers for coastal adaptation-through-restoration plans, based on vulnerable coastal archetypes, such as deltas, estuaries, lagoons and coastal bays. These plans, based on connectivity and accommodation space, result in enhanced resilience and biodiversity under increasing climatic and human pressures. The paper concludes with a review of the interconnections between the technical, financial and governance dimensions of restoration, and discusses how to fill the present implementation gap.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Coastal Ecosystems	Academic Articles	Planning	N/A	N/A

2.1.8.5 Manning, W.D., Scott, C.R and Leegwater. E. (eds) (2021). **Restoring Estuarine and Coastal Habitats with Dredged Sediment: A Handbook.** Environment Agency, Bristol, UK. https://catchmentbasedapproach.org/learn/restoring-estuarine-and-coastal-habitats-with-dredged-sediment/.

This handbook, “Restoring Estuarine and Coastal Habitats with Dredged Sediment”, provides conceptual, practical and regulatory guidance on the beneficial use of sediments arising from dredging activities across the UK. Beneficial use is a tool, providing the geomorphological and physical conditions required for successful restoration. The guidance provided can therefore be applied to support the restoration of coastal and estuarine habitats.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Wetlands, Coastal Ecosystems	General Guideline	Planning, Implementation	N/A	1130

2.1.8.6 Estuarine & Coastal Sciences Association. (n.d.). **Tools & guidance: Restoration Handbooks.** https://ecsa.international/reach/tools-and-guidance.

This resource includes handbooks for various habitats, such as saltmarshes and oysters, and other guidance, including maps.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Coastal Ecosystems, Saltmarshes	General Guideline	Planning, Implementation	N/A	N/A

2.1.8.7 LIFE ADAPTA BLUES (2019-2024). **Adaption to climate change through management and restoration of European estuarine ecosystems.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE18-CCA-ES-001160/adaptation-to-climate-change-through-management-and-restoration-of-european-estuarine-ecosystems.

Coastal areas are particularly vulnerable to climate change because of their exposure to rising sea levels and extreme weather events. In the search for climate change adaptation, nature-based solutions are increasing considered as viable and efficient approach alongside traditional engineering-based solutions. Coastal systems such as saltmarshes, seagrass meadow and reef-forming organisms play a part by protecting coasts against erosion and flooding, supporting other ecosystem services, and sequestering carbon. The general objective of the LIFE

ADAPTA BLUES project is to demonstrate the potential of conserving and restoring European estuaries following an ecosystem-based approach to climate change adaptation, decreasing risks to coastal areas while contributing to climate change mitigation.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Coastal Ecosystems, Saltmarsh, Seagrass	Project	Planning, Implementation	N/A	N/A

2.1.8.8 LIFE HABITATS CALANQUES (2017-2022). **Integrated management in Mediterranean on remarkable coastal habitats suburban of Calanques related to southern Europe.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE16-NAT-FR-000593/integrated-management-in-mediterranean-on-remarkable-coastal-habitats-suburban-of-calanques-related-to-southern-europe.

The objective of LIFE HABITATS CALANQUES was to restore and manage coastal habitats listed in Annex I of the Habitats Directive, along with their associated rare and endemic species. The project was a partnership between Agence Régionale pour l'Environnement (ARPE) and the Calanques national park with landowners and managers in the target Natura 2000 network site. The project team aimed to compile a report on experimental conservation and management methods in Europe and adapt the best available techniques for peri-urban coastlines. Moreover, the project would produce best practice guidelines for integrated coastal management, focusing on how to protect outstanding and fragile natural heritage while also developing economically important recreational uses of the area.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Coastal Ecosystems	Project	Planning, Implementation	N/A	N/A

2.1.8.9 CoastNet LIFE (2018-2025). **Restoring the Baltic coastal habitat networks.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE17-NAT-FI-000544/restoring-the-baltic-coastal-habitat-networks.

CoastNet LIFE aims to improve the conservation status of Natura 2000 sites along the Baltic coastal zone. To achieve this, it plans to carry out restoration work on four types of habitat: boreal Baltic islets and small, open habitats; mosaics of herb-rich, broad-leaved forests and semi-natural habitats; sun-lit habitats; as well as large coastal meadows and new forests on previously uncolonised land. The project's work should help increase the populations of numerous species by giving them new areas to colonise. It will also help to combat the effects of habitat fragmentation and isolation, as well as boosting the populations' resilience to climate change.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Boreal	Coastal Ecosystems, Forests, Grasslands, Rivers, Butterflies	Project	Planning, Implementation	7, 10	N/A

2.1.8.10 REST-COAST (2021-2026). **Large scale restoration of coastal ecosystems through rivers to sea connectivity.** https://cordis.europa.eu/project/id/101037097**.**

The EU-funded REST-COAST project will bring together 38 partners to assess ecosystem services from coastal marshes, seabed meadows and coastal dunes, to reduce erosion and flooding risks while enhancing biodiversity and blue carbon. It will develop large-scale river-coast connectivity and increase the nearshore accommodation space for the resilient delivery of coastal ecosystem services. The project will conduct nine pilots in the main EU regional seas (Baltic, Black, North, Atlantic and Mediterranean) with the aim of increasing the commitment of citizens, stakeholders and policymakers.

Region	Restoration target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic, Black Sea,	Marine Ecosystems, Coastal Ecosystems, Seagrass,	Project	Planning, Implementation	5,7	N/A

Mediterra-nean, Conti-nental, Boreal	Dunes, River Connectivity				

2.1.8.11 LIFE LAGOON REFRESH (2017-2017). **Coastal lagoon habitat (1150*) and species recovery by restoring the salt gradient increasing freshwater input.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE16-NAT-IT-000663/coastal-lagoon-habitat-1150-and-species-recovery-by-restoring-the-salt-gradient-increasing-fresh-water-input.

The LIFE LAGOON REFRESH project foresees the restoration in Venice's northern lagoon of the small tidal costal lagoons. In particular, it aims at conserving coastal lagoons to exploit the ecosystem services provided by this habitat.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Mediterranean	Coastal Ecosystems	Project	Planning, Implementation	N/A	1150

2.1.8.12 LIFE FOR POMORIE LAGOON (2020-2023). **Conservation of Pomorie Lake coastal lagoon**. https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE19-NAT-BG-000804/conservation-of-pomorie-lake-coastal-lagoon.

Pomorie Lake is part of the most valuable wetland complex along the Bulgarian Black sea coast. The project targets the conservation of the priority habitat coastal lagoons (1150*) and a group of bird species listed in Annex 1 of the Birds Directive (avocet, little, sandwich, and common terns). It has great EU importance as a rare ecosystem type and as a place where 40% of all European bird species can be observed. The project will aim to restore these habitats.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Black Sea	Coastal Ecosystems	Project	Planning, Implementation	N/A	1150

2.1.8.13 De Wit, R. and Boutin, N. (2023). **European LIFE Projects Dedicated to Ecological Restoration in Mediterranean and Black Sea Coastal Lagoons**. Environments, 10(6), p. 101. https://doi.org/10.3390/environments10060101.

This paper discusses how ecological restoration has been pursued through LIFE projects in the Natura2000 network in the Mediterranean and Black Sea coastal lagoon sites. The ecological restoration works included (i) removing solid waste and alien invasive species, (ii) re-building lagoons, (iii) creating islets for bird colonies, (iv) restoring the hydrodynamics of the lagoons, and (v) restoring and protecting vegetation.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Coastal Ecosystems	Academic Article	Planning	N/A	N/A

2.2 Grasslands and other Pastoral Habitats

For specific grassland and pastoral habitats related to pollinators or farmland please see chapter 6 and chapter 7, respectively.

2.2.1 Biodiversity. Information System for Europe (n.d). **Grasslands and other pastoral habitats.** https://biodiversity.europa.eu/europes-biodiversity/habitats-to-be-restored/grasslands.

European grasslands and other pastoral habitats are strongly associated with the human activities in particular agriculture. The website addresses the importance of preserving and rejuvenating these ecosystems to support biodiversity. The site likely provides information on the current state of these habitats, threats they face, and potential restoration efforts.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Grasslands	Website	Planning	9	N/A

2.2.2 Olmeda, C., Šefferová, V., Underwood, E., Milan, L., Gil, T. and Naumann, S. (eds) (2019). **EU Habitat Action Plan to maintain and restore to favourable conservation status the habitat type 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites).** European Commission Technical Report, Brussels. https://www.ecologic.eu/sites/default/files/publication/%5bcurrent-date:just_year%5d/EU%20Habitat%20Action%20Plan%206210-final.pdf.

The habitat type 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates is protected under the Habitats Directive (92/43/EEC) and includes a wide range of grassland communities. It is considered a priority habitat if it is an important orchid site. This action plan aims to guide the actions required to maintain and restore the habitat at a favourable conservation status across its range in the EU. It is addressed to all those interested and involved in the conservation and management of this habitat type, including governmental and non-governmental organisations, local communities and stakeholders, habitats specialists, etc. The guide provides more detailed information about the status of this habitat type and its conservation management, including the key recommendations that underpin the framework for action. These grasslands are considered a high priority for conservation of wild pollinator species, such as butterflies, wild bees or hoverflies, as well as for other rare or protected species. They provide multiple benefits and ecosystem services, including carbon storage and prevention of soil erosion. The overall goal of this action plan is to ensure its maintenance and restoration at favourable conservation status in the medium to long term.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Grasslands, Pollinators	General Guideline	Planning	8	6210

2.2.3 Scotton, M., Kirmer, A., Krautzer, B. (2012). **Practical handbook for seed harvest and ecological restoration of species rich grasslands**. Published by Cleup, printed by Wallig Austria. https://rangelandsgateway.org/sites/default/files/2021-01/jefferson.pdf.

This guide gives a description of restoration methods and of management after restoration of species-rich grasslands. Restoration of semi-natural grassland has been successfully realised on many differing sites for many years all over Europe. Restoration success strongly depends on different factors: suitable site preparation of receptor sites, selection of the optimal restoration method and target community, and the implementation of a proper management. Restoration methods include sowing seeds & seed mixtures, spreading seed-rich biomass, special techniques for protection against erosion and drying out, restoration with site-specific plant materials and natural succession.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Grasslands	General Guideline	Planning	N/A	N/A

2.2.4 LIFE Public Database (2023-2028). **Restore and connect existing and new EU Priority dry grasslands (6210*, 6120*, 6230*) to secure favorable conservation status of habitat types and species (orchids, butterflies, and pollinators).** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE22-NAT-DK-LIFE-ORCHIDS-101113801/restore-and-connect-existing-and-new-eu-priority-dry-grasslands-6210-6120-6230-to-secure-favorable-conservation-status-of-habitat-types-and-species-orchids-butterflies-and-pollinators.

While only giving a project description this website clearly mentions the planned habitat improvements which will include e.g. topsoil removal, harvest and sowing of nature seeds on former arable land, turf transplantation, use of Rhinanthus to reduce unwanted grasses, re-establishing natural hydrology, bringing back structures on the dry grasslands e.g., stones, counteract overgrowth, fight invasive alien species (IAS) and arrange a year-round multispecies grazing regime with cattle, Exmoor ponies and goats.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Grasslands, Butterflies, Pollinators	Project	Planning	8	6210, 6120, 6230

2.2.5 Latvijas Dabas fonds (2017-2023). **GrassLIFE: Restoring EU priority grasslands and promoting their multiple use.** https://www.ldf.lv/en/projects/grasslife-restoring-eu-priority-grasslands-and-promoting-their-multiple-use.

GrassLIFE will focus on developing, optimising and improving the conservation status of five EU priority grasslands in Latvia (6120*, 6210*, 6230*, 6270* and 6530*). All restoration activities will be carried out within 14 Natura 2000 network sites. This website gives a very detailed project overview and lists the preparatory actions taken, the conservation actions and the monitoring actions.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Boreal	Grasslands	Project	Planning, Implementation, Monitoring	N/A	6210, 6120, 6230, 6270, 6530

2.2.6 Schils, R.L.M. et al. (2022). **Permanent grasslands in Europe: Land use change and intensification decrease their multifunctionality.** Agriculture, Ecosystems & Environment, 330, p. 107891. https://doi.org/10.1016/j.agee.2022.107891.

Permanent grasslands cover 34% of the European Union's agricultural area and are vital for a wide variety of ecosystem services essential for our society. Over recent decades, the permanent grassland area has declined, and land use change continues to threaten its extent. Simultaneously, the management intensity of permanent grasslands increased. Based on the evidence in 696 out of 70,456 screened papers, published since 1980, the authors found that both land use change and intensification of management decreased multifunctionality. Preventing conversion of permanent grasslands to croplands secured the delivery of multiple ecosystem services. A lower management intensity was associated with benefits for biodiversity, climate regulation and water purification, but impacted the provision of high-quality animal feed. Increasing the number of species in the sward enhanced multifunctionality of permanent grassland without significant trade-offs such as losses in production. This paper provides some key points about the value of permanent as opposed to temporary grassland, cropland, or forest (see Fig 3). Permanent grassland can be compared with these alternative land uses which can be useful when thinking about the value of restoring grassland.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Europe	Grasslands	General Guideline	Planning	N/A	N/A

2.2.7 Kiehl, K., Kirmer, A., Shaw, N., Tischew, S. (2014). **Guidelines for Native Seed Production and Grassland Restoration.** https://www.cambridgescholars.com/product/978-1-4438-5900-4 (*not open access*).

Commercial seed mixtures, consisting of non-native species and genetically uniform cultivars, are widely used in grassland restoration, often with negative effects on biodiversity. This book compiles results from recent studies. The authors review the ecological and genetic aspects of seed propagation and species introduction both from a European and an American perspective and discuss implications for the development of seed zones and for native seed production. Examples from different countries focus on native seed production in practice and suggest different approaches for the certification of seed provenance. Best practice examples from Europe and the United States are used to indicate the advantages of using native seeds for ecological restoration of grasslands, field margins and sagebrush steppe.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe, Global	Grasslands, Steppe	General Guideline	Planning	N/A	N/A

2.2.8 SUPER-G (n.d.). **Sustainable management of permanent grasslands for enhanced ecosystem services.** SUPER-G | The EU Nature Restoration Law and Permanent Grassland in Sweden – SUPER-G

SUPER-G will apply a multi-actor approach, working with farmers; land owners/managers and their advisers; third sector and civil society groups; non-governmental organisations (NGOs) and researchers, policy and business communities to achieve better understanding of the importance and functioning of permanent grassland (PG), benchmarking of PG performance across Europe, co-development of integrated approaches for profitable and sustainable PG management and the co-development of tools and policy mechanisms, which are inclusive of stakeholder and citizen priorities, to support the maintenance and sustainable management of PG.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Boreal	Grasslands	General Guideline	Planning, Implementation, Monitoring	N/A	N/A

2.2.9 Goret, T., Janssens, X., & Godefroid, S. (2021). **A decision-making tool for restoring lowland grasslands in Europe.** *Journal for Nature Conservation*, 63, 126046. https://doi.org/10.1016/j.jnc.2021.126046.

This paper proposes a decision support tool using a stepwise framework informed by the successes and failures obtained in two large-scale restoration projects supplemented by scientific and grey literature. This decision tree addresses different restoration techniques depending on the local context, e.g. the intensity of habitat degradation, the richness of soil nutrients, and the presence in the vicinity of a habitat in a good conservation status. Depending on the type of grassland, our tool then suggests various recurrent management techniques to be applied after restoration. This synthetic work is presented step by step according to a dichotomous key which is intended to help practitioners make the right choices in their restoration process.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Grasslands	Academic Article	Planning	N/A	N/A

2.2.10 Barberis D., Lonati M. and Pagani R. (2023). **Use of locally harvested seeds from permanent grassland for revegetation of disturbed areas**. In: Rankin J., Brown S. and Newell Price P. (eds) Deliverable report 3.6, Synergies and tradeoffs, SUPER-*G* (Sustainable Permanent Grassland Systems and Policies), EC Project Number 774124-2.

A series of co-innovation workshops within 23 farm networks helped to identify permanent grassland (PG) management options, innovations, and technologies to trial on commercial and experimental farms before being road tested and demonstrated on a selection of pilot farms. A series of over 40 experiments were conducted on commercial and research farms across the biogeographic regions on a wide range of topics. The field trials and experiments have involved detailed integrated assessments on farms or permanent grassland (PG) areas to investigate the synergies and trade-offs between productivity, biodiversity, and delivery of other selected ecosystem services (ES).

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Grasslands	General Guideline	Planning, Implementation, Monitoring	N/A	N/A

2.2.11 Roosaluste, E. (2019). **Maintenance plan of wooded meadows and wooded pastures.** https://keskkonnaamet.ee/en/media/5117/download.

This maintenance plan provides an overview of the definition, origin, distribution, communities, biota, the richness of species of wooded meadows and wooded pastures and their causes, and the principles of their restoration and maintenance. This guide is provided for the managers of the Estonian-Latvian joint LIFE project "Restoring and promoting long-term sustainable management of Fennoscandian wooded meadows in Estonia and Latvia" but the principles for restoration are transferable and can also be applied elsewhere in Europe. Restoration techniques: 1) to reduce the source community so that as many different species of woody plants as possible remain; 2) to allow woody plants to grow irregularly, either individually or in groups, to form open areas between them; 3) to retain dead standing trees and lying wood (substrate for fungi, mosses, lichens, tree cavities as a nesting place for birds); 4) to preserve natural and anthropogenic landscape elements such as rocks and piles of rocks, stone fences, small bodies of water, the sites of former

farm buildings, and to clear their surroundings of bushes; 5) to establish proper barnyards for the welfare of animals (either to install in electric herds or to build strong and tall wooden fences against predators); 6) to provide drinking water to animals either by (artificial) water bodies or by drinking vessels; 7) to provide shelters for animals, especially on pastures with a very sparse tree stratum; 8) to involve in the restoration activities livestock which will immediately destroy the bushes, in addition, the animals shall indicate their preferred movement routes, resting places, areas where they do not want to go.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Boreal	Grasslands, Agricultural Ecosystems	General Guideline	Planning	9	6530

2.3 River, Lake, Alluvial and Riparian Habitats

More information about restoration of the natural connectivity of rivers and natural functions of the related floodplains (Art. 7) can be found in chapter 5 .

2.3.1 Biodiversity. Information System for Europe (n.d.). **River, lake alluvial and riparian habitats.** https://biodiversity.europa.eu/europes-biodiversity/habitats-to-be-restored/rivers-lakes.

This website gives an overview of river, lake, alluvial and riparian habitats that need to be restored. It addresses the importance of preserving and rejuvenating these ecosystems to support biodiversity. The site provides information on the current state of these habitats, threats they face, and potential restoration efforts.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Rivers, Lakes, Alluvial Habitats, Riparian Habitats	Website	Planning	7	N/A

2.3.2 UK RRC (2021). **Manual of River Restoration Techniques.** https://www.therrc.co.uk/manual-river-restoration-techniques.

The River Restoration Centre (RRC) Manual of River Restoration Techniques aims to help river managers identify potential restoration techniques for use in river restoration and sustainable river management. First issued in 1997, it provides detailed examples of

innovative and best-practice river restoration techniques, and now includes 68 case examples from 39 sites across the UK which can be downloaded freely as PDFs.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Rivers, Riparian Habitats	General Guideline	Planning, Implementation	7	N/A

2.3.3 MERLIN, Freshwaterblog (2023). **Working with nature to shape a healthier future for Europe's rivers.** https://freshwaterblog.net/2023/11/03/working-with-nature-to-shape-a-healthier-future-for-europes-rivers/.

This article gives an overview of measures that can be used to restore rivers such as re-meandering, dam removal, etc. You can download the manual of river restoration techniques, a guide for catchment scale river restoration, a guide to understanding your river, identifying river restoration options, creating objectives, design and implementation, monitoring and decision support pages.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Rivers, Riparian Habitats	General Guideline	Planning, Implementation, Monitoring	7	N/A

2.3.4 Umwelt Bundesamt (n.d). **River Restoration.** https://www.umweltbundesamt.de/en/topics/water/rivers/river-restoration-start#restoration-measures-improve-the-ecological-status-of-rivers.

This website of the German Environmental Agency gives an overview of river restoration and explains restoration methods. It also gives an overview of planning, implementation, funding and support platforms. It further lists resources for these points as well as listing examples of river restoration projects across Germany.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic, Continental	Rivers, Riparian Habitats	General Guideline	Planning, Implementation	7	N/A

2.3.5 The River Restoration Centre (n.d.). **River Restoration.** https://www.therrc.co.uk/river-restoration

These pages give an introduction to river restoration and an overview of the different practices commonly associated with the river restoration concept. The page is showcasing the work that is being carried out in the UK including the progress towards restoring designated rivers, the map of UK restoration projects, the EU RiverWiki, river restoration initiatives and the UK River Prize.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Rivers, Riparian Habitats	General Guideline	Planning, Implementation	7	N/A

2.3.6 REFORM (n.d). **Restoring rivers for effective catchment management.** https://www.reformrivers.eu/

The overall aim of REFORM is to provide a framework for improving the success of hydromorphological restoration measures to reach, in a cost-effective manner, target ecological status or potential of rivers. The website gives an overview of the project as well as listing many relevant resources such as the final report and scientific publications.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Rivers, Riparian Habitats	General Guideline	Planning, Implementation	7	N/A

2.3.7 RiverWiki (n.d.). **Restoring Europe's Rivers.** https://www.restorerivers.eu/wiki/index.php?title=Main_Page

This database holds 1454 river restoration case studies from 31 countries. These projects can serve as inspiration for further restoration actions. The site is funded through the Environment Agency (England) and managed by the RRC (UK). It is an interactive source of information on river restoration schemes from around Europe.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code

Europe	Rivers, Riparian Habitats	Database	Planning, Implementation	7	N/A

2.3.8 ReBorN (2022). **ReBorN - Restoration of Boreal Nordic Rivers. A LIFE project which restored watercourses heavily affected from the timber floating era.** https://en.rebornlife.org/_files/ugd/a179e9_0497f6cf93eb49948888c5877156ef47.pdf

This Layman Report describes the project in detail including the restoration measures that were taken. These measures include restoring meanders to straightened rivers, enhancing historic river features, improving sinuosity of current planform, green bank protection, improving channel morphology, managing overland floodwaters, creating floodplain wetland features, providing public, private & livestock access, enhancing outfalls to rivers, utilising spoil excavated from rivers, river diversions & removing or bypassing barriers.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Boreal	Rivers, Riparian Habitats	Project	Planning, Implementation, Monitoring	7	N/A

2.3.9 INTERREG Europe (2021). **Rivers and Wetlands: Drivers of Sustainable Regional Development. A Policy Brief from the Policy Learning Platform on Environment and resource efficiency.** https://www.interregeurope.eu/find-policy-solutions/policy-briefs/rivers-and-wetlands-drivers-of-sustainable-regional-development.

This policy brief gives an overview of relevant policies and support for river restoration in the EU. According to the European Environmental Agency (EEA), only around 40 % of the 110,000 bodies of surface water in the EU (i.e. rivers, lakes, and transitional and coastal waters) are currently in good ecological status and only 38 % in a good chemical status, which will make it hard to achieve the corresponding goals set by the Water Framework Directive. The policy brief aims to provide a clear overview of how the current EU policy framework may guide and support local and regional authorities in the implementation of river and wetland restoration measures and of nature-based solutions to improve or reverse the abovementioned trends. It also intends to put the spotlight on the wealth of good practices from Interreg Europe projects that can serve as an inspiration for untapping the potential of rivers as drivers of local and regional sustainable development.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**

Europe	Rivers, Wetlands	Policy Brief	Planning	7	N/A

2.3.10 DRYvER (2020-2025). **Securing biodiversity, functional integrity and ecosystem services in drying river networks.** https://cordis.europa.eu/project/id/869226.

Rivers are among the world's most biodiverse ecosystems but also the most threatened by human activities. For instance, more than half of the world's river networks are running dry. The EU-funded DRYvER project will collect, analyse and model data from nine case studies in Europe and South America. It will create a novel global meta-system approach that incorporates hydrology, ecology, biogeochemistry and socio-economics. Bringing together a multidisciplinary team of experts, the project will develop strategies to mitigate climate change effects on drying river networks and aid their adaptation mechanisms, defining new tools and guidelines. The findings will contribute to meeting the objectives of the Paris Agreement, which aims to limit global warming.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Europe	Rivers	Project	Planning	7	N/A

2.3.11 Floodplain Meadows Partnership (n.d.). **Restoring And Creating New Floodplain Meadows in England and Wales.** https://floodplainmeadows.org.uk/about-meadows/restoration/how-to-restore-meadows.

This website provides an overview of things that have to be considered when planning to restore floodplain meadows. They also provide a list of successful case studies. You can download the advice on how to restore and create floodplain meadows. Once widespread in river valleys, flower-rich floodplain meadows were highly prized as their nutritious hay kept farm animals alive and healthy through the winter. They recover well after flooding, when nutrient-rich river sediments are deposited and act as a natural fertiliser. They are productive during drought because of their fertile soil and deep-rooted plants.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Atlantic	Rivers, Alluvial Habitats, Grasslands	General Guideline	Planning	7	6450

2.3.12 New Mexico Forest and Watershed Restoration (2011). **Guidelines and Protocols for Monitoring Riparian Forest.** https://nmfwri.org/wp-content/uploads/2020/07/Riparian_forest_monitoring_guidelines-1.pdf.

This handbook offers guidelines and protocols for monitoring riparian restoration projects. Protocols are derived from the synthesis of a broad range of existing literature on the assessment of riparian fuels, vegetation, and wildlife habitat into a methodology that is efficient, objective, and appropriate for quantitative summaries. Th ese guidelines are also informed by the experiences of the staff of the New Mexico Forest and Watershed Restoration Institute and its partners and stakeholders. Additional resources are also suggested for measuring variables such as hydrology, water quality, and aquatic habitat.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Rivers, Riparian Habitats, Forests	General Guideline	Monitoring	7	91F0

2.3.13 CONVERGES (2018-2022). **European Riparian Ecosystems.** https://converges.eu/

The COST CONVERGES Action aimed to establish and summarize knowledge about riparian vegetation and ecosystems. It is a network created to coordinate research efforts, to contribute to knowledge conversion between countries and actors (scientists, managers, policy makers, etc.) and to promote practitioners research interests in the scientific community. The webpage offers an entry point to several resources about riparian ecosystems, their state and restoration.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Rivers, Riparian Habitats	General Guideline	Planning, Implementation, Monitoring	7, 10	N/A

2.3.14 CROSSLINK project (2022). **Efficacy of woody riparian buffers for protecting and enhancing stream and riparian habitats.** Sweden, Uppsala. https://www.riparianbuffers.com/

This webpage is a result from the Biodiversa project CROSSLINK which focused on the efficacy of woody riparian buffers for protecting and enhancing stream and riparian habitats. The webpage makes available guidelines for field surveys aiming at evaluating riparian habitat benefits, and for optimization of habitat network design. The protocols cover six categories: (1) Evaluating riparian habitat impacts, (2) Environmental data including

water quality and habitat, (3) Biodiversity data for stream invertebrates, diatoms, terrestrial invertebrates, microbes, and trees, (4) Ecosystem functioning data including algal biomass accrual, sediment dynamics, and organic matter processing, (5) Food web data, and (6) Opimization. It also provides publications about the efficiency and optimisation of riparian habitats in agricultural and urban landscapes for both stream and riparian biota.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Boreal	Rivers, Riparian Habitats	General Guideline	Monitoring	7	N/A

2.3.15 WWF (2018). **Restoration and Management of Riparian Forest Habitats in Bulgaria. WWF - Danube-Carpathian Programme.** Bulgaria, Sofia. https://wwfeu.awsassets.panda.org/downloads/guidelines_for_restoration_and_management_of_riparian_forest_habitats.pdf.

This guide gives an overview of different alluvial and riparian forests in the area and instructions on how to organise and plan restoration measures as well as give an overview of restoration measures. The purpose of these guidelines is to raise the awareness of relevant owners and managers with regard to the special status and particularities of these areas and to assist the experts in the future efforts for restoration and management of riparian habitats. Restoration techniques include passive restoration of riparian habitats - by enhancing natural processes (create conditions for natural regeneration, limit grazing practices, remove invasive species, regulate the species composition in restored units by removing undesired undergrowth, remove competitive vegetation, take measures to protect the river banks from undermining, clean and remove construction and domestic waste and to preserve the biotope trees and deadwood) and active restoration of riparian habitats by afforestation.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Continental	Rivers, Alluvial Habitats, Riparian Habitats, Forests	General Guideline	Planning, Implementation	N/A	91F0

2.3.16 WWF (2023). **Preserving and restoring floodplain forest habitats along the Mura-Drava-Danube rivers.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE22-NAT-AT-LIFE-RESTORE-for-MDD-101113557/preserving-and-restoring-floodplain-forest-habitats-along-the-mura-drava-danube-rivers. https://www.wwf.at/wp-content/uploads/2022/10/LIFE_R4MDD_Factsheet_DE_231020.pdf.

The Life website gives a good overview of the project and describes measures that will be taken. LIFE RESTORE for MDD - Preserving and restoring floodplain forest habitats along the Mura-Drava-Danube rivers" focuses on conservation and restoration of the largest contiguous riparian forest system in the Danube River Basin. For 5 years, 17 partners from Austria, Croatia, Hungary, Slovenia and Serbia will jointly work against the degradation of the priority floodplain forest habitat type HT 91E0* and HT 91F0, by restoring and improving 2,472 ha of floodplains, 45,230 m of water bodies, and by mobilising 966,000 m3 of sediments through river dynamics.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Continental, Pannonian, Alpine	Rivers, Alluvial Habitats, Riparian Habitats, Forests, Floodplains	Project	Planning, Implementation	7, 10	91F0, 91E0

2.3.17 LIFE Andros Park (2017-2022). **Conservation of priority species and habitats of Andros Island protected area integrating socioeconomic considerations.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE16-NAT-GR-000606/conservation-of-priority-species-and-habitats-of-andros-island-protected-area-integrating-socioeconomic-considerations.

The overall objective of LIFE Andros Park is to implement conservation and restoration actions to significantly restore and improve the conservation status of the Habitats Directive Annex I priority terrestrial habitat, alluvial forests (91E0*), as well as the priority marine species, Mediterranean monk seal (*Monachus monachus*), and the priority coastal seabirds, Mediterranean shag (*Phalacrocorax aristotelis desmarestii*) and Audouin's gull (*Larus audouinii*).

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Alluvial Habitats, Forests, Coastal Ecosystems	Project	Planning, Implementation	10	91E0

2.3.18 O'Sullivan, P. and Reynolds, C. S. (eds) (2005). **The Lakes Handbook, Volume 2: Lake Restoration and Rehabilitation.** Environmental Management, Policy & Planning. https://www.wiley.com/en-us/The+Lakes+Handbook%2C+Volume+2%3A+Lake+Restoration+and+Rehabilitation-p-9780632047956. *(not open access).*

This handbook provides an overview of the application of approaches, methods and tools for lake management and restoration. The book gives many regional studies including lakes in Europe such as lakes of Northern Europe and European Alpine Lakes.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Boreal, Alpine	Lakes,	Website	Planning, Implementation	N/A	N/A

2.3.19 Poikane, S., Kelly, M.G., Free, G., Carvalho, L., Hamilton, D.P., Katsanou, K., Lürl, M. (2024). **A global assessment of lake restoration in practice: New insights and future perspectives.** Ecological Indicators. Vol. 158. https://www.sciencedirect.com/science/article/pii/S1470160X23014723.

A global survey of 179 restoration practitioners spanning 65 countries identified the extent of stakeholder engagement as a key factor determining the success or failure of restoration projects. The most effective and widely used restoration measures target nutrient loading (both catchment and in-lake) while hydrological modifications and the implementation of nature-based solutions are used to a lesser extent. Measures for the control of non-native invasive species are rarely applied and are viewed as being largely ineffective. The results of the survey provide direction for future work. The future of lake restoration depends on joined-up thinking that better integrates science into policy and practice and, most importantly, ensures strong and inclusive stakeholder engagement and collaboration across multiple sectors.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Lakes	Academic Articles	Planning	N/A	N/A

2.3.20 LAWA (Bund/Länderarbeitsgemeinschaft Wasser) (2020). **LAWA-BLANO Maßnahmenkatalog (WRRL, HWRMRL, MSRL). LAWA Arbeitsprogramm Flussgebietsbewirtschaftung.** 60 S. https://www.lawa.de/documents/lawa-blano-massnahmenkatalog_1594133389.pdf.

Compilation of a large number of measures to be applied to rivers / floodplains, but also to lakes and marine waters, for the implementation of the Water Framework Directive and the Floods Directive. In case of rivers (102 measure types) addressing point sources, diffuse sources, water extraction, flow regulation and morphological impairment. In German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic, Continental (Germany)	Rivers	Guideline for practitioners	Planning	N/A	N/A

2.3.21 Feld, C.K., Birk, S., Bradley, D.C., Hering, D., Kail, J., Marzin, A., Melcher, A., Nemitz, D., Pedersen, M.L., Pletterbauer, F., Pont, D., Verdonschot, P.F.M., Friberg, N., 2011. From Natural to Degraded Rivers and Back Again: a test of restoration ecology theory and practice. Adv. Ecol. Res. 44, 119–209. https://doi.org/10.1016/B978-0-12-374794-5.00003-1

The paper presents a conceptual framework to help address the general lack of knowledge derived from integrated, well-designed and long-term restoration schemes. The framework was applied to three restoration types and highlights recurrent cause–effect chains, that is, commonly observed relationships of restoration measures (cause) and their effects on abiotic and biotic conditions (effect). Such conceptual models can provide useful new tools for devising more effective river restoration, and for identifying avenues for future research in restoration ecology in general.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Rivers	Academic Article	Planning, Implementation	N/A	N/A

2.3.22 MERLIN (n.d.). **MERLIN Podcast.** https://project-merlin.eu/podcasts.html

MERLIN is a major European Union funded project which is investing millions of Euros to help mainstream freshwater restoration across the continent over the coming years. This podcast follows the MERLIN project in this journey. It offers a behind the scenes look at some of the continent's most ambitious freshwater restoration projects carried out through cutting-edge aquatic science and conservation.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Rivers, Floodplains, Wetlands	General guideline	Planning, Implementation, Monitoring	N/A	N/A

2.4 Forests

More information on forest restoration can be found in chapter 8 (Art. 10 Restoration of Forest Ecosystem).

2.4.1 Biodiversity. Information System for Europe (n.d.). **Forests.** https://biodiversity.europa.eu/europes-biodiversity/habitats-to-be-restored/forests.

Forests and other wooded land cover more than 40 % of Europe, making it one of the most forest-rich regions in the world. The website addresses the importance of preserving and restoring these ecosystems to support biodiversity. The site provides information on the current state of these habitats, threats they face, and potential restoration efforts.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Forests	Website	Planning	10	N/A

2.4.2 FAO (2015). **Global Guidelines for the Restoration of Degraded Forests and Landscapes in Drylands.** http://www.fao.org/3/a-i5036e.pdf.

The aim of the guidelines is to enhance restoration efforts in the world's drylands. They provide specific guidance for policymakers and other decisionmakers, and for practitioners. Twenty-seven case studies are presented to demonstrate the breadth of experiences in dryland restoration, and they also illustrate the actions recommended in these guidelines.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean, Macaronesian	Forests	General Guideline	Planning, Implementation, Monitoring	10	N/A

2.4.3 Moreira, F., Arianoutsou, M., Corona, P., De las Heras, J. (2012). **Post-Fire Management and Restoration of Southern European Forests.** Managing Forest Ecosystems, MAFE, Vol. 24, Springer. https://link.springer.com/book/10.1007/978-94-007-2208-8.

The first publication to access in a comprehensive way the post-fire management in fire-prone European forest types. The main questions and recommended approaches can also be useful for other regions of the world with Mediterranean-type climates, such as parts of Australia, South Africa, North and South America. Designed to disseminate scientific knowledge on post-fire management and restoration of forests towards a target audience of professionals (forest managers, landscape planners, and forest agency staff), graduate students and researchers.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Forests	General Guideline	Planning	10	N/A

2.4.4 Metsantutkimuslaitos (2011). **Restore Resilience and Stability in Developing Tools for Sustainable Forest Management and Restoration**. Finland. https://cordis.europa.eu/project/id/236030/reporting.

The overall objective of RESTORE is to synthesize the knowledge of the biodiversity of pristine European boreal forests, available only in Russia, and bring it in use in European context. That will be done by combing the Russian knowledge and data from pristine boreal forests to that from managed boreal forests in Finland in order to estimate boreal forest ecosystem resilience and stability and develop tools for sustainable forest management (SFM) and restoration. The results are of crucial importance for EU and national policy makers, state forest managers, forest owners, conservationists and NGOs in both Europe and Russia.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Boreal	Forests	Website	Planning	10	N/A

2.4.5 Kuuluvainen, T., Nummi, P. (2023). **Strategies for the Ecological Restoration of the Boreal Forest Facing Climate Change.** In: Girona, M.M., Morin, H., Gauthier, S., Bergeron, Y. (eds) Boreal Forests in the Face of Climate Change. Advances in Global Change Research, vol 74. Springer, Cham. https://doi.org/10.1007/978-3-031-15988-6_17.

This chapter suggests strategic concepts and approaches for boreal forest ecosystem restoration. The issue of restoration is relatively new in boreal forests, and there are no established strategies to guide restoration planning and action. This chapter provides an overview of suggested strategic concepts and approaches for boreal forest ecosystem restoration and discusses their applicability to various situations. The key strategic questions in restoration for attaining a favourable conservation status of native ecosystem types and their intrinsic dynamics in a given area are: what, how much, and when to restore? The authors conclude that adaptive capacity should serve as an overarching strategic framework in boreal forest restoration during times of rapid climate change.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Boreal	Forests	General Guideline	Planning	10	N/A

2.4.6 LIFE Public Database (n.d.). **Restoring the Celtic Temperate Rainforest of Wales toward Favourable Conservation Status (2018-2027).** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE17-NAT-UK-000020/restoring-the-celtic-temperate-rainforest-of-wales-toward-favourable-conservation-status.

The LIFE website and the project website give a comprehensive overview of the project and the objectives such as managing invasive species, restoring ancient oak forests and reintroducing grazing animals to woodlands. The Celtic Rainforests LIFE project aims to improve the conservation status of two woodland habitats listed in Annex 1 of the Habitats Directive in five Natura 2000 network sites (SACs) in north- and mid-Wales.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Forests, Woodlands	Project	Planning	10	9180, 91A0

2.4.7 LIFEFORHAB (2021). **Restoration and improvement of the conservation status of priority forest habitats within Bulgarian Natura 2000 network.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE16-NAT-BG-000817/restoration-and-improvement-of-the-conservation-status-of-priority-forest-habitats-within-bulgarian-natura-2000-network.

The Layman Report gives a good overview of the project, methods, results and benefits of the project. The overall objective of LIFEFORHAB was to improve the conservation status and to increase the habitat coverage of seven priority forest habitats listed in Annex I of the Habitats Directive, within six target Bulgarian NATURA 2000 network sites.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Continental, Alpine	Forests	Project	Planning, Implementation	10	4070, 9180, 91E0, 91H0, 9530, 9560, 91AA

2.5 Steppe, Heath and Scrub Habitats

2.5.1 Biodiversity. Information System for Europe (n.d.). **Steppe, heath and scrub habitats.** https://biodiversity.europa.eu/europes-biodiversity/habitats-to-be-restored/steppe-heath-scrub.

Steppes, heaths and scrubs are dominated by small woody plants often in combination with herbs, and sometimes with a large contingent of mosses, liverworts and lichens. They are distributed across all the biogeographic regions of Europe from Mediterranean to Boreal regions and from lowlands to high altitudes. The website addresses the importance of preserving and restoring these ecosystems to support biodiversity. The site provides information on the current state of these habitats, threats they face, and potential restoration efforts.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Steppe, Heathlands	Website	Planning	N/A	N/A

2.5.2 Azerrad, J. M., Divens, K.A., Livingston, M.F., Teske, M.S., Ferguson, H.L. and Davis, J.L. (2011). **Site-specific management: How to avoid and minimize impacts of development to shrub-steppe.** Washington Department of Fish and Wildlife, Olympia, Washington.

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjEoLqLicaDAxUci_0HHSdBCDwQFnoECA8QAQ&url=https%3A%2F%2Fwdfw.wa.gov%2Fsites%2Fdefault%2Ffiles%2Fpublications%2F01335%2Fwdfw01335.pdf&usg=AOvVaw2E2h938xzF0RXa1eE2h-CN&opi=89978449

This document contains guidelines, considerations, and mitigation actions to take when developing near shrub-steppe ecosystems. The structure includes three main sections: surroundings, mapping shrub-steppes, and general recommendations.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Steppe	General Guideline	Planning, Implementation	N/A	N/A

2.5.3 Dunwiddie, P., and Camp, P. (2013). **Enhancement of Degraded Shrub-Steppe Habitat with an Emphasis on Potential Applicability in Eastern Washington.** Tech Note 443. Bureau of Land Management, Spokane District, Spokane, WA. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjA0ZyMjMa-DAxXY9wIHHaQ3ATQQFnoECCEQAQ&url=https%3A%2F%2Fwww.blm.gov%2Fsites%2Fdefault%2Ffiles%2Fdocuments%2Ffiles%2FLibrary_BLMTechnical-Note443.pdf&usg=AOvVaw2eky1YYrAuKBs6w4yFPu0L&opi=89978449

This technical note from the Bureau of Land Management (BLM) in the United States discusses methods and sources of information for shrub-steppe restoration, characteristics of shrub-steppe, and approaches to restoration. The note also introduces the State-and-Transition Model for Shrub-Steppe, which entails describing initial states of habitats and outlining pathways to restoration, or goal-states.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Steppe	General Guideline	Planning, Implementation	N/A	N/A

2.5.4 Pyke, D.A., Chambers, J.C., Pellant, M., Knick, S.T., Miller, R.F., Beck, J.L., Doescher, P.S., Schupp, E.W., Roundy, B.A., Brunson, M., and McIver, J.D. (2015). **Restoration handbook for sagebrush steppe ecosystems with emphasis on greater sage-grouse habitat—Part 1. Concepts for understanding and applying restoration**: U.S. Geological Survey Circular 1416, p. 44. http://dx.doi.org/10.3133/circ1416.https://pubs.usgs.gov/publication/cir1416.

This document is part 1 of 3 included in the steppe restoration handbook produced by the United States Geological Survey (USGS). The handbook focuses on restoration of habitats used by a particular species (sage-grouse). Part 1 describes restoration ecology concepts specific to sagebrush, methods for ecosystem resilience, and restoration techniques.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code

Global	Steppe	General Guideline	Planning, Implementation	N/A	N/A

2.5.5 Methow Conservancy. (n.d.). **Shrub-Steppe Restoration Guide.** https://methowconservancy.org/discover/shrub-steppe-restoration-guide

This Shrub-Steppe Restoration Guide is for anyone who lives on or cares for shrub-steppe lands – those semi-arid hillsides and plateaus dominated by perennial grasses and shrubs like bitterbrush or sage. It provides guidance on protecting and restoring shrub-steppe habitat on a small scale, strategies for weed control, and ways to rehabilitate the land after disturbances like new driveways, septic fields, and homesites.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Global	Steppe, Grasslands	General Guideline	Planning, Implementation	N/A	N/A

2.5.6 NATURA 2000 Biogeographical Process. (2019). **Steppic Region Roadmap.** https://biogeoprocess.net/steppic-region/.

This updated roadmap is based on the conclusions of the 2nd Natura 2000 Continental, Pannonian, Steppic and Black Sea region Seminar (2018, Strasbourg, FR) where the following themes were discussed: Theme 1 – Linking site-level, regional/national-level objectives and FRVs; Theme 2 – Solving issues in relation to habitat type definitions; Theme 3 – Involving local land managers through integrated site management; Theme 4 – Selecting biogeographical level conservation priorities and measures. The roadmap coordinates expected outcomes and associated actions, as discussed and highlighted by participants in the seminar.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Continental, Black Sea, Pannonian, Steppic	Steppe	General Guideline	Planning	N/A	N/A

2.5.7 Olmeda, C, Šefferová, V, Underwood, E, Millan, L, Gil, T and Naumann, S (eds) (2020). **EU Habitat Action Plan to Maintain and Restore to Favourable Conservation Status the Habitat Type 4030 European Dry Heaths.** European Commission, Brussels.https://ec.europa.eu/environment/nature/natura2000/management/best_practice_en.htm.

This action plan is aimed at providing guidance to maintain and restore, at a favourable conservation status, the Annex I habitat type 4030 - European dry heaths, which is protected under the Habitats Directive1. It is addressed to all those interested and involved in the conservation and management of this habitat type, including governmental and non-governmental organisations, local communities and stakeholders, habitats specialists, etc. The Key requirements to maintain habitat in good conservation status are the maintenance of low soil fertility, combined with appropriate levels of recurrent management to prevent succession. The overall goal of the action plan is to ensure its maintenance or restoration at favourable conservation status in the long term (up to 2030), along with ensuring favourable future prospects in the face of pressures and threats. The framework for action presents specific objectives and key actions to achieve this overall goal. The following sections of this document provide more detailed information about the status of this habitat and its conservation management, including key recommendations that underpin the framework for action. While the focus of this action plan is the habitat type 4030 - European dry heaths, it is important to keep in mind that this habitat interrelates with other habitats and land uses in complex landscape settings, and this needs to be considered when planning and implementing conservation management. The plan also recognizes the importance of this habitat for wild pollinators.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Grasslands, Heathlands, Pollinators	General Guideline	Planning	8	4030

2.5.8 Symes, N.C. and Day, J. (2003). **A practical guide to the restoration and management of lowland heathlands.** RSPB, Sandy. https://www.nhbs.com/a-practical-guide-to-the-restoration-and-management-of-lowland-heathland-book. *(not online).*

This guide provides detailed information on techniques for restoring, maintaining and monitoring lowland heathland habitats. It covers the full range of management issues affecting dry heath, wet heath, mire and associated grassland and open water habitats in Britain.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Grasslands, Wetlands, Heathlands, Mires	General Guideline	Planning	N/A	N/A

2.5.9 LIFE INSULAR (2021-2016). **Integrated strategy for sustainable management of insular habitats in Natura 2000 islands of the Atlantic Ocean**. https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE20-NAT-ES-001007/integrated-strategy-for-sustainable-management-of-insular-habitats-in-natura-2000-islands-of-the-atlantic-ocean.

The main objective of the LIFE INSULAR project is to implement a transnational strategy for an integrated restoration of the priority habitat type 2130* ("grey dunes") and the habitat 4030 (European dry heath) in five Atlantic Ocean islands spread across the Atlantic and Macaronesian biogeographical regions, promoting their favourable conservation status and increasing their resilience to climate change.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic, Macaronesian	Dunes Heathlands, Coastal Ecosystems	Project	Planning, Implementation	N/A	2130, 4030

2.6 Rocky and Dune Habitats

2.6.1 Biodiversity. Information System for Europe (n.d.). **Rocky and dune habitats.** https://biodiversity.europa.eu/europes-biodiversity/habitats-to-be-restored/rock-dune.

Rocky and dune habitats are widely distributed throughout Europe. While dune habitats are often encountered in the coastal areas, rocky habitats spread to the highest mountainous regions. The website addresses the importance of preserving and restoring these ecosystems to support biodiversity. The site provides information on the current state of these habitats, threats they face, and potential restoration efforts.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Dunes, Rocky Habitats	Website	Planning	N/A	N/A

2.6.2 SoLIFE (2018-2024). **Sands of LIFE.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE17-NAT-UK-000023/sands-of-life.

The SoLIFE project aims to restore dynamic processes in Welsh sand dunes, so enabling the free movement of sand necessary to improve the conservation status of all Habitat Directive Annex I sand dune habitats, especially the priority 'grey dune' habitat.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Dunes, Coastal Ecosystems	Project	Planning, Implementation	N/A	2110, 2120, 2130, 2170, 2190

2.6.3 LIFE Ghost (2013-2016). **Techniques to reduce the impacts of ghost fishing gears and to improve biodiversity in north Adriatic coastal areas**. https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE12-BIO-IT-000556/techniques-to-reduce-the-impacts-of-ghost-fishing-gears-and-to-improve-biodiversity-in-north-adriatic-coastal-areas.

The LIFE GHOST project fully achieved its objectives of measuring and reducing the impact of ALDFG on biodiversity in the rocky habitats along the Veneto Region coast. It also successfully proposed and promoted measures for habitat restoration and estimated the socio-economic benefits resulting from removal of fishing gear. The project monitored 2 124 ha of coastal marine bottom, mapped 17 rocky outcrops (tegnùe), and cleaned up 8.16 ha of reefs and 125 ha of artificial rocky structures.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Coastal Ecosystems, Rocky Habitats, Reefs	Project	Planning, Implementation	N/A	N/A

2.6.4 Nordstrom K.F., Jackson N.L. (2021). **Beach and Dune Restoration. Cambridge University Press.** https://doi.org/10.1017/9781108866453. *(not open access).*

This book explores the most effective approaches to use for restoring beaches and dunes. In general chapters three through eight are most relevant to restoration practitioners. It talks about the necessity to restore biodiversity, ecosystem health, and ecosystem services proved by coastal landforms and habitats, especially in the light of climate change. It also analyses the trade-offs involved in restoring beaches and dunes - especially on developed coasts - the most effective approaches to use, and how stakeholders can play

an active role. This book is a valuable resource for coastal scientists, engineers, planners, and managers as well as shorefront residents.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Coastal Ecosystems, Dunes	General Guideline	Planning, Implementation, Monitoring	N/A	N/A

2.6.5 Warnell, K., Mason, S., Siegle, A., Merritt, M. and Olander, L. (2023). **Coastal Habitats 5. Dune Restoration.** https://nicholasinstitute.duke.edu/sites/default/files/project/nature-based-solutions-roadmap/strategy/doi-nbs-roadmap-strategy_dune-restoration.pdf.

These guidelines give an overview of technical approaches to dune restoration as well as a list of further guidance documents. It gives guidance on how to choose site suitability and lists tools, training and resources for planning and implementation. It lists the benefits and outcomes such as climate threat reduction and also lists barriers and solutions for practitioners. Restoration measures: Building up dunes with sand, removing invasive species, planting dune grasses, installing fences around the dune, reducing beach grooming and avoid adverse impacts from beach access.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Coastal Ecosystems, Dunes	General Guideline	Planning, Implementation	N/A	N/A

2.6.6 Doody (2013). **Sand Dune Conservation, Restoration, and Management.** Springer. https://link.springer.com/book/10.1007/978-94-007-4731-9.

This book covers policy and ecological considerations as well as covering best management practices. The different states in which the habitat exists both for the beach/foredune and inland dune are reviewed against the pressures exerted upon them. Options for management are considered and the likely consequences of taking a particular course of action highlighted. These options include traditional approaches to the conservation and management of wildlife and landscapes as well as habitat restoration. The way the value of the areas changes under different management regimes is considered mainly from an environmental perspective. Consideration is given to new approaches to management and restoration including adopting a more dynamic approach.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Coastal Ecosystems, Dunes	General Guideline	Planning, Implementation	N/A	N/A

2.6.7 Geelen *et al.* (n.d.). **Conservation and Restoration of Coastal Dune Habitats in the Atlantic Region.** Natura 2000 Biogeographical process. https://biogeoprocess.net/wp-content/uploads/2023/12/1_5-Dune-Roadmap-2023-Hannover-Luc-Geelen.pdf.

This presentation gives a short overview of conservation and restoration of coastal dune habitats in the Atlantic region, an overview of existing dune habitats and lists the relevant LIFE projects. Coastal dunes are biodiversity hotspots, and many dune specialists are red list species.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Coastal Ecosystems, Dunes	General Guideline	Planning	N/A	2110, 2120, 2130, 2140, 2150, 2160, 2170, 2180, 2190, 21A0

2.6.8 LIFE Caretta Calabria (2013-2017). **Land-and-sea actions for conservation of *Caretta caretta* in its most important Italian nesting ground (Ionian Calabria)**. https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE12-NAT-IT-001185/land-and-sea-actions-for-conservation-of-caretta-caretta-in-its-most-important-italian-nesting-ground-ionian-calabria.

The main objectives of the project were to conserve and restore four key loggerhead nesting areas in coastal habitats (dune series); eliminate and/or mitigate the main threats and risk factors for the reproductive success of the turtle in the area; reduce the impact of fishing activities (by the Calabrian and Sicilian fishing fleets) on the populations of loggerhead turtle in the marine area off the nesting beaches; introduce integrated dynamic coastal zone management for the protection of Natura 2000 habitats (dune series) and of loggerhead turtle habitats under high anthropogenic pressure; produce guidelines for the management of coastal habitats; ensure that the coastal municipalities adopt a shared Action Plan for the prompt implementation of conservation actions along the Ionian coast of Calabria and disseminate best practices on the use of

coastal areas where the turtle nests to local administrators and residents; and update management plans for Natura 2000 sites in the project area.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Coastal Ecosystems, Dunes	Project	Planning, Implementation	N/A	N/A

2.6.9 Jones, L., Rooney, P., Rhymes. J. and Dynamic Dunescapes partners (2021). **The Sand Dune Managers Handbook**. Version 1. Produced for the Dynamic Dunescapes (DuneLIFE) project: LIFE17 NAT/UK/000570; HG-16-086436. https://www.dynamicdunescapes.co.uk/wp-content/uploads/2021/10/The-Dynamic-Dunescapes-Sand-Dune-Managers-Handbook-June-2021_Oct-Update.pdf

This handbook aims to keep our management techniques up to date for the needs of dune conservation in a variety of situations. This handbook introduces some of the principles, ideas, and context relevant to management techniques, descriptions of management techniques, and case studies that cover a variety of themes and activities.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Dunes, Coastal Ecosystems	General Guideline	Planning, Implementation	N/A	N/A

2.6.10 The Conservation Volunteers. (n.d.). **Sand Dunes Handbook.** https://conservationhandbooks.com/sand-dunes/

This is a Handbook of sand dune management. It is intended to be used by conservation volunteers and all others interested in maintaining or improving valuable natural habitats through manual work. It contains everything you need to know about sand dune management - their formation, ecology, the law, health and safety, access, vegetation, stabilisation and much more.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code

Atlantic	Dunes, Coastal Ecosystems	General Guideline	Planning, Implementation	N/A	N/A

2.6.11 LIFEREDUNE. (2022). **Guidelines and Manuals.** http://liferedune.it/linee-guida-e-manuali/

The LIFEREDUNE Project has developed a handful of guidelines and manuals for the management of dunes, including guides for sustainable management, monitoring, and propagation of particular species.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Continental, Mediterranean	Dunes, Coastal Ecosystems	Project	Planning, Implementation, Monitoring	N/A	N/A

2.6.12 The Baie de l'Aiguillon LIFE Project. (2016-2022). **Report: The Baie de l'Aiguillon LIFE project 2016-2022.** https://life.reserve-baie-aiguillon.fr/en/downloadable-documents/.

This report is the result of the Baie de l'Aiguillon LIFE project. The report provides context about the area under study (Baie de l'Aiguillon), points of intervention, techniques for restoration, goals for monitoring, and science communication and awareness.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Atlantic	Dunes, Coastal Ecosystems	Project	Implementation, Monitoring	N/A	N/A

2.6.13 LIFE CoHaBit (2016-2021). **Coastal Habitat Conservation in Nature Park 'Piejura'.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE15-NAT-LV-000900/coastal-habitat-conservation-in-nature-park-piejura.

Valuable protected coastal habitats found in the Piejura Nature Park include embryonic dunes, white dunes, grey dunes and wooded dunes, which are spread over an area of more than 30 km and are characterised by high biodiversity. The LIFE CoHaBit project achieved its objectives of restoring the vulnerable coastal habitats of the Nature Park Piejura in Latvia and mitigating heavy anthropogenic pressure on those habitats.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Boreal	Dunes, Coastal Ecosystems	Project	Implementation, Monitoring	N/A	1150, 1630, 2110, 2120, 2130

2.6.14 LIFE REDUNE (2017-2022). **Restoration of dune habitats in Natura 2000 sites of the Veneto coast.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE16-NAT-IT-000589/restoration-of-dune-habitats-in-natura-2000-sites-of-the-veneto-coast.

The LIFE REDUNE project's aim is to restore and maintain the ecological integrity of a full set of dune habitats listed in Annex I of the Habitats Directive, along with the populations of Stipa veneta, an endangered plant endemic to the dunes of northeast Italy, which is listed in Annex II of the directive as a priority species for conservation. The objective is to guarantee the ecological restoration of the coastal dunes of four Natura 2000 network sites along the North Adriatic coast.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Dunes, Coastal Ecosystems	Project	Implementation, Monitoring	N/A	2110, 2120, 2130, 2250

2.6.15 LIFE RES MARIS (2014-2018). **Recovering Endangered habitats in the Capo Carbonara Marine area, Sardinia**.

https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE13-NAT-IT-000433/life-res-maris-recovering-endangered-habitats-in-the-capo-carbonara-marine-area-sardinia.

The project Natura 2000 site is home to three priority habitats posidonia beds, coastal dunes and wooded dunes all of which are under threat from a range of problems. For the terrestrial habitats (i.e. the coastal dunes and wooded dunes) the main threats come from high human pressure, due to mass tourism, and from the introduction of invasive alien species. Other threats are the accumulation of waste, the cutting down of trees and branches, and dune erosion. The site also includes the marine habitat, the underwater posidonia meadows, that are also under pressure due to mass tourism, especially during the summer. The project addressed the problem of invasive alien species and the threats that they pose to priority habitats with Posidonia seagrass, coastal dunes with Juniperus and wooded dunes with Pinus that needed to be restored.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Dunes, Coastal Ecosystems, Seagrass	Project	Implementation, Monitoring	5	1120

3 Article 5: Restoration of Marine Ecosystems

3.1 General Article 5 Documents

3.1.1 European Commission, European Climate, Infrastructure and Environment Executive Agency, Ruskule, A., Oulès, L., Zamparutti, T. (2021). **Guidelines for implementing an ecosystem-based approach in maritime spatial planning: including a method for the evaluation, monitoring and review of EBA in MSP.** Publications Office. https://data.europa.eu/doi/10.2926/84261

The EU's Maritime Spatial Planning Directive (2014/89/EU) calls on Member States to apply "an ecosystem-based approach" (EBA) in their planning. At international level, UNESCO has called for the use of EBA in maritime spatial plans. This guidance aims to support the work of planners, experts and stakeholders in EU Member States. It presents a practical, stepwise approach for incorporating an ecosystem-based approach (EBA) in maritime spatial plans (MSPs). It is aimed at officials preparing the plans, experts supporting their work, as well as stakeholders involved in the preparation and implementation of maritime spatial plans. Within the overall method presented here, this guidance also includes a practical method to monitor and evaluate EBA in maritime spatial planning.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Marine Ecosystems	General Guideline	Planning, Implementation	N/A	N/A

3.1.2 European Commission, European Climate, Infrastructure and Environment Executive Agency, Zamparutti, T., Strosser, P., Ruskule, A., Veidemanne, K., Milkova, T., Dworak, T., Lieberknecht, L., Gea, G., Piet, G. (2021). **Study on Integrating an Ecosystem-based Approach into Maritime Spatial Planning.** Publications Office. https://cinea.ec.europa.eu/publications/study-integrating-ecosystem-based-approach-maritime-spatial-planning_en.

The Study on Integrating an Ecosystem-based Approach into Maritime Spatial Planning was contracted by the European Commission (by the Executive Agency for Small and Medium-sized Enterprises, EASME, with DG Maritime Affairs and Fisheries). The main objective of the study is to propose feasible and practical approaches and guidelines for applying the EBA in MSP with the presently available information and provide a practical method or tool for evaluating, monitoring and review the application of EBA in MSP.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Marine Ecosystems	Project	Planning, Implementation, Monitoring	N/A	N/A

3.1.3 European Commission, European Climate, Infrastructure and Environment Executive Agency (2022). **The implementation of ecosystem-based approaches applied to fisheries management under the CFP**. https://cinea.ec.europa.eu/publications/implementation-ecosystem-based-approaches-applied-fisheries-management-under-cfp_en.

The Common Fisheries Policy states that an Ecosystem-Based Approach to Fisheries Management (EAFM) needs to be implemented. This study provides a state-of-play of the implementation of EAFM in the North and Baltic Seas, Western Atlantic and Outermost Regions. At the core of this assessment, the study identified three types of “EAFM challenges” that need to be addressed in order to advance EAFM. In addition, typologies were developed for the main EAFM components (fisheries, management measures and policy instruments), and used to assess the available fisheries management information. The analyses revealed that existing measures are largely targeting only one type of EAFM challenge, i.e. mitigating fishing impacts using both input and output measures. Although a lack of consolidated information on existing management measures prevented a full in-depth assessment, some key obstacles were identified in the governance arrangements that should facilitate an EAFM. The advisory process should build on a transdisciplinary knowledge base, integrating various interdisciplinary scientific and local indigenous (e.g. fisher) knowledge to consider the full social-ecological system. Including context and stakeholder interests in decision making can enhance the feasibility, appropriateness, and impact of chosen management measures. The uptake of scientific advice

beyond single-species stock assessments into decision-making should also be improved.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Marine Ecosystems	General Guideline	Planning	N/A	N/A

3.1.4 FutureMARES (2020-2024). **Climate Change and Future Marine Ecosystem Services and Biodiversity.** https://cordis.europa.eu/project/id/869300.

The EU-funded FutureMARES project will deliver new solutions to climate change challenges. This highly multidisciplinary project will investigate socially and economically viable nature-based solutions for climate change adaptation and mitigation. Solutions will include the restoration of habitat-forming species that can buffer coastal habitats from climate change effects and improve seawater quality. Conservation actions and sustainable, ecosystem-based harvesting (capture and culture) of seafood are also a project priority. Overall, the aim is to safeguard these ecosystems' natural capital, biodiversity and services**.**

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Marine Ecosystems	Project	Planning, Implementation	N/A	N/A

3.1.5 BiodivERsA3 (2020-2024). **Marine Coastal Ecosystems Biodiversity and Services in a Changing World.** https://cordis.europa.eu/project/id/869710.

Considering marine coastal ecosystems (MCEs), which are European priority habitats, the EU-funded MaCoBioS project will investigate the impact of climate change on the most important MCEs, such as seagrass beds and kelp forests. It will develop empirical models on interactions between climate change, biodiversity and functions and services of marine coastal ecosystems. MaCoBioS will also work to establish a framework to assess vulnerabilities and it will evaluate the effectiveness of nature-based solutions. The findings will assist in EU strategies on MCEs, biodiversity and climate change.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Marine Ecosystems, Seagrass	Project	Planning, Implementation	N/A	N/A

3.1.6 FAO (2022). **A handbook for identifying, evaluating and reporting other effective area-based conservation measures in marine fisheries.** Rome. https://doi.org/10.4060/cc3307en.

Fisheries management measures can deliver outcomes that align with the Food and Agriculture Organization's (FAO's) Strategy on Mainstreaming Biodiversity across Agricultural Sectors (FAO, 2020), the United Nations (UN) Sustainable Development Goals (SDGs), and the Convention on Biological Diversity's (CBD) 2050 Vision for Biodiversity (CBD, 2018a). Many also conform to the definition, criteria and guidance on 'other effective area-based conservation measures' (OECMs) developed by the CBD Conference of Parties (CBD COP). In a fisheries context, OECMs are established, spatially defined management and/or conservation measures other than protected areas that produce positive, long-term and in situ biodiversity outcomes, in addition to the intended fishery outcomes. This handbook outlines one possible process to assess potential areas with existing ABMTs quickly, as well as identifying those that can be shown to contribute to sustained positive biodiversity outcomes.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Marine Ecosystems	General Guideline	Planning	N/A	N/A

3.1.7 MSP4BIO (2022-2025). **Improved Science-Based Maritime Spatial Planning to Safeguard and Restore Biodiversity in a coherent European MPA network.** https://cordis.europa.eu/project/id/101060707.

Biodiversity protection and restoration can be facilitated with the use of knowledge-based marine spatial planning. The EU-funded MSP4BIO project will develop an integrated flexible socio-ecological management system to deal with a rapidly changing environment for coastal, offshore and deep-sea ecosystems. By validating this system at six test sites in five European sea basins, MSP4BIO will enhance

approaches, methods and tools to increase scientific knowledge. Marine biodiversity scientists as well as planners and marine protected areas managers will benefit from this work, which will also support policy processes and decisions.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Marine Ecosystems	Project	Planning	N/A	N/A

3.1.8 MPA Europe (2023-2026). **Marine Protected Areas Europe.** https://cordis.europa.eu/project/id/101059988.

The EU-funded MPA Europe project will systematically map an optimal network of marine protected areas (MPAs) in all European seas that include as high a biodiversity of species, habitats and ecosystems as possible, and blue carbon stores. The project will include the first data-driven classification of ecosystems in European seas and range maps for thousands of species using data from Copernicus, EMODnet and the Ocean Biodiversity Information System. The results will be freely available through the project's online atlas. Stakeholders, including national and regional authorities, industry and NGOs, will know where MPAs are located to optimise the inclusion of biodiversity and blue carbon through marine spatial planning in 30 % of European seas, and best meet the targets for marine protection by 2030.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Marine Ecosystems	Project	Planning	N/A	N/A

3.1.9 Marine SABRES (2022-2026). **Marine Systems Approaches for Biodiversity Resilience and Ecosystem Sustainability.** https://cordis.europa.eu/project/id/101058956.

Social–ecological systems (SES) and ecosystem-based management (EBM) are globally recognised tools to enable balanced marine development and conservation. The EU-funded Marine SABRES project will co-design a simple SES approach to rapidly enable and upscale EBM across Europe and abroad. The project will set European marine management on a course to reverse biodiversity decline by

integrating sustainable ecosystems and a resilient blue economy. Marine SABRES will empower managers to make sustainable decisions and citizens to engage with marine biodiversity conservation. The project will demonstrate the practical management efforts in the Tuscan Archipelago, the Arctic North-East Atlantic and the Macaronesian archipelagos.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Marine Ecosystems	Project	Planning	N/A	N/A

3.1.10 BIOcean5D (2022-2026). **Marine Biodiversity Assessment and Prediction Across Spatial, Temporal and Human Scales.** https://cordis.europa.eu/project/id/101059915.

BIOcean5D unites major European centers in molecular/cell biology (EMBL), marine biology (EMBRC), and sequencing (Genoscope), together with 26 partners from 11 countries, to build a unique suite of technologies, protocols, and models allowing holistic re-exploration of marine biodiversity, from viruses to mammals, from genomes to holobionts, across multiple spatial and temporal scales stretching from pre-industrial to today. A focus is to understand pan-European biodiversity land-to-sea gradients and ecosystem services, including marine exposomes, notably with an expedition (TREC, 2023/24) that will deploy mobile labs, research vessels including the Tara schooner, and innovative citizen science tools, across 21 coastal countries and 35 marine labs from the Mediterranean to Arctic seas. New data will be harmonized with existing data into an open-access data hub, leveraging international infrastructures, and generating transformative, cross-technologies/cross-scales standard marine biodiversity knowledge at the socio-ecosystem level.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Marine Ecosystems	General Guideline	Planning	N/A	N/A

3.1.11 OBAMA-NEXT (2022-2026). **Observing and Mapping Marine Ecosystems – Next Generation Tools.** https://cordis.europa.eu/project/id/101081642.

Accurate and reliable biological ocean observations are critical for marine resource management. The EU-funded OBAMA-NEXT project will develop a toolbox for generating accurate, precise, and relevant information to describe marine ecosystems and their biodiversity. The project will integrate new and emerging technologies, including remote sensing, eDNA, optical instruments, and citizen science, with existing marine monitoring techniques to improve the capacity to describe ecosystem function and biodiversity with higher spatial and temporal resolution. OBAMA-NEXT will involve stakeholders in the identification of products needed in an iterative co-creating and specification process. The project will assess and improve the toolbox in 12 selected Learning Sites, representing diverse ecosystems and data sources within the four European regional seas.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Marine Ecosystems	Project	Planning	N/A	N/A

3.1.12 DiverSea (2023-2027). **Integrated Observation, Monitoring and Prediction Architecture for Functional Biodiversity of Coastal Seas.** https://cordis.europa.eu/project/id/101082004.

DiverSea develops novel marine observation and monitoring technology by combining: 1a) The new DNA-based identification approach “DNA-marks”: This approach will harnesses low coverage/cost genomic data to document genetic diversity and discriminate beyond species, to the population and individual level. This opens revolutionary possibilities, both for environmental samples (eDNA) and for monitoring species key biological parameters beyond simple identification, and, 1b) The experimentation required to quantify uncertainties in marine eDNA/eRNA interpretation, while developing general indictor methods with novel approaches harnessing new approaches and theory on mechanisms of molecular shedding and degradation; 2) emerging molecular techniques and approaches integrated with autonomous systems satellite remote sensing, citizen science, existing monitoring program data collection and, covering EOVs/EBVs, for comprehensive mapping of important marine habitats; 3) A novel data integration processing and interrogation AI-ML architecture that processes incoming biological, physical and biogeochemical data from diverse data platforms and from case studies in (2).

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code

Europe	Marine Ecosys-tems	General Guideline	Planning, Mon-itoring	N/A	N/A

3.1.13 CLIMAREST (2022-2025). **Coastal Climate Resilience and Marine Restoration Tools for the Arctic Atlantic Basin.** https://cordis.europa.eu/project/id/101093865.

Climate change is impacting coastal regions all along the European coastline, which is home to over 40 % of the continent's population. Therefore, ecosystem restoration and initiatives to enhance climate resilience in these regions are a top priority. In this context, the EU-funded CLIMAREST project will develop, test and optimise a modular toolbox that integrates expert knowledge, scientific information, multilevel stakeholder and community involvement, ecosystem service improvement analysis, cost-benefit analysis, priority of actions, and custom-designed protocols for restoring and monitoring a wide range of diverse coastal habitats. The toolbox framework will be tested in five ecosystems across a latitudinal gradient of the Arctic-Atlantic basin. The tools will be further tested for upscaling in comparable ecosystems.

Region	**Restora-tion Tar-get**	**Type of Source**	**Stage of Res-toration Pro-cess**	**Other NRL articles ad-dressed**	**Habitat Code**
Arctic, Atlantic	Marine Ecosys-tems	Project	Planning, Mon-itoring	N/A	N/A

3.1.14 A-AAgora (2022-2026). **Blueprint for Atlantic-Arctic Agora on cross-sectoral cooperation for restoration of marine and coastal ecosystems and increased climate resilience through transformative innovation.** https://cordis.europa.eu/project/id/101093956.

The EU Mission "Restore our Ocean and Waters by 2030" (Mission Ocean) aims to protect and restore the health of our ocean and waters. The EU-funded A-AAgora project will demonstrate via technological, social, logistic and economic innovation actions the reduction of pressures in coastal areas, through the application of ecosystem-based management and nature-based solutions to boost resilience to climate change and mitigate its impacts. A-AAgora will carry out demonstration activities in the Atlantic and Arctic basin and co-identify areas and locations where the solutions are replicable. Moreover, it will draw up blueprints and roadmaps to replicate and scale up the ecosystem and biodiversity restoration solutions and actions, contributing to Mission Ocean’s development and the piloting phase of the Atlantic-Arctic basin lighthouse.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Arctic, Atlantic	Marine Ecosystems	Project	Planning, Implementation	N/A	N/A

3.1.15 PROTECT BALTIC (2023-2028). **Enabling comprehensive effective and efficient protection and restoration measures for a resilient Baltic Sea ecosystem.** https://cordis.europa.eu/project/id/101112866.

This project will develop infrastructure for, and ensure long term access to, an unparalleled data driven, ecoregion scale, evidence base to support strategic planning, measures and management, develop a blue print for, and establish, a data driven, regionally agreed protection framework to improve governance and transboundary cooperation, including politically agreed shared conservation and restoration objectives, targets etc to reach the desired state, identify the current baseline of protection efforts across the entire sea basin, cross-reference the desired state with the current baseline to identify gaps in protection and restoration efforts, provide concrete and replicable support to ensure capacity for the Baltic Sea MS to strategically fill the gaps, harmonise, and achieve the full potential of the protection and restoration efforts.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Boreal	Marine Ecosystems	General Guideline	Planning, Implementation	N/A	N/A

3.1.16 EFFECTIVE (2023-2027). **Enhancing social well-being and economic prosperity by reinforcing the effectiveness of protection and restoration management in Mediterranean MPAs**. https://cordis.europa.eu/project/id/101112752.

The EFFECTIVE main objective is to develop a comprehensive scientific knowledge base and practical guidance, combining science, technological nature-based solution, digitalization, and social implication for the application of the Ecosystem-Based management to the protection and restoration management of the EU's Mediterranean Blue Natural Capital. To ensure the success of this main objective, the EFFECTIVE project counts on partners with broad expertise in relevant areas covering all the three pillars of the EBMS (from applying research stages until companies) as follows: managerial pillar, information pillar, and participation pillar and also a nature-based solution. In addition, this project provides the implementation of the EBMS in four pilot areas (Mar de l'Empordà, Ebro Delta, Sardinia Septentrional, Cavo Greco) towards protection and restoration solutions, besides taking

into account the connectivity between three of them through the existing Cetacean Migration Corridor.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Marine Ecosystems	General Guideline	Planning, Implementation	N/A	N/A

3.1.17 CORDIS (2020). **Getting down to the business of marine ecosystem restoration in European seas and beyond.** https://cordis.europa.eu/article/id/421774-getting-down-to-the-business-of-marine-ecosystem-restoration-in-european-seas-and-beyond.

The website gives an overview of marine ecosystem restoration in a European context. It also links useful resources related to marine ecosystem restoration in the EU. The MERCES (3.7.2) project (Marine Ecosystem Restoration in Changing European Seas) has encouraged Nature-based Solutions for marine ecosystem resilience. Marine ecosystems, like their terrestrial counterparts, reveal a tremendous diversity. MERCES has explored the potential of restoration actions in shallow soft and hard bottoms, including mesophotic habitats and deep-sea habitats across Europe from Norway to Turkey.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic, Mediterranean, Black Sea	Marine Ecosystems	Website	Planning	N/A	N/A

3.1.18 The Marine Ecosystem Restoration in Changing European Seas (MERCES) Project. (2016). **D6.1: Review of existing international governance structures regarding the conservation, restoration and recovery of marine ecosystems.** http://www.merces-project.eu/?q=content/list-deliverables. http://www.merces-project.eu/.

The MERCES Project is focused on the restoration of different degraded marine habitats, with the aim of 1) assessing the potential of different technologies and approaches; 2) quantifying the returns in terms of ecosystems services and their socio-economic impacts; 3) defining the legal-policy and governance frameworks

needed to optimize the effectiveness of the different restoration approaches. This report is an output of WP6, and has the following objectives:

- To identify the different uncertainties related to marine restoration;
- To develop a typology of governance arrangements;
- To combine narratives, uncertainties and governance arrangements in a conceptual framework to understand the enabling and constraining conditions to effectively govern marine restoration practices in specific areas.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Marine Ecosystems	Project	Planning	N/A	N/A

3.1.19 Natural Resources Wales. (2022). **Benthic habitat assessments for marine developments.** https://naturalresources.wales/guidance-and-advice/business-sectors/marine/benthic-habitat-assessments-for-marine-developments/?lang=en

This is best practice technical guidance for developers designing marine benthic habitat surveys and monitoring in relation to maritime developments. This guidance sets out our methods and approaches for survey and monitoring of benthic marine habitats where such work is required to support environmental and ecological impact assessments for developments and activities in or near Welsh waters.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Marine Ecosystems	General Guideline	Planning, Monitoring	N/A	N/A

3.1.20 LIFE ECOREST (2021-2026). **Ecological restoration of human-impacted benthic marine ecosystems through active strategies and participatory approach.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE20-NAT-ES-001270/ecological-restoration-of-human-impacted-benthic-marine-ecosystems-through-active-strategies-and-participatory-approach.

The main objective of the LIFE ECOREST project is to contribute to reversing the poor conservation status of benthic habitats of the Catalan continental margin that are impacted by fishing activities. This will involve re-establishing the habitats' main ecosystem services and functions. Specifically, LIFE ECOREST aims at restoring the existing no-take areas (290 km2) in the continental shelf and slope (5-550 m depth) of the Catalan continental margin through the recovery and transplanting of

ecosystem engineering benthic species accidentally caught by fishers in adjacent zones. This will be done through active restoration strategies to be implemented in close collaboration among scientists, fishers and public administrations, and transferred to other areas.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Marine Ecosystems	Project	Planning, Monitoring	N/A	1170

3.1.21 ROC-POP-LIFE (2017-2021). **Promoting biodiversity enhancement by Restoration of Cytoseira Populations**. https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE16-NAT-IT-000816/promoting-biodiversity-enhancement-by-restoration-of-cystoseira-populations.

Brown algae (*Cystoseira*) plays a key role in marine conservation, supporting biodiversity, food webs and sequestrating a large amount of carbon dioxide. The ROC-POP-LIFE project aims to trigger the restoration of the Annex 1-listed reef habitat type (1170) in two Natura 2000 network marine sites - Cinque Terre and Miramare - which are also specially protected areas of Mediterranean importance). The reefs' restoration will be achieved by reintroduction of *Cystoseira* specimens taken from three Natura 2000 network sites - one in Italy (Portofino) and two in Slovenia (Strunjan) where scientific data indicates populations were present in the past. Pressures that lead to *Cystoseira's* disappearance have been removed and protection is now provided under the Natura 2000 network.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Marine Ecosystems, Reefs	Project	Planning, Implementation	N/A	1170

3.1.22 BLUEREEF (2006 – 2013). **Rebuilding of Marine Cavernous Boulder Reefs in Kattegat**. https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE06-NAT-DK-000159/rebuilding-of-marine-cavernous-boulder-reefs-in-kattegat.

Offshore cavernous boulder reefs in shallow waters have a high biodiversity and are a rare and biologically important subtype of reef habitats. In Denmark, however, cavernous boulder reefs in shallow waters have been extensively exploited; they have been targeted for their high concentration of easy-to-excavate large boulders that are suitable for constructing sea defences and harbour jetties. Restoration, using natural stones from a quarry in the southern part of Norway, resulted in 6 tonnes of macroalgae and 3 tonnes of bottom fauna, plus 700 million individual fauna. Changes in the fish community structure were also evident. Cod increased by three to six-fold in the restored reef area.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic, Continental	Marine Ecosystems, Reefs	Project	Planning, Implementation	N/A	1170

3.1.23 LIFE LOPHELIA (2019-2025). **Method development for cold-water coral reef habitat restoration with implementation in Kosterfjord-Väderöfjord, Sweden.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE18-NAT-SE-000959/method-development-for-cold-water-coral-reef-habitat-restoration-with-implementation-in-kosterfjord-vaderofjord-sweden.

The cold-water coral Lophelia reef (*Lophelia pertusa*) is one of the major habitat-building species which produces three dimensional structures in the deep sea. The long-term objective of the project is to achieve a network of viable reproductive reef sites which are able to exchange larvae to maintain rejuvenation, and to update the national Red List status of Lophelia pertusa in Sweden from critically endangered to endangered or better.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic, Boreal	Marine Ecosystems, Deep Sea, Reefs	Project	Planning, Implementation	N/A	1170

3.1.24 ECOREST. (n.d.). **Resources on Restoration of Marine Habitats.** https://www.life-ecorest.eu/restoration-of-marine-habitats/.

The ECOREST project aims to restore 30,000 hectares of deep-sea habitats off the coast of Spain. This webpage explains the importance of restoration, delving into a few different types of habitats, and provides links to useful, relevant resources and guidance.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic, Mediterranean	Marine Ecosystems	General Guideline	Planning, Implementation	N/A	N/A

3.2 Seagrass Beds

3.2.1 Gamble C., Debney, A., Glover, A., Bertelli, C., Green, B., Hendy, I., Lilley, R., Nuuttila, H., Potouroglou, M., Ragazzola, F., Unsworth, R. and Preston, J, (eds). (2021). **Seagrass Restoration Handbook.** Zoological Society of London, UK., London, UK. https://catchmentbasedapproach.org/learn/seagrass-restoration-handbook/.

This Seagrass Restoration Handbook provides foundational and practical guidance on the restoration and conservation of seagrasses and seagrass beds in the UK and Ireland with a focus on the Zostera species *Z. marina* and *Z. noltei.* The guidance outlined is also relevant to restoration projects across the biogeographic range of these seagrass species. To restore seagrass habitats, with the many ecosystem services they provide, will require a combination of approaches depending on the location, surrounding landscape and extent of degradation or loss. This handbook aims to shed light on these different approaches, and to support small-scale projects but ultimately with an ambition to facilitate larger seagrass seascape restoration efforts.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Marine Ecosystems, Coastal Ecosystems, Seagrass	General Guideline	Planning, Implementation	N/A	N/A

3.2.2 Kent, F., Lilley, R., Unsworth, R., Cunningham, S., Begg, T., Boulcott, P., Jeorrett, C., Horsburgh, R. and Michelotti, M. (2021). **Seagrass restoration in Scotland - handbook and guidance.** NatureScot Research Report 1286. https://www.nature.scot/scotlands-first-seagrass-restoration-guide

This handbook discusses seagrass diversity in Scotland, policy and legislation, planning restoration sites, restoration techniques, monitoring, and case studies.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Marine Ecosystems, Coastal Ecosystems, Seagrass	General Guideline	Planning, Implementation, Monitoring	N/A	N/A

3.2.3 Biomares (2007-2011). **Restoration and Management of Biodiversity in the Marine Park Site Arrábida-Espichel.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE06-NAT-P-000192/restoration-and-management-of-biodiversity-in-the-marine-park-site-arrabida-espichel.

The Natura 2000 site Arrábida-Espichel is located just south of Lisbon, on the west coast of Portugal. Seagrass meadows in the site guaranteed shelter and food to the juveniles of many species of marine fauna, giving it a nursery role similar to many estuaries. However, in recent years, these non-estuarine Zostera marina meadows and their associated biodiversity had been almost totally destroyed. The project successfully restored reefs and submerged sandbanks in an MPA and conducted the preparatory actions for habitat restoration of Zostera marine meadows. It gathered marine data and raised awareness of local stakeholders.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Marine Ecosystems, Seagrass, Reefs	Project	Planning, Implementation	N/A	1110, 1170

3.2.4 LIFE SEPOSSO (2017-2022). **Supporting Environmental governance for the Posidonia oceanica sustainable transplanting operations.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE16-GIE-IT-000761/supporting-environmental-governance-for-the-posidonia-oceanica-sustainable-transplanting-operations.

The goal of the LIFE SEPOSSO project is to carry out activities (in compliance with the 2015 European Directive on Environmental Impact Assessment (EIA) and the 2014 Maritime Spatial Planning (MSP) Directive) that support the restoration of *P. oceanica* meadows that have been destroyed by infrastructural marine works, using in particular information systems and information tools. The main objective of the project is to create an electronic information system to measure and evaluate the efficiency and effectiveness of the inspection and surveillance works related to EIA prescriptions. This includes the transplanting of *P. oceanica* as a alternative method for meadows restoration, given that in Italy specific EIA procedures have identified transplanting as the best measure available for restoring destroyed meadows.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Marine Ecosystems, Seagrass	Project	Planning, Implementation, Monitoring	N/A	1120

3.2.5 Co.Me.Bi.S. (2006-2009). **Urgent conservation measures for biodiversity of Central Mediterranean Sea.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE06-NAT-IT-000050/urgent-conservation-measures-for-biodiversity-of-central-mediterranean-sea.

Many of the Mediterranean coastal and marine habitats of the Lazio region in central Italy and of Calabria in the south are under threat directly, or indirectly, from human activities. The ancient coastal/ marine landscapes boast a “mosaic” of rare and threatened habitats listed in the EU habitats directive. Project actions were planned for eight coastal or marine SCIs in the Lazio region; and for one marine site in Calabria. These actions focussed on the drawing up of planning documents (an overall Action Plan for the conservation of the coastal sites of Lazio, Guidelines for the restoration of coastal habitats in the Mediterranean context, Management Plans for the sites of Lazio). Some pilot actions were carried out in each site.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Marine Ecosystems, Coastal Ecosystems, Seagrass	Project	Planning, Implementation	N/A	1120, 1150, 1210, 1310, 1410, 1420

3.2.6 JRC. (2023). **Towards an ecosystem-based approach in marine ecosystem accounting. Seagrass ecosystems in the Mediterranean Sea: from diversity to restoration.** https://publications.jrc.ec.europa.eu/repository/handle/JRC130756

The report will focus on seagrass ecosystems, with a case study in the Mediterranean Sea, explaining their importance as essential (vulnerable) ecosystems with several key roles, from biodiversity hotspots to climate change mitigation, and highlighting their characteristics, condition, threats, and potential values of ecosystem services fundamental for the society and economy. Finally, the report will summarize the main methodologies applied for seagrass restoration (section 3) and include a brief narrative on the marine ecosystem accounting (section 4) as pivotal implementation of conservation, protection and restoration actions in the framework of European legislations, such as Biodiversity Strategy for 2030 and the Proposal on Nature Restoration Law, Marine Strategy Framework Directive, Common Fisheries Policy Regulation, Ecosystem-based Approach for Maritime Spatial Planning Directive, Nature-based Solutions, Sustainable Blue Economy, Taxonomy Regulation for Sustainable Activities, and the Regulation (EU) No 691/2011 on European environmental economic accounts.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Marine Ecosystems, Coastal Ecosystems, Seagrass	General Guideline	Planning	N/A	N/A

3.2.7 POSEIDONE (2010-2014). **Urgent conservation actions of *Posidonia beds of Northern Latium.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE09-NAT-IT-000176/urgent-conservation-actions-of-posidonia-beds-of-northern-latium-.

Neptune Grass, or Mediterranean tapeweed (*Posidonia oceanica*) is endemic to the Mediterranean Sea. The objectives of this project were to safeguard and to restore some SCIs of particular importance to the conservation of the priority habitat Poseidonia beds - through concrete actions and education campaign to reduce and potentially eliminate damage done by illegal fishing. The project successfully carried out the main concrete conservation action i.e. placing 550 anti-trawling 'tetrapods' in the sea at strategic points in order to protect the *P. oceanica* meadows. An important part of this was the gaining of support/ consensus for protection from local stakeholders.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code

Mediterranean	Marine Ecosystems, Seagrass	Project	Planning, Implementation	N/A	1120

3.2.8 Life Posidonia Andalucia (2011-2016). **Conservation of Posidonia oceanica meadows in Andalusian Mediterranean Sea**. https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE09-NAT-ES-000534/conservation-of-posidonia-oceanica-meadows-in-andalusian-mediterranean-sea.

The Life Posidonia Andalucia project's main objective was to improve the conservation status of *Posidonia oceanica* meadows in Andalucia. This was achieved by undertaking research and then applying appropriate protection measures. One of the main lessons learnt from this project is the need to devote more means to the early detection and eradication of these species and to carry out continuous monitoring. Two artificial reefs were created in two of the SCI to reduce the impact of illegal trawling. Further, 41 ecological mooring buoys were installed to reduce erosion and the dispersion of IAS, which is aggravated by free anchoring. An information campaign regarding the location and use of these buoys that was specifically addressed to potential users took place prior to installation and an "Anchoring Code of Conduct" was created.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Mediterranean	Marine Ecosystems, Seagrass	Project	Planning, Implementation, Monitoring	N/A	1120

3.2.9 Mourato, C.V., Padrão, N., Serrão, E.A. and Paulo, D. (2023). **Less Is More: Seagrass Restoration Success Using Less Vegetation per Area.** *Sustainability* 15, no. 17: 12937. https://doi.org/10.3390/su151712937.

The study develops the checkers design for large-scale seagrass restoration. The checkerboard design uses biomass more efficiently by using fewer sods in a checkerboard pattern. The study assesses survival rates and other factors of success for this restoration method.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**

Global	Marine Ecosystems, Coastal Ecosystems, Seagrass	Academic Article	Implementation	N/A	N/A

3.3 Macroalgal Forests

3.3.1 Cebrian E., Tamburello L., Verdura J., Guarnieri G., Medrano A., Linares C., Hereu B., Garrabou J., Cerrano C., Galobart C. and Fraschetti S. (2021). **A Roadmap for the Restoration of Mediterranean Macroalgal Forests.** Front. Mar. Sci. 8:709219. doi: 10.3389/fmars.2021.709219.
https://www.frontiersin.org/articles/10.3389/fmars.2021.709219/full

The authors propose a roadmap for Mediterranean macroalgal restoration to assist researchers and stakeholders in decision-making, considering the most effective methods in terms of cost and cost-effectiveness, and taking background environmental conditions and potential threats into account. Last, the challenges currently faced by the restoration of rocky coastal ecosystems under changing climate conditions are also discussed.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Marine Ecosystems, Macroalgal Forests	Academic Article	Planning	N/A	N/A

3.3.2 REEForest (2022-2026). **Restoration of Cystoseira macroalgal forests to enhance biodiversity along Mediterranean rocky reefs.**
https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE21-NAT-IT-REEForest-101074309/restoration-of-cystoseira-macroalgal-forests-to-enhance-biodiversity-along-mediterranean-rocky-reefs.

REEForest LIFE aims to reverse the degradation of the endangered Cystoseira Habitat 1170 by implementing active restoration and setting up monitoring plans in 4 marine protected areas (Italy: Sinis Peninsula, Cilento National Park, Bergeggi Island; Greece: Gyaros island) where the causes of degradation have been addressed. Macroalgal forests, one of the most productive and valuable habitats in the Mediterranean, are presently rapidly being lost because of direct and indirect human impacts.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code

Mediterranean	Marine Ecosystems, Macroalgal Forests	Project	Planning, Implementation	N/A	1170

3.3.3 Smith C.J., Verdura J., Papadopoulou N., Fraschetti S., Cebrian E., Fabbrizzi E., Monserrat M., Drake M., Bianchelli S., Danovaro R., Malak D.A., Ballesteros E., Benjumea Tesouro T., Boissery P., D'Ambrosio P., Galobart C., Javel F., Laurent D., Orfanidis S. and Mangialajo L. (2023). **A decision-support framework for the restoration of Cystoseira sensu lato forests.** Front. Mar. Sci. 10:1159262. doi: 10.3389/fmars.2023.1159262.
https://www.frontiersin.org/articles/10.3389/fmars.2023.1159262/full

The goal of this article is to link habitats and species to UN and EU Restoration Targets, providing guidelines for the restoration of Mediterranean macroalgal forests. A stepwise decision tree is the output, with considerations for implementation, monitoring, and long-term management.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Marine Ecosystems, Macroalgal Forests	Academic Article	Planning, Implementation, Monitoring	N/A	N/A

3.3.4 **Gianni, F.,** Mačić, V., Bartolini, F., Pey, A., Laurent, M., & Mangialajo, L. (2020). **Optimizing canopy-forming algae conservation and restoration with a new herbivorous fish deterrent device.** *Restoration Ecology*, *28*(4), 750-756. http://afrimed-project.eu/?page_id=20. https://onlinelibrary.wiley.com/doi/10.1111/rec.13143

This academic is a publication of the AFRIMED Project, which aims to develop, implement, and promote step-change protocols for restoring algal forests in the Mediterranean Sea. The article discusses a specific technique/technology that prevents herbivorous fish from predating on algal forests, as a method of restoration.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Marine Ecosystems, Macroalgal Forests	Academic Article	Implementation	N/A	N/A

3.3.5 Falace A., Kaleb S., De La Fuente G., Asnaghi V., Chiantore M. (2018). **Ex situ cultivation protocol for Cystoseira amentacea var. stricta (Fucales, Phaeophyceae) from a restoration perspective.** PLoS ONE 13(2): e0193011. https://doi.org/10.1371/journal.pone.0193011. http://www.rocpoplife.eu/download/

This publication is an output of the ROCPOP-Life Project, which is actively restoring *Cystoseira* forests in the Mediterranean by collecting healthy populations, implementing controlled reproduction, reforesting, and conducting regular monitoring on the success of the operation. The article discusses how different factors have affected the success of reproduction efforts.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Marine Ecosystems, Macroalgal Forests	Academic Article	Implementation	N/A	N/A

3.4 Shellfish Beds

3.4.1 Fitzsimons J.A., Branigan S, Gillies C.L., et al. (2020). **Restoring shellfish reefs: Global guidelines for practitioners and scientists.** Conservation Science and Practice. 2:e198. https://doi.org/10.1111/csp2.198.

The paper outlines: (a) the case for shellfish reef restoration and securing financial resources; (b) planning, feasibility, and goal setting; (c) biosecurity and permitting; (d) restoration in practice; (e) scaling up from pilot to larger scale restoration, (f) monitoring, (g) restoration beyond oyster reefs (specifically mussels), and (h) successful communication for shell-fish reef restoration projects.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Marine Ecosystems, Shellfish Beds	General Guideline	Planning, Implementation	N/A	1170

3.4.2 Fitzsimons, J., Branigan, S., Brumbaugh, R.D., McDonald, T. and zu Ermgassen, P.S.E. (eds) (2019). **Restoration Guidelines for Shellfish Reefs.** The Nature Conservancy, Arlington VA, USA. https://www.tnc.org.hk/content/dam/tnc/nature/en/documents/australia/TNC_Shellfish_Reef_Restoration_Guidelines_WEB.pdf.

This publication is intended to provide foundational information to serve as a useful starting point for shellfish reef restoration. By capitalising on novel techniques applied in different countries, management frameworks reflecting different social and political settings, and relatively new monitoring guidance, this publication should have application globally. The restoration guidelines outlined here expand and update the original 2006 practitioners guide developed by The Nature Conservancy, and the approach is aligned to the Society for Ecological Restoration's International standards.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Marine Ecosystems, Shellfish Beds	General Guideline	Planning, Implementation	N/A	1170

3.4.3 Preston J., Gamble, C., Debney, A., Helmer, L., Hancock, B. and zu Ermgassen, P.S.E. (eds) (2020). **European Native Oyster Habitat Restoration Monitoring Handbook.** The Zoological Society of London, UK., London, UK. https://nativeoysternetwork.org/resources/.

This handbook is one of the preeminent resources in terms of guidelines for shellfish habitat restoration. The handbook includes sections on European restoration projects, monitoring of projects, development of plans for restoration, and methods, techniques, and metrics for restoration. The website contains two other handbooks of use, *European Guidelines on Biosecurity in Native Oyster restoration 2020* and *European Native Oyster Habitat Restoration Handbook 2020: UK & Ireland*.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Marine Ecosystems, Shellfish Beds	General Guideline	Planning, Implementation, Monitoring	N/A	N/A

3.4.4 Sas, H., Kamermans, P., van der Have, T. M., Lengkeek, W., & Smaal, A. C. (2016). ***Shellfish reef restoration pilots: Voordelta The Netherlands.*** (Annual report; No. 2016). Wageningen Marine Research. https://edepot.wur.nl/405730.

The Project includes background on shellfish restoration in the region, methods for restoration pilots (including design and monitoring), and results of the project, including factors of success, such as growth, survival, and reproduction.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Marine Ecosystems, Shellfish Beds	Project	Planning, Implementation, Monitoring	N/A	1170

3.4.5 Blue Marine Foundation. (2021). **Guide to Oyster Nurseries UK & Ireland.** https://www.bluemarinefoundation.com/projects/solent/

The guide provides practical support and instructions for oyster restoration and contains essential information for setting up and maintaining oyster nurseries deployed from marina pontoons or similar floating structures in the marine environment. The Solent Oyster Rotation Project also has other sources that may be of use, such as *Shellfish Biosecurity Measures Plan 2020* and *Example Habitats Regulations Assessment (HRA) – UKSA*.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Atlantic	Marine Ecosystems, Shellfish Beds	General Guideline	Planning, Implementation	N/A	N/A

3.5 Maerl Beds

3.5.1 Hall-Spencer, M., Kelly, J., Maggs, C. A. (2010). **Background Document for Maerl Beds.** OSPAR Commission. https://www.ospar.org/documents?v=7221.

Maerl beds are non-renewable resources, this background document give advice on protection, mapping and monitoring. This Background Document on maërl beds has been developed by OSPAR following the inclusion of this habitat on the OSPAR List of threatened and/or declining species and habitats (OSPAR agreement 2008-6). The document provides a compilation of the reviews and assessments that have been prepared concerning this habitat since the agreement to include it in the OSPAR List in 2004.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code

Atlantic	Marine Ecosys-tems	General Guideline	Planning	N/A	N/A

3.6 Sponge, Coral and Coralligenous Beds

3.6.1 Léocadie, A., Pioch, S., Pinault, M. (2020). **Guide to Ecological Engineering: The restoration of coral reefs and associated ecosystems.** Published by IFRECOR. 114 pages. https://icriforum.org/guide-to-ecological-engineering-the-restoration-of-coral-reefs-and-associated-ecosystems/.

This report provides important information and analyses that were critical in informing UNEP's upcoming coral restoration report for UNEA-5 and was the outcome of extensive data collection by the authors. It provides an inventory of ecological engineering techniques employed mainly in France but also globally, for the restoration of coral reefs and their associated ecosystems (seagrasses and mangroves).

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Atlantic	Marine Ecosystems, Reefs, Seagrass	General Guideline	Planning, Implementation	N/A	1170

3.6.2 Hein M.Y., McLeod I.M., Shaver E.C., Vardi T., Pioch S., Boström-Einarsson L., Ahmed M., Grimsditch G. (2020). **Coral Reef Restoration as a strategy to improve ecosystem services – A guide to coral restoration methods.** United Nations Environment Program, Nairobi, Kenya. https://icriforum.org/wp-content/uploads/2021/01/Hein-et-al.-2020_UNEP-report-1.pdf.

This document presents an overview of the best available knowledge in the field of coral reef restoration and provides realistic recommendations for the use of restoration as a management strategy for coral reefs to assist managers, practitioners, policy makers, and funding agencies to make informed decisions.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Global	Marine Ecosystems, Coral Reefs	General Guideline	Planning, Implementation	N/A	1170

3.6.3 Hein, M., Mcleod, E., Razak, T., Fox, H. (2022). **Meeting 30 by 30: The Role of Coral Reef Restoration.** https://icriforum.org/wp-content/uploads/2022/12/Hein-McLeod-et-al.-2022-Reef-Restoration-White-Paper.pdf.

This report reviews the role of coral reef restoration in the context of climate change and global 30 by 30 targets arguing that while restoration should not be used as a silver-bullet in the face of global declines, it has an important role to play to deliver social and ecological goals. By carefully reviewing current limitations barriers and opportunities, this report provides avenues for improving the effectiveness of coral reef restoration and assist evidence-based investment and decision making. These include a list of best practices for coral reef restoration, as well as targeted guidance on how to overcome policy barriers, build capacity, and support investments and research and development. The authors conclude with specific recommendations for governments, funders, conservation organizations, and stakeholders on how to meet 30 by 30 targets through promoting the persistence, survival, and where necessary the restoration of tropical coral reefs to secure valuable ecosystem services that they provide.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Marine Ecosystems, Coral Reefs	General Guideline	Planning, Implementation	N/A	1170

3.6.4 Shaver E C, Courtney C A, West J M, Maynard J, Hein M, Wagner C, Philibotte J, MacGowan P, McLeod I, Boström-Einarsson L, Bucchianeri K, Johnston L, Koss J. (2020). **A Manager's Guide to Coral Reef Restoration Planning and Design**. NOAA Coral Reef Conservation Program. NOAA Technical Memorandum CRCP 36, pp. 128. https://www.coris.noaa.gov/activities/restoration_guide/welcome.html.

A Manager's Guide to Coral Reef Restoration Planning and Design supports the needs of reef managers seeking to begin restoration or assess their current restoration program. The Guide is aimed at reef resource managers and conservationists, along with everyone who plans, implements, and monitors restoration activities. Through a six-step, adaptive management planning process, the Guide helps managers gather relevant data, ask critical questions, and have important conversations about restoration in their location. The process set out in the Guide leads to the creation of a Restoration Action Plan. The Guide includes two Appendices and other tools and materials that can be used assist readers in developing a Restoration Action Plan.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code

Global	Marine Ecosystems, Reefs	General Guideline	Planning, Implementation	N/A	1170

3.6.5 LIFE Public Database (2022-2027). **Deep Reef restoration and litter removal in the Mediterranean Sea (2022-2027).** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE21-NAT-IT-LIFE-DREAM-101074547/deep-reef-restoration-and-litter-removal-in-the-mediterranean-sea.

The website gives a good overview of the restoration measures. Active restoration (deployment of artificial structure as substrate for deep reefs the forming-species growth) will be integrated with passive restoration activities (marine litter removal in correspondence of deep reefs). The involvement of fishers and stakeholders within LIFE DREAM activities intends to enhance the impact of the project and boost a social behaviour change. The results of LIFE DREAM would represent the baseline to extend the Natura 2000 network to the deep Mediterranean Sea and to restore deep sensitive habitats by providing best practices for deep reef restoration and the related costs and benefits.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Marine Ecosystems, Deep Sea	Project	Planning	N/A	1170

3.6.6 UNEP-MAP-RAC/SPA. (2008). **Action plan for the conservation of the coralligenous and other calcareous bio-concretions in the Mediterranean Sea**. Ed. RAC/SPA,Tunis : pp. 21. https://www.rac-spa.org/coralligenous.

The action plan provides an overview of data collection and inventories, monitoring activities and threats to these habitats.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Mediterranean	Marine Ecosystems	General Guideline	Planning, Monitoring	N/A	N/A

3.7 Vents and Seeps

3.7.1 Van Dover *et al.* (2014). **Ecological restoration on the deep sea: Desiderata.** Marine Policy, Vol. 44, pp. 98-106. https://doi.org/10.1016/j.marpol.2013.07.006.

This paper describes a hydrothermal vent field restoration project in the Manus Basin, Papua New Guinea and the Darwin Mounds off the west coast of Scotland, explaining techniques and costs (after commercial mineral extraction). For these case studies, a set of socio-economic, ecological, and technological decision parameters that might favour (or not) their restoration are examined. Costs for hypothetical restoration scenarios in the deep sea are estimated and first indications suggest they may be two to three orders of magnitude greater per hectare than costs for restoration efforts in shallow-water marine systems.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Marine Ecosystems, Deep Sea	General Guideline	Planning, Monitoring	N/A	N/A

3.7.2 DEEP REST (n.d.). **Conservation & restoration of deep-sea ecosystems in the context of deep-sea mining.** https://deep-rest.ifremer.fr/About-DEEP-REST/Project-overview.

This project investigates two deep-sea ecosystems: polymetallic nodukle fields and hydrothermal vents. Four major areas will be investigated: the Clarion-Clipperton Zone (CCZ) and the DISCOL Experimental Area (DEA) in the Pacific Ocean for nodule fields and the northern Mid-Atlantic Ridge (nMAR), and the Arctic Mid-Ocean Ridge (AMOR) for active and inactive hydrothermal vents. DEEP REST will develop a novel approach to improve our conservation/restoration capacities. This is an ongoing project (until 2025) and it is worth to look out for the results which will include an evaluation of restoration actions.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Marine Ecosystems, Deep Sea	General Guideline	Planning	N/A	N/A

3.8 Soft Sediments (Above 1000 Meters of Depth)

3.8.1 Aiken, M., C., Mulloy, R., Dwane, G., Jackson, E. L. (2021). **Working with Nature Approaches for the Creation of Soft Intertidal Habitats**. Front. Ecopl. Evol., Sec. Conservation and Restoration Ecology, Vol.9. https://doi.org/10.3389/fevo.2021.682349.

This paper discusses the design considerations for creating new sediment habitats in the intertidal zone within new coastal infrastructure works. The paper focusses on the sediment control structures required to satisfy the physiological and ecological requirements of seagrass and mangroves – two keystone intertidal species that are common candidates for restoration – and illustrate the concepts by discussing the case study of soft habitat creation within a major multi-commodity port.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Global	Marine Ecosystems, Coastal Ecosystems	Academic Article	Planning	N/A	1110

3.8.2 REWRITE (2023-2028). **Rewilding and Restoration of Intertidal Sediment Ecosystems for Carbon Sequestration, Climate Adaptation and Biodiversity Support.** https://cordis.europa.eu/project/id/101081357.

Within European coastal zones, intertidal areas consisting of soft sediment emerging during each low tide, form complex seascapes covering more than 10 000 km2 along the 35 000 km of the tidal coastline. These habitats provide multiple ecosystem services with great potential to cope with the biodiversity-climate crisis by contributing to carbon neutrality, climate resilience and biodiversity support. Expanding innovative approaches, REWRITE will focus on the climate-biodiversity-society nexus, to reach 4 specific objectives: -identify environmental, social and cultural drivers and barrier parameters to rewild intertidal sediment seascapes within the context of climate change; -strongly engage stakeholders to achieve a step-change in their appreciation of the natural function of these seascapes and integrate their interests within a co-design of scenario for future European shoreline; -estimate and upscale trajectories of intertidal seascapes from the local to the European level, following rewilding (passive), restoring (active), “business as usual” or “do nothing” options; -establish tools and methods for successful rewilding to ensure a high ecological and societal co-benefit/low-cost ratio for a climate-neutral and resilient European shoreline.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code

Global	Marine Ecosystems, Coastal Ecosystems	General Guideline	Planning	N/A	11120

3.8.3 Karine Gagnon, Vahit Alan, Tatjana Bakran-Petricioli, Elizabeth GT Bengil, Laura Carugati, Marjolijn JA Christianen, Hartvig Christie, Roberto Danovaro, Zaira Da Ros, Cristina Gambi, Marco Lo Martire, Laura L Govers, Max Gräfnings, Silvija Kipson, Georg Martin, Lukas Meysick , Liina Pajusalu, Eli Rinde, İnci Tüney Kızılkaya, Tjisse van der Heide (2019). **Manual of restoration measures in soft bottoms based on surveys and experiments**. http://www.merces-project.eu/sites/default/files/WP2_D2.1_Glossy_final.pdf.

This manual gives an overview of marine ecosystem restoration projects and gives recommendations to managers and policy makers. This part of the MERCES project. The aims of MERCES (Marine Ecosystem Restoration in Changing European Seas). are to restore degraded marine habitats within Europe, including coastal hard-bottom habitats, coastal soft-bottom habitats, and deep-sea habitats. MERCES seeks to assess the potential for various approaches and technologies to increase restoration success, develop new approaches, quantify the recovery of ecosystem services following restoration, and define the legal and political framework that can optimize restoration efforts.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Global	Marine Ecosystems, Coastal Ecosystems	General Guideline	Planning	N/A	N/A

4 Article 6: Urban Ecosystems

4.1 CitiesWithNature (n.d.). **Guidelines for Urban Ecosystem Restoration.** https://citieswithnature.org/guidelines-for-urban-ecosystem-restoration/

This guide gives a definition as well as examples of urban ecosystem restoration, it informs about the different types of restoration approaches und provides lessons learned and best practices from across the world, how financial resources can be leveraged and how your city can get involved in the UN Decade of Ecosystem Restoration.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	Urban Ecosystems	General Guideline	Planning	N/A

4.2 INTERREG (2020). **Urban Ecosystems. The importance of green infrastructure and nature-based solutions for the development of sustainable cities**. A Policy Brief from the Policy Learning Platform on Environment and resource efficiency. https://www.interregeurope.eu/find-policy-solutions/policy-briefs/urban-ecosystems.

This policy brief aims at inspiring local policymakers to take steps in improving their urban ecosystems. After a brief overview of the EU strategic legislative and implementation packages emphasising the benefits of sustainable urban development for a better quality of life and attractive cities, the socio-economic benefits of adopting nature-based solutions at a city level are explored as they offer multiple strategic opportunities in this regard.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	Urban Ecosystems	Policy Brief	Planning	N/A

4.3 UCLG Learning and INTERLACE (2022). **Urban Ecosystem Restoration & Nature-based Solutions.** UCLG Peer Learning Note #31. Available at: https://learning.uclg.org/peer_learning_notes/pln-31/.

This note provides good practice examples from different cities and peri-urban areas in Costa Rica, Ecuador, Spain and Colombia on how to integrate nature for more resilient urban spaces. United Cities and Local Governments (UCLG) together with several other partners of the INTERLACE project published this Peer Learning Note on the potential of urban ecosystem restoration and nature-based solutions.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	Urban Ecosystems	General Guideline	Planning	N/A

4.4 European Commission, Joint Research Centre, Maes, J., Quaglia, A., Guimarães Pereira, Â. *et al.* (2021). **BiodiverCities – A roadmap to enhance the biodiversity and green infrastructure of European cities by 2030**. Final report, Publications Office. https://data.europa.eu/doi/10.2760/288633.

BiodiverCities, a European Parliament pilot, aims to improve civil society participation in planning decision-making with respect to urban biodiversity, the nature in and around cities. BiodiverCities increases the awareness of this underpinning role of urban biodiversity. 13 European cities contribute by setting up citizen engagement activities. This roadmap gives an overview of the project, including citizen engagement, mapping and assessment of urban biodiversity, an analysis of ecosystem services and next steps.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	Urban Ecosystems	General Guideline	Planning	N/A

4.5 CORDIS (n.d.). **Nature-based solutions: Transforming cities, enhancing well-being.** https://cordis.europa.eu/article/id/421853-nature-based-solutions.

This website gives an overview of Nature-based solutions in an urban setting and links to many relevant EU-funded projects. The projects provide a strong foundation for future research and implementation, putting the EU on the map as an ambitious global leader in building sustainable, resilient and prosperous societies.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Urban Ecosystems	Database	Planning	N/A

4.6 IUCN (n.d.). **The Urban Nature Index.** https://portals.iucn.org/library/node/50782.

The IUCN Urban Alliance, a broad coalition of IUCN constituents concerned with the urban dimensions of nature conservation, has unveiled a new knowledge product for measuring the ecological performance of cities: the IUCN Urban Nature Indexes (UNI). Comprising six themes with five indicator topics nested within each theme, the UNI is intended to help policymakers, stakeholders and local communities understand their impacts on nature, set science-based targets for improvement, and monitor progress using science-based measures. By enhancing environmental transparency and accountability, and by focusing on improvement rather than fixed targets, the UNI aims to catalyse local action for nature in all cities.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Urban Ecosystems	Database	Planning	N/A

4.7 NYC Parks (n.d.). **Guidelines for urban forest restoration.** https://www.google.de/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjNtbTA7viDAxVRhf0HHdLVCp84ChAWegQIC-BAB&url=https%3A%2F%2Fwww.nycgovparks.org%2Fpagefiles%2F84%2Fguidelines-to-urban-forest-restoration.pdf&usg=AOvVaw3N7DYhNfhvzGIi-ObnSOa7x&opi=89978449.

This extensive guide is a collection of theories and practices developed over a timeframe of thirteen years of natural area restoration by the New York City Department of Parks & Recreation's. While these practices have been established and tested in New York they can also be applied to other cities. The guide gives an overview of site inventory, assessment and selection, site planning and design, site preparation, planting, establishment and adaptative management practices.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	Urban Ecosystems, Forests	General Guideline	Planning	10

4.8 Deboeuf De Los Rios, G., Barra, M., Grandin., G. (2022). **Renaturing Cities – Methods, Examples and Recommendations.** ARB îdF, L'Institut Paris Region. https://www.re-green-project.eu/resources/.

This report gives an overview of what renaturing is, how to identify areas with high renaturing potential and explains successful renaturing step by step. Renaturing makes it possible to adapt cities to climate change and to make them more permeable to wildlife by developing nature-based solutions.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Urban Ecosystems	General Guideline	Planning	N/A

4.9 proGIreg (2022). **Planning and implementing nature-based solutions.** https://progireg.eu/resources/planning-implementing-nbs/.

ProGIreg stands for 'productive Green Infrastructure for post-industrial urban regeneration': nature for renewal. The project's 'Front Runner Cities' Dortmund (Germany), Turin (Italy), Zagreb (Croatia) and Ningbo (China) host Living Labs in post-industrial districts where nature-based solutions are developed, tested and implemented'. Cascais (Portugal), Cluj-Napoca (Romania), Piraeus (Greece) and Zenica (Bosnia and Herzegovina) are 'Follower Cities' that closely follow the progress in the Living Labs in the Front Runner Cities and engage in city-to-city exchange to replicate the nature-based solutions of the front-runners. This report is a summary of the proGIreg projects efforts in planning and implementing nature-based solutions, the summary is derived from in-depth reports linked to the end of each chapter.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global, Europe	Urban Ecosystems	Project	Planning	N/A

4.10 Conexus (n.d.). **Resources.** https://www.conexusnbs.com/resources.
The resources include accessible knowledge on how to restore natural ecosystems; improve the quality of life in and around cities; and support collaboration between Latin America and Europe.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global, Europe	Urban Ecosystems	Database	Planning	N/A

4.11 Clever Cities Guidance (n.d.). **CLEVER Cities Guidance.** https://clever-guidance.clevercities.eu/.

This platform explores insights, tools, indicators and lessons learned about nature-based solutions (NbS) for sustainable urban regeneration. It also provides case studies and lessons learned on NbS mainstreaming in policy and planning, social impact generation and measurement, and co-creation and stakeholder empowerment.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Urban Ecosystems	Database	Planning	N/A

4.12 Interlace (n.d.). **Urban Governance Atlas.** https://interlace-hub.com/urban-governance-atlas.

The Urban Governance Atlas is an interactive online database showcasing 250 policy instruments supporting nature-based solutions and ecosystem restoration. The Atlas allows users to discover policy instruments from around the world, learn what has made them successful, lessons from their design and implementation, and their different approaches to governance.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	Urban Ecosystems	Database	Planning	N/A

4.13 European Commission, Joint Research centre - J Babi Almenar, F Marando, S Vallecillo, G Zulian, C Cortinovis, M Zurbaran Nucci, N Chrysoulakis, D Parastatidis, M Heris, I Grammatikopoulou. **Urban Ecosystem accounts following the SEEA EA standard: A pilot application in Europe**. https://publications.jrc.ec.europa.eu/repository/handle/JRC133240

This report presents a pilot SEEA EA urban ecosystem account for EU-27 and EFTA Member States in 2018. It discusses challenges for the development of urban ecosystem accounts and potential solutions. The outputs illustrate where re-greening efforts should be applied and discusses feasibility and potential issues of targets. The report also presents key insights to operationalise SEEA EA for urban ecosystem accounts. It provides an instructive guiding example to national and local authorities starting to draft their own urban ecosystem accounts.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Urban Ecosystems	General Guideline	Planning	N/A

5 Article 7: Restoration of the Natural Connectivity of Rivers & Functions of the Related Floodplains

More resources on river restoration and floodplain restoration can be found in chapter 2.3.

5.1 Kampa, E. (2022). **Why is Nature Restoration Critical for River Connectivity.** IEEP, Ecologic Institute: Brussels, Berlin. https://www.ecologic.eu/19031.

This policy brief highlights the importance of a high degree of river connectivity for healthy and biodiverse water bodies that can provide key ecosystem services such as water supply for different human uses and resilience to climate change impacts. The policy brief presents evidence and data on the decline of river connectivity due to human interventions, in particular river barriers and floodplain degradation, and the benefits offered by measures to restore free-flowing rivers.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Rivers, River Connectivity, Floodplains, Riparian Habitats	Policy Brief	Planning	4

5.2 AMBER Consortium (2020). **The AMBER Barrier Atlas. A Pan-European database of artificial instream barriers**. Version 1.0 https://amber.international/european-barrier-atlas/

Throughout Europe, there is inconsistent and incomplete data on how many barriers currently exist. Thus, the magnitude of river fragmentation in Europe is almost unknown. An essential first step of the AMBER project was to create an inventory of barriers within European rivers— a Pan-European Atlas of In-Stream Barriers which addressed Art 7(1) of the NRL. To date, this map is the most comprehensive overview of available information on barriers in Europe. There are over half a million recorded barriers fragmenting our rivers.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Rivers, River Connectivity	Database	Planning, Implementation	4

5.3 AMBER (2016-2020). **Adaptive Management of Barriers in European Rivers.** https://cordis.europa.eu/project/id/689682.

AMBER delivered innovative solutions to river fragmentation in Europe by developing more efficient methods of restoring stream connectivity through adaptive barrier management. The project seeks to address the complex challenge of river fragmentation through a comprehensive barrier adaptive management process, based on the integration of programme design, management, and monitoring to systematically test assumptions about barrier mitigation, adapt and learn.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Rivers, River Connectivity	General Guideline	Planning	4

5.4 European Commission (2022). **Barrier Removal for River Restoration. European Commission, Directorate-General for Environment, Biodiversity strategy for 2030 – Barrier removal for river restoration.** Publications Office of the European Union. https://data.europa.eu/doi/10.2779/181512.

This document aims to support Member States and other actors involved in river restoration. The NRL sets the target to make at least 25 000 km of rivers free-flowing again. This document provides general principles, and examples of existing approaches and methods that could be used to select and prioritise barriers that would need to be removed in order to reach the target of at least 25 000 km of free-flowing rivers in the EU. Finally, the document sets out an overview of the different EU funding mechanisms that could support river restoration projects.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Rivers, River Connectivity	General Guideline	Planning	4

5.5 Fish migration & BirdLIFE (2018-2024). **A new approach: a gradual, ecological freshwater-saltwater transition between Wadden Sea, Ijsselmeer and the hinterland.** https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE16-NAT-NL-000155/a-new-approach-a-gradual-ecological-freshwater-saltwater-transition-between-wadden-sea-ijsselmeer-and-the-hinterland.

The Fish migration & BirdLIFE project aims at the restoration of a natural river course – to encourage fish migration – by restoring the connectivity between the Wadden Sea and the IJsselmeer. The concrete conservation actions will consist of the natural landscaping of the fish migration river and the creation of breeding islands and high-tide resting areas for birds.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Atlantic	Rivers, River Connectivity, Coastal Ecosystems	Project	Planning, Implementation	4

5.6 European Commission, Directorate-General for Environment (2021). **Current practice in flood risk management in the European Union.** Publications Office of the European Union, https://data.europa.eu/doi/10.2779/235272.

This European Commission report presents a compilation of current practices in Flood Risk Management (FRM) in the European Union (EU). This includes case studies reconnecting rivers with their floodplains, river restoration projects and planting native species to slow the flow and stabilise riverbanks.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Rivers, River Connectivity, Floodplains, Riparian Habitats	General Guideline	Planning	4

5.7 European Environment Agency (2019). **Floodplains: a natural system to preserve and restore.** https://www.eea.europa.eu/publications/floodplains-a-natural-system-to-preserve-and-restore.

This work aims to highlight that natural floodplains support achieves multiple EU policy objectives. It also aims to show that natural and restored floodplains provide an alternative to structural measures for providing flood protection, and at the same time support achieving higher quality ecosystem service like improved water quality, improved conditions for biodiversity conservation and improved recreational value.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Floodplains	General Guideline	Planning	4

6 Article 8: Restoration of Pollinator Populations

6.1 Hochkirch, A., Vujić, A., Flinn, G. (2021). **Species Action Plans for EU Pollinators – Shortlist of 15 Species Action Plans.** https://wikis.ec.europa.eu/display/EUPKH/Action+Plans?preview=/23462161/36704078/SAP%20Pollinators%20Report.pdf.

The International Union for Conservation of Nature (IUCN), in collaboration with experts from the IUCN Species Survival Commission, in particular the Invertebrate Conservation Committee and the Hoverfly Specialist Group, as well as Buglife, have started working on the production of Action Plans for conservation of threatened pollinator species in the EU. Experts have so far developed a shortlist of fifteen candidate pollinators species for which action plans are needed in Europe. This report is the outcome of the expert workshop which took place on 18 June 2021 and presents the 15 candidate species.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Pollinators	Project	Planning	N/A

6.2 Yeray Monasterio León, Y. M., Carreira, C. R., Jiménez, R. E.., Javier Almunia, Martin Wiemers, Ante Vujic, Craig Macadam, Julia Raser, Axel Hochkirch (2023). **Canarian Islands endemic pollinators of the Laurel Forest zone - Conservation plan 2023-2028.** Publication prepared for the European Commission within the framework of the contract No 07.0202/2020/839411/SER/ENV.0.2. https://wikis.ec.europa.eu/display/EUPKH/Action+Plans?preview=/23462161/90277022/Species%20Action%20Plan%20for%20the%20Canarian%20Islands%20pollinators%202023-2028.pdf.

This document was drafted within the framework of an EU funded project, Action Plans for conservation of threatened pollinator species in the EU, launched by the European Commission in the context of the implementation of the EU Pollinators Initiative. The objective of the project was to develop three EU Species Action Plans for the most threatened pollinator species, by building on existing experience and using the European Red List as a reference. The methodology to develop these action plans is based on the Guidelines for Species Conservation Planning (IUCN SSC, 2017), developed by the former IUCN SSC Conservation Planning Sub-Committee, as well as the CPSG Conservation Planning Principles and Steps (CPSG, 2020), developed by IUCN SSC Conservation Planning Specialist Group (CPSG). This Action Plan focuses on four insect species – two butterflies, one bee, and one hoverfly – sharing a common, ancient habitat: the Laurel Forest. Once widespread in the Mediterranean area, this ecosystem supports rich biodiversity and many endemic species throughout the Canary Islands but has nevertheless suffered from destruction and degradation. The decline of this habitat due to human activity is a major threat to the species considered for this Action Plan, along with alien species and the changing climate.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Europe	Pollinators	General Guideline	Planning, Implementation	N/A

6.3 Michez, M., Radchenko, V., Macadam, C., Wilkins, V., Raser, J., Axel Hochkirch, A. (2023). **Teasel-plant specialised bees in Europe - Conservation action plan 2023-2030.** Publication prepared for the European Commission within the framework of the contract No 07.0202/2020/839411/SER/ENV.02. https://wikis.ec.europa.eu/display/EUPKH/Action+Plans?preview=/23462161/90277028/Species%20Action%20Plan%20for%20the%20teasel-plant%20bees%202023-2030.pdf.

Wild bees are known to represent the most important pollinator group of wild plants and crops. These wild bees are at particular risk of extinction as land use changes cause the decline of suitable habitats while also taking away the teasel plants on which they rely for their survival. The reduction of host plants due to agricultural intensification and decrease of xerothermic grassland is now leading to the disappearing of the six species studied in this Plan.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Europe	Pollinators	General Guideline	Planning, Implementation	N/A

6.4 Vujić, A., Miličić, M., Janković Milosavljević, M., van Steenis, J., Macadam, C., Wilkins, V., Raser, J., & Hochkirch, A (2023). **Hoverflies specialised to veteran trees in Europe – Conservation Action Plan 2023- 2030.** Publication prepared for the European Commission within the framework of the contract No 07.0202/2020/839411/SER/ENV.0.2. https://wikis.ec.europa.eu/display/EUPKH/Action+Plans?preview=/23462161/90277029/Species%20Action%20Plan%20for%20the%20veteran%20trees%20hoverflies%202023-2030.pdf.

This Action Plan is dedicated to six hoverflies species that are specialised on veteran trees and wet, decaying wood. These saproxylic insects not only are important pollinators but also act as nutrient recyclers, pests' predators, and indicators of ecosystem health. "Hoverflies specialised to veteran trees in Europe – Conservation Action Plan 2023–2030" sheds a light on the importance of appropriate forestry practices that keep into account the needs of pollinators species that rely on dead wood and ancient trees. The removal of veteran trees, the replacement of key tree species, and the implementation of hoverfly-unfriendly woodland management are all threats to these species.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Pollinators	General Guideline	Planning, Implementation	10

6.5 European Commission (n.d.). **LIFE projects relevant for pollinators.** LIFE programme - EU Pollinator Information Hive - EC Public Wiki (europa.eu).

This link directs to all the projects that are relevant for pollinators under the LIFE programme.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Pollinators	Database	Planning, Implementation, Monitoring	N/A

6.6 European Commission (n.d.). **Horizon 2020 projects relevant for pollinators.** Horizon 2020 - EU Pollinator Information Hive - EC Public Wiki (europa.eu).

This link directs to all the Horizon 2020 projects that are relevant for pollinators.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Pollinators	Database	Planning, Implementation, Monitoring	N/A

6.7 National Biodiversity Data Centre, Ireland (n.d.). **All-Ireland Pollinator Plan (2021-2025).** https://pollinators.ie/resources/.

The resources page lists a number of useful resources including many “How-to” guides. It also includes the regularly updated All-Ireland Pollinator Plan which details the 186 science-based actions we need to take to reverse pollinator decline, it translates them in a range of clear and creative ways that enable all sectors of society – schools, communities, farmers, businesses, gardeners, local authorities, etc. – to get involved in pollinator conservation.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Atlantic	Pollinators	General Guideline	Planning, Implementation	N/A

6.8 National Biodiversity Data Centre, Ireland (n.d.). **Protecting Farmland Pollinators**. https://biodiversityireland.ie/projects/protecting-farmland-pollinators/.

The main aim of the ‘Protecting Farmland Pollinators’ project was to identify small actions that farmers can take that would allow biodiversity to coexist within a productive farming system. This website is full of resources, including guidelines on creating a network of flower-rich meadows across farmland and learnings from project managers.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Atlantic	Pollinators, Agricultural Ecosystem	General Guideline	Planning, Implementation	4, 9

6.9 European Commission (n.d.). **EU Pollinator Information Hive**. EU Pollinator Information Hive - EU Pollinator Information Hive - EC Public Wiki (europa.eu)

This website provides information on the conservation of wild pollinators in the EU. There is information on pollinators generally, opportunities to get involved , information about ongoing projects and testimonials from conservation experts, and resources that have been collected from Member States.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Pollinators	General Guideline	Planning, Implementation	N/A

6.10 Wilk, B., Rebollo, V., Hanania, S. (2019). **A guide for pollinator-friendly cities: How can spatial planners and land use managers create favourable urban environments for pollinators?** Guidance prepared by ICLEI Europe for the European Commission. ICLEI Europe • Publications & tools (iclei-europe.org)

This guidance supports the EU Pollinators Initiative, adopted by the Commission in 2018 as the first-ever EU coordinated action on pollinators. The Initiative sets strategic objectives and a set of actions to be taken by the EU and its Member States to address the decline of pollinators in the EU and contribute to global conservation efforts. This guidance contributes to Action 6, which aims to improve pollinator habitats in urban areas and the wider landscape.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Pollinators, Urban Ecosystems	General Guideline	Planning, Implementation	6

6.11 Costa Domingo, G., Underwood, E. (2021). **Key recommendations for supporting pollinator-friendly farming in the EU.** IEEP, blogs. Key recommendations for supporting pollinator-friendly farming in the EU - IEEP AISBL

This blog entry on the IEEP includes key recommendations to improve farmland pollinator conservation. There are further resources linked (e.g., the EU's Pollinator Information Hive mentioned in 6.3). Key pollinator-friendly management practices include Managing existing farmland habitats for pollinators, ensuring diversity and abundance of flowering plants, creating extra pollinator resources, leaving bare patches, stones and deadwood, implementing systems to reduce pesticide and fertilizer use, taking a landscape scale approach to plan and position wild pollinator habitats.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Pollinators, Agricultural Ecosystems	General Guideline	Planning	9

6.12 Salsbury, N. (2019). **The Pollinator Habitat Restoration Guide. WNPS Native Bee and Restoration Practices.** https://www.wnps.org/content/documents/cps/past-programs/20190126_pollinator_habitat_restoration_guide.pdf.

This presentation is intended as a how-to practitioners guide of best management practices. The guide gives advice on site assessment, site design, and design implementation.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	Pollinators	General Guideline	Planning	N/A

6.13 Xerces Society for Invertebrate Conservation (n.d.). **Habitat Restoration.** https://xerces.org/pollinator-conservation/habitat-restoration.

The website offers general advice on planning, installing and maintaining pollinator friendly habitats. It further provides many resources such as the Arkansas NRCS Pollinator Conservation Planning Handbook and the report on Best Management Practices for Pollinators on Western Rangelands. While these are all US focusses, methods and techniques are transferable but need to be adapted to a European context.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	Pollinators	General Guideline	Planning, Implementation	9

6.14 LIFE for Insects (2022). **Layman report on the LIFE for Insects project.** https://lifeforinsects.nature.cz/-/flick-through-the-layman-report-on-the-life-for-insects-project?redirect=%2Fhomepage.

LIFE for Insects used a combination of clear-cutting, grazing, mowing and re-seeding to restore nearly 600 hectares of land. The efforts of LIFE for Insects - a five-year initiative spanning both sides of the mountainous Czech-Slovak border – allowed for critically-endangered butterflies, beetles and plants to slowly make a comeback. The layman report gives a good overview of the project as well as the methods that were used. The habitats restored include open canopy forests, dry pastures and wet meadows.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Pollinators, Butterflies	Project	Planning, Implementation	4, 9, 10

6.15 van Swaay C, Collins C, Dušej G, Maes D, Munguira ML, Rakosy L, Ryrholm N, Šašić M, Settele J, Thomas JA, Verovnik R, Verstrael T, Warren M, Wiemers M, Wynhoff I (2012). **Dos and Don'ts for butterflies of the Habitats Directive of the European Union.** Nature Conservation 1: 73–153. http://dx.doi.org/10.3897/natureconservation.1.2786.

The report lists detailed accounts of each species, their habitat requirements and foodplants. As the title indicates it also lists the dos and don’ts of the management of their habitats. Managing habitats in the correct way is the single most important issue affecting the survival of European butterflies.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Pollinators, Butterflies	General Guideline	Planning, Implementation	9

6.16 Heer, P., Pellet, J., Sierro, A. et al. (2013). **Evidence-based assessment of butterfly habitat restoration to enhance management practices.** Biodiversity Conservation 22, 239–252 (2013). https://doi.org/10.1007/s10531-012-0417-9. *(not open access).*

This study investigates the efficiency of a habitat restoration programme aimed at reducing the risk of extinction of the Iolas blue *Iolana iolas*, one of the rarest butterflies of Central Europe. The study provides evidence-based recommendations for improving ongoing habitat restoration: (i) the attractiveness of host plant plantations must be enhanced by promoting mass blossoming, which can be achieved through systematic autumn pruning of the extant plantations; (ii) new plantations should be created in order to fill in the gaps in the landscape matrix, to increase meta-population capacity through improved habitat connectivity. Finally, this study demonstrates the relevance of efficiency tests as an integral, adaptive phase of any conservation research activity.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Pollinators, Butterflies	Academic Article	Planning	N/A

7 Article 9: Restoration of Agricultural Ecosystems

For more specific restoration guidance documents such as peatland and meadow restoration see chapter 2 (peatlands are covered in 2.1, meadows are covered in 2.2). For pollinator restoration (including butterflies) see chapter 6.

7.1 Farmland Birds

7.1.1 European Commission (n.d.). **Birds@Farmland Initiative.** https://environment.ec.europa.eu/topics/nature-and-biodiversity/birds-directive_en.

The initiative developed tools to support farmland bird conservation. The project focussed on 10 Member States (Austria, Bulgaria, Czechia, Germany, Spain, Finland, France, Hungary, Italy, and Portugal). The findings are relevant for all Member States. There are several relevant reports and factsheets that were produced by the initiative. The most relevant ones are Agricultural System Factsheets, Flagship Species Factsheets (EN versions from p. 5) and Conservation Schemes Factsheets (EN version from p. 3).

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems, Farmland Birds	Website	Planning	N/A

7.1.2 Kajtoch, Ł. (2017). **The importance of traditional orchards for breeding birds: The preliminary study on Central European example.** Acta Oecologica, Vol. 78, pp. 53-60. https://doi.org/10.1016/j.actao.2016.12.010.

Orchards are parts of agriculture and apart from their economic role they may preserve biodiversity in highly transformed farmlands. An increasing intensity of orchards management is known to be threat for some species, especially pollinators

and birds. Bird species' richness and abundance were found to be highest in abandoned orchards but overall bird diversity and species composition in abandoned did not differ from these found in extensively managed orchards. Unfortunately, the number of abandoned and extensively managed orchards is declining from agricultural landscapes, and traditional orchards are replaced by conventional fruit plantations. Needs of orchard protection should be implemented into Agri-Environmental Schemes/High Nature Value farming systems and possibly also into habitat directive of EU.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems, Farmland Birds, Pollinators	Academic Article	Planning	4, 8

7.1.3 Kail, J., Januschke, K., Daniel Hering, D. (2023). **Freshwater-related species richness in Natura 2000 sites strongly depends on the surrounding land use besides local habitat conditions**. Journal of Environmental Management, Vol. 340, 118025, https://doi.org/10.1016/j.jenvman.2023.118025.

The Birds and Habitats Directive are the cornerstones of Europe's nature conservation policy, and the resulting Natura 2000 (N2k) sites form the largest coordinated network of protected areas in the world. For this study conditional inference forests were used to assess the importance of land use in the surrounding and upstream of the German N2k sites compared to local habitat conditions inside. Freshwater-related species richness depended on land use in the surrounding besides local habitat conditions. Results indicated that this was especially true for birds in small N2k sites embedded in a wet, diverse, and patchy landscape and for non-birds due to the provision of additional habitats outside the N2k sites.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems, Farmland Birds	Academic Article	Planning	4

7.1.4 Lewis-Phillips, J., Brooks, S. J., Sayer, C. D., Patmore, I. R., Hilton, G. M., Harrison, A., Robson, H., Axmacher, J. C., (2020). **Ponds as insect chimneys: Restoring overgrown farmland ponds benefits birds through elevated productivity of**

emerging aquatic insects. Biological Conservation, Vol. 241. https://doi.org/10.1016/j.biocon.2019.108253.

This study investigates how farmland pond management influences insects and how that consequently influences the abundance of birds. This study highlights an urgent need to re-evaluate pond restoration and management within agri-environmental schemes in Europe and beyond. The findings suggest that restoring networks of farmland ponds to open-canopy macrophyte-dominated conditions could be a highly effective way of increasing the availability of aquatic insect prey for birds.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems, Farmland Birds, Ponds	Academic Article	Planning	4

7.1.5 Sayer, C.D., Biggs, J.,Greaves, H.M., & Williams, P. (2023). **Guide to the restoration, creation and management of ponds**. University College London, London, UK. https://norfolkponds.org/.

This guide provides all the information to help support farmland pond conservation. The guide gives clear instructions on pond creation, restoration, resurrection and pond management. When unpolluted, ponds can act as biodiversity hotspots that are critically important for aquatic invertebrates (like dragonflies), wetland plants, amphibians and fishes. They also proof to be important for insects and thus farmland birds.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems, Farmland Birds, Ponds	General Guideline	Planning	4

7.1.6 Lengyel, S., Nagy, G., Tóth, M., Mészáros, G., Nagy, C. P., Mizsei, E., Szabolcs, M., Mester, B., Mérő, T. O. (2023). **Grassland restoration benefits declining farmland birds: A landscape-scale before-after-control-impact experiment.** Biological Conservation. Vol. 277. https://doi.org/10.1016/j.biocon.2022.109846.

Despite a surge of agri-environmental support, farmland birds continue to decline. The study has found that grassland restoration increased farmland bird abundance and diversity. For restoration guidelines on grassland restoration see chapter 2.2.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	Agricultural Ecosystems, Farmland Birds, Grasslands	Academic Article	Planning	4

7.2 Agricultural Soils

7.2.1 Biodiversa (n.d.). **How soil biodiversity can strengthen resilience and ecosystem services in agricultural landscapes.** https://www.biodiversa.eu/2022/10/06/how-soil-biodiversity-can-strengthen-resilience-and-ecosystem-services-in-agricultural-landscapes/.

This policy brief presents information on how soil biodiversity supports a wide range of ecosystem services, and influences crop properties beyond productivity, but that its benefits are often not well-known or underestimated. It encourages policymakers to provide incentives for farmers and support local implementation plans complementary to more global policies such as the Common Agricultural Policy (CAP) and the European Green Deal.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems, Soils	Policy Brief	Planning	N/A

7.2.2 FAO & ITPS (2021). **Recarbonizing Global Soils – A technical manual of recommended management practices. Volume 1 – Introduction and Methodology.** https://www.fao.org/documents/card/en/c/cb6386en.

This report gathers the existing data on the impacts of the main soil management practices on soil organic carbon content in a variety of environments. This report also presents different ways of sustainable soil management practices at different scales. This is supported by case studies that have been shown to have a positive effect on soil organic carbon.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	Agricultural Ecosystems, Soils	General Guideline	Planning	N/A

7.2.3 Value Change (2018). **Value Chain (Scope 3) Interventions – Guidance for Soil Organic Carbon.**
https://www.google.de/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjG-pPfuviDAxXdgP0HHRvDB10QFnoECBEQAQ&url=https%3A%2F%2Fwww.goldstandard.org%2Fsites%2Fdefault%2Ffiles%2Fdocuments%2F2018_10_value_chain_interventions_soc_guidelines_draft.pdf&usg=AOvVaw0Dw8hNob6koOwYZ9Aw0mtB&opi=89978449.

This Guidance is arranged to first facilitate a decision on which approaches and methods could be applied to quantify and monitor soil organic carbon. It then provides further guidance on each approach, as well as recommend relevant tools, protocols and methodologies. Finally, the document details how to apply numbers generated in relevant equations in the Interventions Guidance.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	Agricultural Ecosystems, Soils	General Guideline	Planning	N/A

7.2.4 Local Land Services (2021). **Ten Ways to build soil carbon. Greater Sydney Local Land Services.**
https://www.google.de/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjG-pPfuviDAxXdgP0HHRvDB10QFnoECCAQAQ&url=https%3A%2F%2Fwww.lls.nsw.gov.au%2F__data%2Fassets%2Fpdf_file%2F0019%2F1321543%2F10-Ways-to-Build-Soil-Carbon.pdf&usg=AOvVaw3CU3k8eq_NpEQt5REgmN_H&opi=89978449

This booklet is designed as an introduction to 10 strategies farmers can use to build soil organic carbon within their farming systems. The information in this booklet is just a start and strategies will need to be assessed against economic, environmental and personal goals and then tailored for each property. When implementing these strategies, soil testing is recommended to benchmark and track changes in soil organic carbon over time. Resources with more detailed information are provided with

each of the strategies and at the end of this booklet. The general strategies, methods and management practices can also be applied to a European context.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	Agricultural Ecosystems, Soils	General Guideline	Planning	N/A

7.2.5 UK Parliament (2022). **Restoring Agricultural Soils.** POSTNOTE. https://www.google.de/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwi5t8KZv_iDAxVMgv0HHYTVDd04FBAWegQIAhAB&url=https%3A%2F%2Fresearchbriefings.files.parliament.uk%2Fdocuments%2FPOST-PN-0662%2FPOST-PN-0662.pdf&usg=AOvVaw3ecTjTxG7oRLSf16G4IBJR&opi=89978449.

This policy brief gives background information on agricultural soils, summarises the state of England's agricultural soils, and explores soil indicators that could be used for monitoring in policy frameworks. The brief also explains different restoration measures.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Atlantic	Agricultural Ecosystems, Soils	Policy Brief	Planning	N/A

7.3 Agricultural Bio- and Landscape diversity

7.3.1 European Commission (n.d). **Enhancing agricultural biodiversity.** https://agriculture.ec.europa.eu/sustainability/environmental-sustainability/biodiversity_en.

This website gives an overview of the EU's ambition to enhance biodiversity in agricultural system, it gives an overview of the policy framework and funding opportunities. It also includes links to resources that help with monitoring as well as knowledge, research and innovation tools including a farm advisory system.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed

Europe	Agricultural Ecosystems	Website	Planning	N/A

7.3.2 Biodiversa (n.d). **The Common Agricultural Policy can strengthen biodiversity and ecosystem services by diversifying agricultural landscapes.** https://www.biodiversa.eu/2022/10/06/the-common-agricultural-policy-can-strengthen-biodiversity-and-ecosystem-services-by-diversifying-agricultural-landscapes/.

If managed appropriately, Europe's diverse farmland landscapes can provide many benefits to people and nature as well as more sustainable agriculture. Ecosystem services such as pollination and natural biological pest control depend strongly on the amount of semi-natural habitat patches on farmland, and the preservation of such habitats will become even more important due to the effects of climate change. This 4-page brief presents key recommendations on how the Common Agricultural Policy (CAP) can significantly contribute to diversifying agricultural landscapes in support of nature and people, for a more sustainable agriculture. ^

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Europe	Agricultural Ecosystems, Landscape Diversity	Policy Brief	Planning	8

7.3.3 EU CAP Network (2023). **Designing successful schemes to promote the maintenance, restoration and creation of landscape features.** https://eu-cap-network.ec.europa.eu/sites/default/files/publications/2023-06/EUCAPNetwork_Factsheet_TGLandscapeFeatures.pdf.

This factsheet provides an overview of successful measures to design schemes to encourage the maintenance, restoration and creation of landscape features on farmland. The factsheet uses successful examples from different Member States.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Europe	Agricultural Ecosystems, Landscape Diversity	Policy Brief	Planning	N/A

7.3.4 Boinot, S., Alignier, A., Pétillon, J., Ridel, A., Aviron, S. (2023). **Hedgerows are more multifunctional in preserved bocage landscapes.** Ecological Indicators, Vol. 154, 110689. https://doi.org/10.1016/j.ecolind.2023.110689.

Hedgerows are key multifunctional habitats in agricultural landscapes. Hedgerows are key wildlife habitats in agricultural landscapes, with presumably high multifunctionality – that is the capacity to provide multiple ecological, agronomic or cultural functions. This study assessed the effects of hedgerow features, adjoining farming systems, landscape context, and their interactions on hedgerow multifunctionality based on four ecological functions – biodiversity conservation, potential pollination, potential predation, and pest colonisation. Results support previous studies showing the beneficial effects of flower cover, margin width, adjacent organic farming, and other variables related to hedgerow structural complexity on individual taxa or proxies of functions. Most importantly, our study reveals that hedgerows are more multifunctional in landscapes with dense hedgerow networks (so-called 'bocage' landscapes), which is likely the result of greater habitat amount, connectivity, and environmental heterogeneity.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems, Landscape Diversity, Pollinators	Policy Brief	Planning	8

7.3.5 Kathrin Litza, K., Audrey Alignier, A., Déborah Closset-Kopp, D., Aude Ernoult, A., Cendrine Mony, C., Magdalena Osthaus, M., Joanna Staley, J., Sanne Van Den Berge, S., Thomas Vanneste, T., Martin Diekmann, M. (2022). **Hedgerows as a habitat for forest plant species in the agricultural landscape of Europe.** Agriculture, Ecosystems & Environment, Vol. 326, 107809. https://doi.org/10.1016/j.agee.2021.107809.

Hedgerows are semi-natural wooded habitats and an important element in agricultural landscapes across Western and North-Western Europe. They reduce erosion, function as carbon sinks and thus provide essential ecosystem services. Moreover, they form a structurally diverse ecosystem for numerous taxa and connect otherwise fragmented forest habitats. This study compiled data from the hedgerow-rich oceanic regions of Europe, covering a gradient from Southern Sweden to Northern France, to analyse the influence of management, landscape context and climate variables on the number of herbaceous forest specialists in hedgerows. The study found that hedgerows in regions that are warm or that are impacted by heat and drought events contain fewer forest species. Intensive adjacent land-use had a negative impact on forest species richness, while the surrounding forest cover was not significantly important. In congruence with previous regional studies, wider

hedgerows contain more forest species, which is most likely caused by a more effective buffering of the microclimate. Thus, hedgerow width gains in importance in times of climate change and increasing extreme weather events.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems, Landscape Diversity	Academic Article	Planning	N/A

7.3.6 Windsor, F. M., Tavella, J., Rother, D., C., Raimundo, R. L. G., Devoto, M., Guimarães Jr., Evans, D., M. (2021). **Identifying plant mixes for multiple ecosystem service provision in agricultural systems using ecological networks.** Journal of Applied Ecology, Vol. 58, No. 12, pp. 2770-2782. https://doi.org/10.1111/1365-2664.14007.

Managing agricultural environments in a way that maximises the provision of multiple ecosystem services is a significant challenge in the development of sustainable and secure food systems. Advances in network ecology provide a way forward, particularly in arable landscapes, as they incorporate mutualistic and antagonistic interactions associated with crop production. Plant mixes designed solely for maximising pollinator species richness are not optimal for the provision of other ecosystem services and disservices (e.g. parasitism of insect pests and herbivory). The method presented here will allow for the design of management strategies that facilitate the provision of multiple ecosystem services. To this end, the authors provide a protocol for practitioners to develop their own plant mixes suitable for farm-scale management.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems	Academic Article	Planning	N/A

7.3.7 REFOREST (2022-2026). **Agroforestry at the forefront of farming sustainability in multifunctional landscapes in Europe.** https://cordis.europa.eu/project/id/101060635.

Ever since the dawn of agriculture during the Neolithic Period, the relationship between humans and land has been a reciprocal one: the land produces the necessary means of sustenance, but it can only achieve this if it is properly tended to. Agroforestry yields essential products such as food and timber, at the same time ensuring the protection of biodiversity so the natural environment continues to provide its resources and other benefits. The EU-funded REFOREST project aims to overcome the barriers to wider agroforestry adoption in Europe. To that end, it will encourage knowledge exchange amongst stakeholders, provide solutions to farmers, and propose relevant policy interventions that will elevate agroforestry to a key driver of farm productivity, socioeconomic viability and sustainability.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems	Project	Planning	10, 4

7.3.8 Batáry, P., Báldi, A., Kleijn, D., Tscharntke, T. (2010). **Landscape-moderated biodiversity effects of agri-environmental management: a meta-analysis.** Biological Sciences. The Royal Society B. https://doi.org/10.1098/rspb.2010.1923.

Agri-environmental management (AEM) is heralded as being key to biodiversity conservation on farmland, yet results of these schemes have been mixed, making their general utility questionable. The study found that AEM significantly increased species richness and their abundance. In croplands, species richness but not abundance was significantly enhanced in simple but not in complex landscapes. In grasslands, AEM effectively enhanced species richness and abundance regardless of landscape context. Pollinators were significantly enhanced by AEM in simple but not in complex landscapes in both croplands and grasslands. The results highlight that the one-size-fits-all approach of many agri-environmental programmes is not an efficient way of spending the limited funds available for biodiversity conservation on farmland. Therefore, the authors conclude that AEM should be adapted to landscape structure and the species groups at which they are targeted.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems	Academic Article	Planning	4, 8

7.3.9 Froidevaux, J. S. P., Louboutin, B., Jones, G. (2017). **Does organic farming enhance biodiversity in Mediterranean vineyards? A case study with bats and arachnids.** Agriculture, Ecosystems & Environment, Vol. 249, pp. 112-122. https://doi.org/10.1016/j.agee.2017.08.012.

The effectiveness of organic farming for promoting biodiversity has been widely documented, yet most studies have been undertaken in temperate agroecosystems with a focus on birds, insects, and plants. Despite the Mediterranean basin being a biodiversity hotspot for conservation priorities, the potential benefits of organic farming for biodiversity there has received little attention. The study found that abundance of arachnids was higher in organic vineyards, although arachnid species richness was positively associated with the amount of ground vegetation cover. Organic farming was ineffective on its own to enhance bat activity and species richness regardless of the landscape context. Rather, our results suggested that landscape features were more important for bats than vineyard management, with significantly higher bat activity recorded on vineyard plots located at proximity to hedgerows and rivers. When designing conservation strategies in Mediterranean farmlands, the authors strongly recommend the implementation of a multi-scale approach to assure benefits for a wide range of species.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Mediterranean	Agricultural Ecosystems, Landscape Diversity	Academic Article	Planning	N/A

7.3.10 Manning, A. D., Fischer, J., Lindenmayer, D. B. (2006). **Scattered trees are keystone structures – Implications for conservation**. Biological Conservation, Vol. 132, No. 3, pp. 311-321. https://doi.org/10.1016/j.biocon.2006.04.023.

Scattered trees are prominent features in many landscapes worldwide, including natural landscapes, cultural landscapes, and recently modified landscapes. The ecological importance of scattered trees is widely acknowledged in natural landscapes but has not been sufficiently appreciated in human-modified landscapes. This paper shows that scattered trees are keystone structures in a wide range of landscapes. At the local scale, ecological functions of scattered trees include provision of a distinct microclimate; increased soil nutrients; increased plant species richness; increased structural complexity; and habitat for animals. At the landscape scale, ecological roles include increased landscape-scale tree cover; increased connectivity for animals; increased genetic connectivity for tree populations; and provision of genetic material and focal points for future large-scale ecosystem restoration. A key management challenge in all landscapes with scattered trees is to maintain a balance between recruitment and mortality of trees in an appropriate spatial pattern. Meeting this challenge may represent an important step towards the genuine integration of conservation and production in human-modified landscapes.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	Agricultural Ecosystems, Landscape Diversity	Academic Article	Planning	N/A

7.3.11 European Commission (n.d.). **Impacts of farming practices on environment and climate.** https://wikis.ec.europa.eu/display/IMAP/Impacts+of+farming+practices+on+environment+and+climate.

This wiki synthesises a large amount of scientific evidence to assess the impacts of farming practices on the environment, climate and agricultural productivity. There is also a complete list of farming practices and answers to the questions of the impacts of specific farming practices and which farming practices are linked to a specific impact.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems	Database	Planning	N/A

7.3.12 SHOWCASE (2020-2025). **Showcasing synergies between agriculture, biodiversity and ecosystem services to help farmers capitalising on native biodiversity.** https://cordis.europa.eu/project/id/862480.

Little is known about what effectively motivates farmers to integrate biodiversity into daily farm management. In addition, there are only a few studies showing that biodiversity-based approaches produce benefits, and this evidence is poorly communicated. The EU-funded SHOWCASE project aims to shed light on these issues by reviewing and testing the ecological effectiveness of a range of economic and societal incentives to implement biodiversity management in farming operations and examine farmer and public acceptance. The project is focusing on result-based incentives, involvement in citizen science biodiversity monitoring and biodiversity-based business models. Moreover, it will design communication strategies that are tailor-made for farmers and other key stakeholders operating in different socio-economic and environmental conditions.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems	Project	Planning	N/A

7.3.13 Biodiversa (n.d.). **Green infrastructure within agricultural landscapes strengthens the supply of ecosystem services.** https://www.biodiversa.eu/2022/10/06/green-infrastructure-within-agricultural-landscapes-strengthens-the-supply-of-ecosystem-services/.

This policy brief provides evidence that increasing landscape diversity through green infrastructure (GI) can improve the supply of ecosystem services, looking at biocontrol and pollination, and that current EU and national agricultural policies fail to effectively support GI implementation in Member States. It further provides pathways for improving landscape heterogeneity and developing EU, national and local policies that support the development of GI and the uptake of such measures by farmers.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Agricultural Ecosystems, Landscape Diversity	Policy Briefs	Planning	N/A

8 Article 10: Restoration of Forest Ecosystems

For restoration guidelines of more specific forest types see chapter 2.4.

8.1 Beatty, C.R., Cox, N. A., and M. E. Kuzee (2018). **Biodiversity guidelines for forest landscape restoration opportunities assessments.** First edition. Gland, Switzerland: IUCN. v + 43pp. https://portals.iucn.org/library/node/47713.

These Biodiversity guidelines for forest landscape restoration opportunities assessments are intended to provide more context, more resources and fresh perspectives to the ongoing global interaction between biodiversity conservation and forest landscape restoration. These guidelines are intended to help practitioners translate and communicate the importance of their work into a biodiversity context, and to help mainstream biodiversity in other sectors. The result should be an assessment process that explicitly identifies options for the choice of and interaction among species in a landscape to produce the biological, social and ecological benefits that form the purpose for restoration.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Forests	General Guideline	Planning	4

8.2 SWD (2023). **Guidelines on Biodiversity-Friendly Afforestation, Reforestation and Tree Planting.** https://ec.europa.eu/transparency/documents-register/detail?ref=SWD(2023)61&lang=en.

These guidelines on Biodiversity-Friendly Afforestation, Reforestation and Tree Planting provide a set of practical recommendations to support authorities, forest and landowners, and managers and civil society to better implement biodiversity-friendly afforestation, reforestation and tree-planting projects including at the local level. It also gives information on financing afforestation, reforestation and tree planting.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Forests	General Guideline	Planning	4, 6, 9

8.3 SUPERB (n.d.). **Forest Restoration Workplans.** Example of the workplan: https://forestrestoration-b4f9.kxcdn.com/wp-content/uploads/2023/02/Workplan_Spain_V1.0.pdf.

These forest restoration workplans, developed within the Green deal project SUPERB, will be of guidance for forest practitioners and managers for setting up restoration plans and measures in different forest areas in Europe, ranging from set-asides and old growth, reforesting spruce dieback areas, coppice management, floodplain restoration, continuous cover mixed forests, to afforestation in urban areas, etc. Within SUPERB workplans have been made for areas in twelve different countries with a variety in forest type, different stressors and social-economic circumstances. Both the format of the workplan and the content of the twelve demo areas will be of use and give insights in possible restoration trajectories.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code

Europe	Forests	General Guideline	Planning, Implementation, Monitoring	4	N/A

8.4 SWD (2023). **Guidelines for Defining, Mapping, Monitoring and Strictly Protecting EU Primary and Old-Growth Forests.** https://environment.ec.europa.eu/publications/guidelines-defining-mapping-monitoring-and-strictly-protecting-eu-primary-and-old-growth-forests_en.

Practical guidance to national policy- and decision-makers that will allow them to effectively identify and protect remaining primary and old-growth forest in the EU. In the EU Biodiversity Strategy there is a commitment to strictly protect all remaining EU primary and old-growth forests. The guidelines thus set out criteria for identifying primary and old-growth forest areas based on a list of indicators or principles. A timeline is suggested for their mapping and strict protection.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**
Europe	Forests	General Guideline	Planning	4

8.5 New Mexico Forest and Watershed Restoration Institute (2019). **Short Guide for Developing CFRP Restoration Prescriptions.** https://foreststewardsguild.org/wp-content/uploads/2019/06/NMFWRI01_prescription.pdf.

This is a guide gives clear instructions for what to consider when planning forest restoration projects and gives examples for different types of forests. The purpose of this short guide is to provide information to assist in designing a restoration prescription that will move forests toward healthier, more natural conditions. The forest types that are covered are Ponderosa Pine Forest, Piñon-Juniper Forest, Southwestern Mixed Conifer Forest and Bosque Forest.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**Other NRL articles addressed**	**Habitat Code**
Global	Forests	General Guideline	Planning	4	N/A

8.6 SUPERB (2022). **Upscaling Forest Restoration - Protocol for regular forest inventory** (Essential + Additional). https://forestrestoration-b4f9.kxcdn.com/wp-content/uploads/2022/05/MRV-protocols-forest-inventory_Maximal_FINAL_Jun2022.pdf.

This protocol gives instructions on how to collect data on the change in forest structure and composition along the restoration gradient to complete the Monitoring, Reporting and Verification of Biodiversity and Ecosystem Services (MRV-BES) for restoration action.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Forests	General Guideline	Planning	4

8.7 Shelhaas et al. (2022). **European forest assessment tool, EFISCEN-Space**. https://doi.org/10.18174/583568.

EFISCEN-space is a European forest resource model used to gain insights into the future development of European forests. With the model different scenarios can be simulated at regional to national scales. This projection tool is designed to assess long term effects of restoration activities, under various management alternatives of restoration. Success indicators are part of the tool; as well as indicators in Article 10 that can be analysed with the model. With the tool forest restoration plans can be designed and assessed. See also https://www.wur.nl/nl/project/european-forest-resource-analysis-tools.htm.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed	Habitat Code
Europe	Forests	General Guideline	Planning, Implementation, Monitoring	4	N/A

8.8 DG ENV (2023). **Guidelines on closer-to-nature forest management.** https://op.europa.eu/en/publication-detail/-/publication/2d1a6e8f-8cda-11ee-8aa6-01aa75ed71a1/language-en.

The aim of these guidelines is therefore to promote biodiversity-friendly and adaptive forest management as part of a common framework for closer-to-nature forest management. They present relevant practices and showcase the benefits of these practices for forest multifunctionality and climate change resilience without neglecting socioeconomic benefits. The guidelines will assist competent authorities and key stakeholders in developing and promoting biodiversity-friendly and adaptive practices in forest management across different scales, discussing challenges and opportunities.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Forests	General Guideline	Planning	4

8.9 Di Sacco, A. et al. (2021). **Ten golden rules for reforestation to optimize carbon sequestration, biodiversity recovery and livelihood benefits.** Global Change Biology, Vol. 27., No. 7, p. 1328-1348, https://doi.org/10.1111/gcb.15498.

This paper proposes ten rules that need to be considered for forest ecosystem restoration. These are as follows: (1) Protect existing forest first; (2) Work together (involving all stakeholders); (3) Aim to maximize biodiversity recovery to meet multiple goals; (4) Select appropriate areas for restoration; (5) Use natural regeneration wherever possible; (6) Select species to maximize biodiversity; (7) Use resilient plant material (with appropriate genetic variability and provenance); (8) Plan ahead for infrastructure, capacity and seed supply; (9) Learn by doing (using an adaptive management approach); and (10) Make it pay (ensuring the economic sustainability of the project).

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Global	Forests	General Guideline	Planning	4

8.10 INTERREG (2023). **Nature restoration Forest ecosystems.** A Policy Brief from the Learning Platform on Environment and Resource Efficiency. https://www.interregeurope.eu/sites/default/files/2023-07/TO6%20Policy%20Brief%20Nature%20restoration_Forest%20ecosystems_final.pdf.

This policy brief provides an outlook on EU initiatives that local and regional authorities should refer to for: boosting the restoration of forest ecosystems, afforestation, climate adaptation measures to the benefit of local communities. The policy brief also features a selection of Interreg Europe good practices and policy changes of particular interest with a high degree of replicability and adaptability to other local contexts.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed

Europe	Forests	Policy Brief	Planning	4

8.11 Biodiversa (n.d.). **How natural forest expansion in Europe can offer cost-effective benefits to people.** https://www.biodiversa.eu/2022/10/06/how-natural-forest-expansion-in-europe-can-offer-cost-effective-benefits-to-people/.

This policy brief presents information on how natural forest expansion can offer a cost-effective nature-based solution and climate mitigation measure. It provides evidence on the benefits of natural forest expansion, as well as insights into how it is perceived by citizens across Europe and how its potential can be fully realised. In particular, the brief calls for a better recognition of natural forest expansion in policy and management contexts, in order to better seize and manage opportunities it provides to contribute multiple policy and management objectives, for instance in the context of the EU Forest Strategy.

Region	Restoration Target	Type of Source	Stage of Restoration Process	Other NRL articles addressed
Europe	Forests	Policy Brief	Planning	4

9 National Restoration Guidelines

9.1 Austria

9.1.1 Bundesministerium Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie (2022). **Biodiversity Strategy Austria 2030+ [Biodiversitäts-Strategie Österreich 2030+].** https://www.bmk.gv.at/themen/klima_umwelt/naturschutz/biol_vielfalt/biodiversitaetsstrategie_2030.html.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	General Guidance	General Guideline	Planning, Implementation	N/A

9.1.2 UVOR (2006-2010). **Unterberg-Vorland.** LIFE 3.0 - LIFE06 NAT/A/000124 (europa.eu).

Available in German and English.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Pollinators, Butterflies, Grasslands	Project	Planning, Implementation	4, 8, 9, 10

9.1.3 Paternoster, D., Danziger, F., Koukal, T., Kudrnovsky, H., Lackner, S., Berger, A., Schadauer, K., Wrbka, T., Stejskal-Tiefenbach, M., Ellmauer, T. – Umweltbundesamt (2021). **Strategic Framework for the Prioritisation for the restoration of ecosystems at national and sub-national levels [Strategischer Rahmen für eine Priorisierung zur Wiederherstellung von Ökosystemen auf Nationalem und Subnationalem Niveau].** https://www.umweltbundesamt.at/studien-reports/publikationsdetail?pub_id=2370&cHash=4babebf3d5c56f46ecdeac55d9ea4bc6.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	General Guidance	General Guideline	Planning, Monitoring	N/A

9.1.4 IRIS (2019-2027). **Integrated River Solution Austria**. https://life-iris.at/en/.

Available in German and English.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Rivers	Project	Planning, Implementation, Monitoring	4, 7

9.1.5 Streamland (2017-2021). **Mainstreaming integrated river landscape development.** https://www.umweltdachverband.at/themen/wasser/streamland.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Rivers	Project	Planning, Implementation	4, 7

9.1.6 Eberstaller-Fleischanderl, D., Ebgerstaller, J. (2014). **River Engineering and Ecology [Flussbau und Ökologie – Flussbauliche Maßnahmen zur Erreichung des gewässerökologischen Zielzusandes].** https://info.bml.gv.at/themen/wasser/schutz-vor-hochwasser/richtlinien-leitfaeden/flussbau-oekologie.html.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Rivers	General Guideline	Planning, Implementation	4, 7

9.1.7 Stiefelmeyer, H. – Bundesministerium für Landwirtschaft, Regionen und Tourismus (2020). **Water Maintenance Concepts [Gewässerpflegekonzepte – Leitfaden].** https://www.umweltfoerderung.at/fileadmin/user_upload/umweltfoerderung/betriebe/Wasser_Betriebe/Alle_Dokumente/Leitfaden_Gewaesserpflegekonzepte.pdf.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Rivers	General Guideline	Planning, Implementation	4, 7

9.1.8 Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (2014). **Preserve and develop watercourses [Fliessgewässer erhalten und Entwickeln – Praxisfibel zur Pflege und Instandhaltung].** https://info.bml.gv.at/themen/wasser/schutz-vor-hochwasser/richtlinien-leitfaeden/praxisfibel.html.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed

Alpine	Rivers	General Guideline	Planning, Implementation	4, 7

9.1.9 Eberstaller-Fleischanderl, JD., Eberstaller, J., Schramayr, G., Fischer, H., Kraus, E. (2008). **Riparian Vegetation Management [Ufervegetationspflege unter Berücksichtigung schutzwasserwirtschaftlicher und ökologischer Anforderungen].**

https://info.bml.gv.at/themen/wasser/schutz-vor-hochwasser/richtlinien-leitfaeden/ufervegetationspflege.html.

Available in German.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**NRL articles addressed**
Alpine	Rivers	General Guideline	Planning, Implementation	4, 7

9.1.10 Bundesministerium für Landwirtschaft, Regionen und Tourismus (2020). **More nature for our rivers [Mehr Natur für unsere Flüsse].** https://info.bml.gv.at/service/publikationen/wasser/Neue-Broschuere_Mehr-Natur-fuer-unsere-Fluesse---Gewaesseroekologische-Erfolge-in-Oesterreich.html.

Available in German.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**NRL articles addressed**
Alpine	Rivers	General Guideline	Planning, Implementation	4, 7

9.1.11 Bundesministerium für Land- und Forstwirtschaft, Regionen und Wasserwirtschaft (2023). **15 years of promoting aquatic ecology in Austria [Lebenswerte Flüsse - 15 Jahre Förderung Gewässerökologie in Österreich].** https://info.bml.gv.at/service/publikationen/wasser/lebenswerte-fluesse.html.

Available in German.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**NRL articles addressed**
Alpine	Rivers	General Guideline	Planning, Implementation	4, 7

9.1.12 Bundesministerium für Land- und Forstwirtschaft, Regionen und Wasserwirtschaft (n.d.). **Ecology in Flood Protection [Ökologie im Hochwasserschutz].** https://info.bml.gv.at/themen/wasser/gewaesserbewirtschaftung/umsetzungsprojekte/oekologie_hochwasserschutz.html.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Rivers	General Guideline	Planning, Implementation	4, 7

9.1.13 Schröck, C. Glatzel, S., Lorenz, J., Machold, C. – Bundesministerium für Landwirtschaft, Regionen und Tourismus (2022). **Peatland Strategy Austria 2030+ [Moorstrategie Österreich 2030+].** https://info.bml.gv.at/service/publikationen/wasser/moorstrategie-oesterreich-2030.html.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Wetlands, Peatlands, Bogs, Mires	General Guideline	Planning	4, 9

9.1.14 Glatzel, S., Pühringer, C., Bachner, G., Lazowski, W., Schwarz, U. – Bundesministerium für Land- und Forstwirtschaft, Regionen und Wasserwirtschaft (2023). **Floodplain Strategy Austria 2030+ [Auenstrategie Österreich 2030+].** https://info.bml.gv.at/service/publikationen/wasser/auenstrategie-oesterreich-2030.html.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Floodplains	General Guideline	Planning	4, 7

9.1.15 Oberleitner, I. – Lebensministerium (2006**). Austrian Wetland Strategy [Österreichische Feuchtgebietsstrategie].** https://info.bml.gv.at/themen/wasser/wasser-eu-international/europaeische-und-internationale-wasserwirtschaft/feuchtgebiete/nationale-umsetzung/feuchtgebstrategie.html.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Wetlands	General Guideline	Planning	4

9.1.16 Markut, T., Meindl, P., Kummer, S. (2022). **Agroforestry – From Idea to Implementation [Agroforst- Von der Idee bis zur Umsetzung].** https://www.fibl.org/de/shop/1248-agroforst.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Agricultural Ecosystems	General Guideline	Planning, Implementation	9

9.1.17 Ländliches Fortbildungs Institut (2020). **Location Adapted Alpine Pasture Management – From Knowledge to Action [Almen standortangepasst bewirtschaften – Vom Wissen zum Handeln].**

https://noe.lko.at/media.php?filename=download%3D%2F2021.03.25%2F1616673930126673.pdf&rn=03_Almen_standortgemaess_bewirtschaften_2020.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Agricultural Ecosystems, Grasslands	General Guideline	Planning, Implementation	4, 9

9.1.18 Bergmüller, K., Nemeth, E. (2029). **Evaluation of the impacts of agri-environement measures using bird data [Evaluierung der Wirkungen von Agrarumweltmaßnahmen anhand von Vogeldaten].** BirdLife Österreich, Bundesministerium für Nachhaltigkeit und Tourismus]. https://www.zobodat.at/pdf/Birdlife-Projektberichte_4_2019_0001-0042.pdf.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Agricultural Ecosystems, Grasslands	General Guideline	Planning, Implementation	4, 9

9.1.19 Österreichisches Kuratorium für Landtechnik und Landentwicklung (2023). **Nature Protection Monitoring in ÖPUL 2023 [Naturschutz Monitoring im ÖPUL 2023].** https://www.naturschutzmonitoring.at/de/startseite/.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Agricultural Ecosystems, Farmland Birds	General Guideline	Monitoring	9

9.1.20 Dürr, A., Loicht, J., Strauss, P., Hösl, R., Weninger, T. (2023). **Heck.in. Ecosystem services of hedgerows - an indicator-based assessment system [Heck.in. Hecken und ihre Ökosystemleistungen – eine Bewertung anhand von Indikatoren. Anwendungshandbuch Langfassung].** Bundesamt für Wasserwirtschaft, Petzenkirchen, AT, Eigenverlag. https://doi.org/10.5281/zenodo.8013698 English Version:

https://doi.org/10.5281/zenodo.8048413

Available in German and English.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed

Alpine	Agricultural Ecosystems	General Guideline	Planning, Implementation	9

9.1.21 Mayer, R., Starz, W., Jenšac, A. (2023). **ReKult Iris meadows: Recultivation of Iris Sibirica meadows for biodiversity and sustainable organic farming [ReKult-Iriswiesen: Rekultivierung von Iris Sibirica Wiesen für Artenvielfalt und nachhaltige ökologische Landwirtschaft].** https://dafne.at/projekte/rekult-iriswiesen#release-reports.

Available in German and English.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Grasslands, Agricultural Ecosystems	Project	Planning, Implementation	4, 9

9.1.22 Bundesministerium für Land- und Forstwirtschaft, Regionen und Wasserwirtschaft (2023). **Special Directive ÖPUL 2023 [Sonderrichtlinie ÖPUL 2023 – Sonderrichtlinie des Bundesministers für Land- und Forstwirtschaft, Regionen und Wasserwirtschaft für das Österreichische Programm zur Förderung einer umweltgerechten, extensiven und den natürlichen Lebensraum schützenden Landwirtschaft].**

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Agricultural Ecosystems	General Guideline	Planning, Implementation	9

9.1.23 Bundesministerium für Land- und Forstwirtschaft, Regionen und Wasserwirtschaft (2018). **Austrian Forest Strategy 2020+ [Österreichische Waldstrategie 2020+].** https://info.bml.gv.at/themen/wald/walddialog/waldstrategie-2020/waldstrategie_paper.html.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Forests	General Guideline	Planning, Implementation	4, 10

9.2 Czech Republic

9.2.1 Jongepierová. I., Pěsout, P., Jongepier, J.W., Prach, K. (2012). **Ecological restoration in the Czech Republic.** Nature Conservation Agency of the Czech Republic. Knihovna.nature.cu

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Forests, Wetlands, Grasslands, Rivers	General Guideline	Planning	4, 7, 10

9.2.2 Jongepierová. I., Pěsout, P., Jongepier, J.W., Prach, K. (2012**). Ecological restoration in the Czech Republic II.** Nature Conservation Agency of the Czech Republic. https://knihovna.nature.cz/media-viewer?rootDirectory=73236&origin=https%3A%2F%2Fknihovna.nature.cz%2Frecords%2F8011fa0e-1486-4424-b057-a183f6c5697e#!?file=30871

Available in Czech and English.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Forests, Grasslands, Heathlands, Rivers, Wetlands, Urban Ecosystems	General Guideline	Planning	4, 6, 7, 10

9.3 Finland

9.3.1 Kotiaho, J.S., Kuusela, S., Nieminen, E., Päivinen, J., and Moilanen, A. (2016). **Framework for assessing and reversing ecosystem degradation – Report of the Finnish prioritization working group on the options and costs of meeting**

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Available in Finnish and English.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	General Guidance	General Guideline	Planning	N/A

9.3.2 Ympäristöministeriö Miljöministeriet – Ministry of the Environment (n.d.). **Helmi habitats programme aims to strengthen biodiversity.** https://ym.fi/en/helmi-habitats-programme.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	Wetlands, Mires, Grasslands, Coastal Ecosystems, Woodlands, Forests	Project	Planning, Implementation	4, 10

9.3.3 Metso (n.d.). **Forest Biodiversity.** https://metsonpolku.fi/en/frontpage.

Available in Finnish, Swedish and English.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	Forests	Project	Implementation	4, 10

9.3.4 Similä, M., Junninen, K. (eds) (2012). **Ecological restoration and management in boreal forests – best practices from Finland. Metsähallitus.** https://julkaisut.metsa.fi/en/publication/ecological-restoration-and-management-in-boreal-forests-best-practices-from-finland/.

Available in Finnish, Sámi, Swedish and English.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed

Boreal	Forests	General Guideline	Planning, Implementation, Monitoring	4, 10

9.3.5 Aapala, K., Similä, M., Penttinen, J. (2013). **Restoration guide for drained peatlands [Ojitettujen soiden ennallistamisopas].** https://julkaisut.metsa.fi/julkaisu/ojitettujen-soiden-ennallistamisopas/ English Version: https://julkaisut.metsa.fi/wp-content/uploads/sites/2/2021/02/ecolres-peatlands-1.pdf.

Available in Finnish and English.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	Peatlands	General Guideline	Planning, Implementation	4

9.3.6 Eskelinen, I., Juutinen, R. (n.d.). **Restoration Guide [Lähteikköjen ennallistamisopas].** https://vesi.fi/aineistopankki/wp-content/uploads/2023/06/Lahteikkojen-ennallistamisopas_s.pdf.

Available in Finnish.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	Wetlands	General Guideline	Planning, Implementation	4

9.3.7 Suomen ympäristökeskus Finlands miljöcentral – Finnish Environmental Institut (n.d.). **Open Information**. https://www.syke.fi/en-US/Open_information.

Available in Finnish, Swedish and English.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	General Guidance	Database	Planning, Implementation, Monitoring	N/A

9.3.8 LAJI.FI (n.d.). **Finnish Biodiversity Information Facility.** https://laji.fi/en.

Available in Finnish, Swedish and English.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	General Guidance	Database	Planning, Implementation, Monitoring	N/A

9.3.9 Suomen ympäristökeskus Finlands miljöcentral – Finnish Environmental Institut (n.d.). **Zonation in Finland**. https://www.syke.fi/zonation/en.

Available in Finnish, Swedish and English.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	General Guidance	Database	Planning	N/A

9.4 France

9.4.1 Pearltrees (2023). **21 initiatives to adapt protected areas to climate change [21 démarches d'adaptation d'aires protégées au changement climatique].** http://www.pearltrees.com/aires_protegees_et_changement_climatique/adaptation-changement/id39742490.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	General Guidance	Database	Planning, Implementation	4, 5, 10

9.4.2 Dasnias, P. (2002). **Ecological development of water quarries [Aménagement écologique des carrières en eau].** https://www.genieecologique.fr/reference-biblio/amenagement-ecologique-des-carrieres-en-eau.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	General Guidance	General Guideline	Planning, Implementation	4

9.4.3 Poulet, N., Séon-Massin, N., Basilico, L. (2012). **Aquatic Biodiversity: From Diagnosis to Restoration [Biodiversité aquatique: du diagnostic à la restauration].** https://www.genieecologique.fr/sites/default/files/documents/biblio/rencontre-biodiversite-aquatique.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Mediterranean	Marine Ecosystems	General Guideline	Planning, Implementation	5

9.4.4 Dellinger, S. (2020). **Designing and implementing an ecological engineering project [Conception et mise en oeuvre d'un projet de génie écologique].** https://catalogue.bnf.fr/ark:/12148/cb46622287p;jsessionid=35D5609BF8C3C04C8A1FAAB92D92DD7B.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	General Guidance	General Guideline	Planning, Implementation	N/A

9.4.5 Direction interrégionale de la mer Méditerranée. (2019). **Strategic Document for Ecological Restoration in the Mediterranean [Document stratégique pour la restauration écologique en Méditerranée].** PAMM Méditerranée Occidentale**.** **https://www.genieecologique.fr/sites/default/files/documents/biblio/dirm_med_-_brochure_strategie_restauration.pdf.**

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Mediterranean	Marine Ecosystems	General Guideline	Planning, Implementation	5

9.4.6 Seleck, M., Sylvain, B., Mahy, G. (2022). **Dynamic Management of Temporary Quarries [Gestion Dynamique de la Nature Temporaire en Carrières].** https://orbi.uliege.be/handle/2268/268137.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	General Guidance	General Guideline	Planning, Implementation	N/A

9.4.7 Huc,S. ; Delafoulhouze,M. ; Terpereau,G. ; Mulatero,C. ; Vahe,L. - Conservatoire Botanique National (2023). **Guide to help define stages in the restoration of herbaceous ecosystems – with wild and local plants [Guide d'aide à la définition des étapes de restauration des écosystems herbacés – avec des végétaux sauvages et locaux].** www.cbn-alpin-biblio.fr/GED_CBNA/128698094687/BB_45646.pdf.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	General Guidance	General Guideline	Planning, Implementation	4

9.4.8 Pittana,E. ; Barrel,A. ; Cerise,O. ; Culat,Al. ; Huc,S. ; Porteret,J. ; Vallee,S. ; Chabloz,D. ; Madormo,F. ; Poggio,L. ; Bassignana,M. - Conservatoire Botanique National (2020). **Guide to good practice for revegetation in Natura 2000 sites – Materials and Methods for Operators in the Sector [Guide de bonnes pratiques pour la revégétalisation dans les Sites Natura 2000 - Matériels et méthodes pour les opérateurs de la filière].** https://cbn-alpin-biblio.fr/Record.htm?idlist=10&record=19207959124910251319.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	General Guidance	General Guideline	Planning, Implementation	N/A

9.4.9 Quae, E. (2018). **Guide to the management of dunes and associated beaches [Guide de gestion des dunes et des plages associées].** https://www.onf.fr/+/21f::guide-de-gestion-des-dunes-et-des-plages-associees.html.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Mediterranean	Dunes, Coastal Ecosystems	General Guideline	Planning, Implementation	4

9.4.10 Marzo A., Herreros R., Zreik C. (Eds.) (2015). **Guide to Good Restoration Practice 9.4.11 Restoration of Mediterranean Habitats [Guide des Bonnes Pratiques de Restauration des Habitats Méditerranéens].** Ecoplantmed, ENPI, CBC-MED. www.ecoplantmed.eu/downloads/1589.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Mediterranean	Dunes, Coastal Ecosystems, Forests, Rivers	General Guideline	Planning, Implementation	4, 10

9.4.11 Abdulhak,S., Michoulier,M., Huc,S., Salmon,Q., Legland,T., Arthaud,F. (2021). **Guide to the hydrophytes of the Alps. Biology, ecology, vegetation [Guide des hydrophytes des Alpes. Biologie, écologie, végétalisation].** https://cbn-alpin-biblio.fr/Record.htm?idlist=4&record=19655313124914735959.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	General Guidance	General Guideline	Planning, Implementation	N/A

9.4.12 Léocadie, A., Pioch, S., Pinault, M. (2020). **Ecological Engineering Guide: Repairing coral reefs and associated ecosystems [Guide d'Ingénierie Écologique: La réparation des récifs coralliens et des écosystèmes associés].** Édition IFRECOR. https://www.icriforum.org/wp-content/uploads/2020/09/2d636eb8f9730ed9d4a21bf395f37680.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Mediterranean	Marine Ecosystems, Reefs	General Guideline	Planning, Implementation	5

9.4.13 Réseau sur la restauration des zones humides de Bretagne, Forum des Marais Atlantiques (n.d.). **Methodological and technical guide to wetland restoration [Guide méthodologique et technique sur la restauration des zones humides].** https://rerzh.forum-zones-humides.org/ressources-et-outils/carnets-methodologiques-et-techniques/.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic	Wetlands	General Guideline	Planning, Implementation	4

9.4.14 Jullien, E., Opériol, P. (2011). **Methodology guide - Restoring watercourses: communicating to work together [Guide méthodologique - Restauration des cours d'eau : communiquer pour se concerter].** https://www.geniee-cologique.fr/sites/default/files/documents/biblio/guide_restauration-ce.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	Rivers	General Guideline	Planning	4, 7

9.4.15 Gourdain, P. (ed.) (2022). **Guide to monitoring hydromorphological restoration operations in watercourses [Guide pour l'élaboration des suivis**

d'opérations de restauration hydromorphologique en cours d'eau]. https://www.genieecologique.fr/sites/default/files/documents/biblio/naturae2022a5pdfa.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	Rivers	General Guideline	Monitoring	4, 7

9.4.16 Délégation Régionale du Centre National de la Propriété Forestière Nord Pas-de-Calais Picardie (2012). **Guide to the restoration of riparian zones [Guide pour la restauration des ripisylves].** https://www.genieecologique.fr/sites/default/files/documents/biblio/brochure_ripisylves.pdf.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	Rivers, Riparian Habitats	General Guideline	Planning, Implementation	4, 7

9.4.17 Predoni, M. (2016). **RESTAUREG: Practical guide to regulatory procedures [RESTAUREG : Guide pratique des démarches réglementaires].** https://www.genieecologique.fr/reference-biblio/restaureg-guide-pratique-des-demarches-reglementaires.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Mediterranean	Coastal Ecosystems, Marine Ecosystems	General Guideline	Planning, Implementation	4, 5

9.4.18 Gudefin A., Lenfant P., Fonbonne S., Boissery P. 2022**. Technical guide - Evaluation of experimental pilots and ecological restoration work, the case of harbour nurseries [Guide technique - Evaluation des pilotes expérimentaux et**

des travaux de restauration écologique, cas des nurseries portuaires]. ICO Solutions / DRIVER / Agence de l'Eau Rhône Méditerranée Corse. https://www.restauration-ecologique.com/_files/ugd/bed0fd_fbaa93941f4047fba07d902cf1fe82aa.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Mediterranean	General Guidance	General Guideline	Planning, Implementation	4, 5

9.4.19 ONEMA (2014). **River Restoration and Natural Water Retention [La restauration de rivière et les mesures de rétention naturelle des eaux].** https://www.genieecologique.fr/sites/default/files/documents/biblio/rencontres-n331.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	Rivers	General Guideline	Planning, Implementation	4, 7

9.4.20 Capderrey, C., Olivier, JM., Moussard, S., Foussard, V., Bacq, N. (2016**). Feedback from the ecological restoration of estuarine environments [Retours d'expériences de restauration écologique en milieu estuarien].** ONEMA https://professionnels.ofb.fr/sites/default/files/pdf/actus/Capderrey%20et%20al%202016%20Retex%20restauration%20ecologique%20estuaires.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	Rivers, Coastal Ecosystems	General Guideline	Planning, Implementation	4

9.4.21 Soyer, H., Rivallain, M., Reynaud, C., Tordera, L. (2022). **Taking action for urban biodiversity: Ecological engineering for nature in the city [Agir pour la biodiversité urbaine : le génie écologique au service de la nature en ville].** https://www.genie-ecologique.fr/wp-content/uploads/2022/11/UPGE_Synthese-GE-en-milieu-urbain_v2022.04.12.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental, Mediterranean	Urban Ecosystems	General Guideline	Planning, Implementation	6

9.4.22 Koch, EM., Spiegelberger, T., Barrel, A., Bassignana, M., Curtaz, A. (2015). **Local seeds in ecological restoration in mountain areas – Production and use of mixtures for conservation [Les semences locales dans la restauration écologique en montagne Production et utilisation de mélanges pour la preservation].** https://www.osug.fr/IMG/pdf/alp_grain_fra.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Grasslands	General Guideline	Planning, Implementation	4

9.4.23 UICN Comité français (2022). **Nature-based Solutions for gravitational risks and wildfires in France [Les Solutions fondées sur la Nature pour les risques gravitaires et incendie en France].** Paris, France. https://uicn.fr/wp-content/uploads/2023/03/sfn-foret-web.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	Forests	General Guideline	Planning, Implementation	4, 10

9.4.24 UICN Comité français (2022). **Nature-based Solutions for coastal risks in France [Les Solutions fondées sur la Nature pour les risques littoraux en France].** Paris, France. https://uicn.fr/wp-content/uploads/2022/07/sfn-littoraux-web.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Mediterranean	Coastal Ecosystems	General Guideline	Planning, Implementation	4

9.4.25 UICN Comité français (2019). **Nature-based Solutions for water-related risks in France [Les Solutions fondées sur la Nature pour les risques liés à l'eau en France].** Paris, France. https://uicn.fr/wp-content/uploads/2020/01/sfn-light-ok.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	Wetlands, Rivers, Lakes	General Guideline	Planning, Implementation	4

9.4.26 Agence de l'eau Seine-Normandie (2007). **Manual for the hydromorphological restoration of watercourses [Manuel de restauration hydromorphologique des cours d'eau].** https://www.genieecologique.fr/reference-biblio/manuel-de-restauration-hydromorphologique-des-cours-deau.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	Rivers	General Guideline	Planning, Implementation	4, 7

9.4.27 Les Rencontres (2017). **Restoring River Connectivity: Exemplary Initiatives from France and Europe [Restauration de la continuité des rivières : des démarches exemplaires à mettre en lumière en France et en Europe].**

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Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	Rivers, River Connectivity	General Guideline	Planning, Implementation	4, 7

9.4.28 Life Marha (n.d.). **Restoration of degraded environments - Installation of ecological moorings [Restauration de milieux dégradés - Installation de mouillages écologiques].** https://www.life-marha.fr/node/339.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Mediterranean	Marine Ecosystems	General Guideline	Planning, Implementation	5

9.4.29 Ministère de la Transition Écologic (n.d.). **Create, manage and organise anchorage and light equipment zones (ZMEL) [Créer, gérer et organiser les zones de mouillage et d'équipements légers (ZMEL)].** https://mer.gouv.fr/sites/default/files/2020-12/Guide_zone_mouillage_equipements_legers_0.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Mediterranean	Marine Ecosystems	General Guideline	Planning, Implementation	5

9.4.30 Malaval, S., Couëron,G., Cambecèdes J., Largier, G. (2019). **Ecological restoration of meadows and in the Pyrenees: a technical guide to regenerating degraded soils and in the mountains [Restauration écologique de prairies et de pelouses pyrénéennes - un guide technique pour régénérer les sols et les**

végétations dégradés en montagne]. https://www.genieecologique.fr/sites/default/files/documents/biblio/restauration-ecologique-revegetalisation_pyrenees.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Grasslands, Soils	General Guideline	Planning, Implementation	4, 9

9.4.31 Huc,S., Arlandis Fores,J., Dupre La Tour,A., Rouillon,A., Spiegelberger,T. (2018). **Sem'les Alpes. Locally sourced seeds to restore open habitats in the Alps [Sem'lesAlpes: des semences d'origine locale pour la restauration de milieux ouverts en montagne alpine].** https://cbn-alpin-biblio.fr/Record.htm?idlist=7&record=19295740124910139229.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Grasslands	General Guideline	Planning, Implementation	4

9.4.32 Lenfant P., Gudefin A., Fonbonne S., Lecaillon G., Aronson J., Blin E., Lourie S.M., Boissery P., Loeuillard J.-L., Palmaro A., Herrouin G., Person J. (2015). **Ecological restoration of Mediterranean shallow water nurseries [Restauration écologique des nurseries des petits fonds côtiers de Méditerranée].** Orientations et principes. https://www.genieecologique.fr/sites/default/files/documents/biblio/guide_restauration_ecologique_petits_fonds_cotier_mediterranee_driver.pdf.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Mediterranean	Marine Ecosystems	General Guideline	Planning, Implementation	5

9.4.33 UICN Comité français (2012). **Ecological restoration for protected areas – Principles, guidelines and best practice [Restauration écologique pour les**

aires protégées - Principes, lignes directrices et bonnes pratiques]. https://www.iucn.org/fr/content/restauration-ecologique-pour-les-aires-protegees.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	General Guidance	General Guideline	Planning, Implementation	N/A

9.4.34 Barre, V., Aubanel, A., Chapius, JL., Barnaus, G., Bagnis, R. (2003). **Reef restoration: a practical guide for decision-makers and developers [Restauration récifale: guide pratique à l'usage des décideurs et aménageurs].** https://www.genieecologique.fr/sites/default/files/documents/biblio/restauration_recifale_guide_decideurs_amenageurs_ifrecor_2003.pdf.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Mediterranean	Marine Ecosystems, Reefs	General Guideline	Planning, Implementation	5

9.4.35 Rey, F. (2018). **Habitat Restoration and Flood Prevention through Vegetation Engineering [Restaurer les milieux et prévenir les inondations grâce au génie vegetal].** https://www.quae.com/produit/1485/9782759227792/restaurer-les-milieux-et-prevenir-les-inondations-grace-au-genie-vegetal. *Not open access.*

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	Riparian Habitats	General Guideline	Planning, Implementation	4

9.4.36 Wetland-Based Solutions (2020). **[Restoring Mediterranean wetlands: the new policy-maker's guide to sustainable management and ecosystem restoration by 2030 [Restaurer les zones humides méditerranéennes : le nouveau guide**

du décideur politique pour une gestion durable et la restauration des écosystèmes d'ici à 2030]. The Mava Foundation. French: https://tourduvalat.org/download/38450/. English: https://tourduvalat.org/en//download/38456/.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	Wetlands	General Guideline	Planning, Implementation	4

9.4.37 Cerema (2022). **Monitoring Nature-based adaptation solution (SafN) projects - Indicator repository based on the 10 pilot sites of the demonstrator programme of the ARTISAN integrated LIFE project [Suivi des projets de Solutions d'adaptation fondées sur la Nature (SafN) - Référentiel d'indicateurs fondé sur les 10 sites pilotes du programme démonstrateur du projet LIFE intégré ARTISAN].** https://www.ofb.gouv.fr/sites/default/files/2022-06/ARTISAN_D4_R%C3%A9f%C3%A9rentiel_vf.pdf.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine, Atlantic, Continental, Mediterranean	General Guidance	General Guideline	Planning, Implementation	N/A

9.4.38 CBN (2023). **Toolkit for monitoring the ecological restoration of open grassland environments [Boîte à outils de suivi de la restauration écologique des milieux ouverts herbacés].** https://cbn-alpin-biblio.fr/GED_CBNA/128791394697/BB_45781.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Alpine	Grasslands	General Guideline	Monitoring	4

9.5 Germany

9.5.1 Ammon-Kujath, I. (2005). **Guidelines for the restoration of wetlands in Brandenburg [Leitfaden zur Renaturierung von Feuchtgebieten in Brandenburg].** Studien und Tagungsberichte des Landesumweltamtes Brandenburg, Bd. 50. https://lfu.brandenburg.de/cms/media.php/lbm1.a.3310.de/lua_bd50.pdf.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Wetlands	General Guideline	Planning	4

9.5.2 Buchwald, R., Rosskamp, T., Steiner, L., & Willen, M. (2011). **Restoration and creation of species-rich meadows through mowing - a contribution to nature conservation in intensively utilised landscapes [Wiederherstellung und Neuschaffung artenreicher Mähwiesen durch Mähgut-Aufbringung–ein Beitrag zum Naturschutz in intensiv genutzten Landschaften].** Abschlussbericht Deutsche Bundesstiftung Umwelt.
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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Grasslands	General Guideline	Planning	4

9.5.3 Bunzel-Drüke, M., Böhm, C., Ellwanger, G., Finck, P., Grell, H., Hauswirth, L., Herrmann, A., Jedicke, E., Joest, R., Kämmer, G., Köhler, M., Kolligs, D., Krawczynski, R., Lorenz, A., Luick, R., Mann, S., Nickel, H., Raths, U., Reisinger, E., Riecken, U., Rößling, H., Sollmann, R., Ssymank, A., Thomsen, K., Tischew, S., Vierhaus, H., Wanger, H.-G., Zimball, O. (2019). **Semi-natural grazing and NATURA 2000: Year-round grazing in the management of habitat types and species in the European protected area system NATURA 2000 [Naturnahe Beweidung und NATURA 2000. Ganzjahresbeweidung im Management von Lebensraumtypen und Arten im europäischen Schutzgebietssystem NATURA 2000].** Heinz Sielmann Stiftung, Duderstadt. 2. überarbeitete und erweiterte Auflage. https://www.abu-naturschutz.de/projekte/laufende-projekte/naturnahe-beweidung.
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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Grasslands	General Guideline	Planning, Implementation	4, 9

9.5.4 Bunzel-Drüke, M., Böhm, C., Finck, P., Kämmer, G., Luick, R., Reisinger, E., Riecken, U., Riedl, J., Scharf, M., Zimball, O. (2008). **"Wild pastures": Practical guide for year-round grazing in nature conservation and landscape development ["Wilde Weiden": Praxisleitfaden für Ganzjahresbeweidung in Naturschutz und Landschaftsentwicklung].** Arbeitsgemeinschaft Biologischer Umweltschutz im Kreis Soest eV (ABU). https://www.abu-naturschutz.de/fileadmin/user_upload/Veroeffentlichungen/Weideleitfaden/WildeWeiden.pdf.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Grasslands	General Guideline	Planning, Implementation	4, 9

9.5.5 Burkart-Aicher, A. et al. (n.d.). **Online handbook "Grazing in nature conservation" [Online-Handbuch "Beweidung im Naturschutz"].** Akademie für Naturschutz und Landschaftspflege (ANL), Laufen. http://www.anl.bayern.de/fachinformationen/beweidung/handbuchinhalt.htm.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Grasslands, Agricultural Ecosystems, Forests	General Guideline	Planning, Implementation	4, 9, 10

9.5.6 Deutscher Verband für Landschaftspflege e. V. (2018). **Guidelines for individual farm biodiversity councelling [Leitfaden für die einzelbetriebliche Biodiversitätsberatung].** Nr. 24 der DVL-Schriftenreihe „Landschaft als Lebensraum“. https://www.dvl.org/fileadmin/user_upload/Publikationen/DVL-

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Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Agricultural Ecosystems	General Guideline	Planning	9

9.5.7 Deutscher Verband für Landschaftspflege e. V. (2023). **Sowing the wild - harvesting diversity. Basics and practical insights into the production of organic seeds [Wildes säen – Vielfalt ernten. Grundlagen und Praxiseinblicke in die Produktion von Regiosaatgut].** Nr. 30 der DVL-Schriftenreihe „Landschaft als Lebensraum“. https://www.dvl.org/fileadmin/user_upload/Publikationen/DVL-Schriftenreihe_Landschaft-als-Lebensraum/DVL-Publikation-Schriftenreihe-30_Leitfaden_WildesSaen.pdf.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Grasslands	General Guideline	Planning, Implementation	4

9.5.8 Dolnik C., Jansen D., Rickert B.-H. (2020). **Practical guide BlütenMeer 2020: Developing flower meadows and heaths [Praxisleitfaden BlütenMeer 2020. Blumenwiesen und Heiden entwickeln].** Stiftung Naturschutz Schleswig-Holstein, Molfsee. https://www.stiftungsland.de/fileadmin/pdf/Bluetenmeer2020/20-2841_Praxisleitfaden_Naturschutz_Internet.pdf.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Grasslands, Heathlands	General Guideline	Planning, Implementation	4

9.5.9 Dullau, S., Tischew, S. (2019). **Grassland guidelines. Management recommendations for habitat types 6520, 6510 and 6440 in Saxony-Anhalt**

[Grünlandleitfaden. Bewirtschaftungsempfehlungen für die Lebensraumtypen 6520, 6510 und 6440 in Sachsen-Anhalt].
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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Grasslands	General Guideline	Planning, Implementation	4

9.5.10 Elias, D., Mann, S., Necker, M., Tischew, S. (Hrsg.) (2019**). Practical guide to goat grazing - Use of goats for grazing scrubland sites in the Lower Saale Valley [Praxisleitfaden Ziegenbeweidung - Einsatz von Ziegen zur Beweidung verbuschter Trockenstandorte im Unteren Saaletal].** Hochschule Anhalt, Bernburg. http://dx.doi.org/10.25673/14136.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Grasslands, Agricultural Ecosystems	General Guideline	Planning, Implementation	4, 9

9.5.11 Finke, D., Werner, M. (2020**). Species-rich green spaces - Guidelines for the creation and maintenance of species-rich green spaces along roads, paths and squares [Artenreiche Grünflächen - Handreichung zur Anlage und Pflege artenreicher Grünflächen an Straßen, Wegen und Plätzen].** Ministerium für Energiewende, Landwirtschaft, Umwelt, Natur und Digitalisierung des Landes Schleswig-Holstein (MELUND). https://www.naturschutzberatung-sh.de/fileadmin/user_upload/handlungsleitfaden_strassenbegleitgruen.pdf.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Urban Ecosystems	General Guideline	Planning, Implementation	6

9.5.12 Harnisch, M., Otte, A., Schmiede, R., Donath, T. W. (2014). **Use of mown material for the restoration of alluvial meadows [Verwendung von Mahdgut zur Renaturierung von Auengrünland].** Stuttgart, Verlag Eugen Ulmer. https://www.ulmer.de/usd-4118184/verwendung-von-mahdgut-zur-renaturierung-von-auengruenland-.html. *Not open access.*

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Grasslands, Alluvial Habitats	General Guideline	Planning, Implementation	4

9.5.13 Heinz, S., Rupp, F., Mayer, F., Kuhn, G. (2018). **Transfer - Species enrichment in grassland - Transfer of experience from nature conservation to agriculture [Transfer - Artenanreicherung im Wirtschaftsgrünland -Übertragung der Erfahrungen aus dem Naturschutz auf die Landwirtschaft].** Schriftenreihe Bayerische Landesanstalt für Landwirtschaft 8. https://www.lfl.bayern.de/mam/cms07/publikationen/daten/schriftenreihe/transfer-artenanreicherung-wirtschaftsgruenland_lfl-schriftenreihe.pdf

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Grasslands, Agricultural Ecosystems	General Guideline	Planning, Implementation	4, 9

9.5.14 Hietel, E., Reichling, T., Lenz, C. (2021). **Practical guide for the establishment and enhancement of edges and field margins [Leitfaden für naturverträgliche und biodiversitätsfreundliche Solarparks – Maßnahmensteckbriefe und Checklisten].** Hochschule Bingen. https://www.th-bingen.de/fileadmin/projekte/Solarparks_Biodiversitaet/Leitfaden_Massnahmensteckbriefe.pdf.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed

Atlantic, Continental	Grasslands, Agricultural Ecosystems	General Guideline	Planning, Implementation	4, 9

9.5.15 Kirmer, A., Jeschke, D., Kiehl, K., Tischew, S. (2022). **Practical guide for the establishment and enhancement of edges and field margins [Praxisleitfaden zur Etablierung und Aufwertung von Säumen und Feldrainen].** Eigenverlag Hochschule Anhalt, Bernburg. 3. Auflage. https://www.offenlandinfo.de/fileadmin/user_upload/Downloads/Kirmer_etal_2022_Praxisleitfaden_Saeume_und_Feldraine.pdf.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Agricultural Ecosystems	General Guideline	Planning, Implementation	9

9.5.16 Kirmer, A., Krautzer, B., Scotton, M., Tischew, S. [Hrsg.] (2011). **Practical handbook for seed collection and renaturalisation of species-rich grassland [Praxishandbuch zur Samengewinnung und Renaturierung von artenreichem Grünland].** Eigenverlag Lehr- und Forschungszentrum Raumberg-Gumpenstein. https://pudi.lubw.de/detailseite/-/publication/14301.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Grasslands	General Guideline	Planning, Implementation	4

9.5.17 Kirmer, A., Řehounková, K., Müllerová, A., Tischew, S., Šebelíková, L., Lipárová, J., Prach, K., Lencová, K. (2019). **Guidelines to establish flower-rich structures in urban and rural areas.** https://www.offenlandinfo.de/fileadmin/user_upload/Publikationen/Guidelines_flower-rich_structures_FINAL.pdf.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Grasslands, Urban Ecosystems	General Guideline	Planning, Implementation, Monitoring	4, 6

9.5.18 Kollmann, J., Kirmer, A., Tischew, S., Hölzel, N., Kiehl, K. (2019). **Restoration Ecology [Renaturierungsökologie].** Springer, Berlin. https://link.springer.com/book/10.1007/978-3-662-54913-1. *Not open access.*

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	General Guidance	General Guideline	Planning	N/A

9.5.19 Meyer, S., Leuschner, C. [Hrsg.] (2015). **100 Fields for Diversity - Initiatives to promote the wild flora of arable land in Germany [100 Äcker für die Vielfalt – Initiativen zur Förderung der Ackerwildkrautflora in Deutschalnd].** Universitätsverlag Göttingen.
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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Agricultural Ecosystems	General Guideline	Planning, Implementation	9

9.5.20 Schröder, R., Jeschke, D., Walker, R., & Kiehl, K. (2020). **Extensive green roofs with native wild plants using the example of North-West Germany - a practical guide [Extensive Dachbegrünung mit gebietseigenen Wildpflanzen am Beispiel Nordwestdeutschlands-ein Leitfaden für die Praxis].** https://opus.hs-osnabrueck.de/frontdoor/deliver/index/docId/1905/file/2020_PRAXISLEITFADEN_Dachbegruenung.pdf.

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Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Urban Ecosystems	General Guideline	Planning, Implementation	6

9.5.21 Siuda, C. (2002). **Guidelines for raised bog restoration in Bavaria [Leitfaden der Hochmoorrenaturierung in Bayern].** Bayerisches Landesamt für Umweltschutz. https://www.bestellen.bayern.de/application/eshop_app000004.

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Peatlands, Bogs	General Guideline	Planning, Implementation	4

9.5.22 Siuda, C., Thiele, A. (2010). **Peatland restoration compact - action key for practice [Moorrenaturierung kompakt - Handlungsschlüssel für die Praxis].** Bayerisches Landesamt für Umweltschutz. https://www.bestellen.bayern.de/application/eshop_app000004.

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Peatlands	General Guideline	Planning, Implementation	4

9.5.23 Skowronek, S., Eberts, C., Blanke, P., & Metzing, D. (2023). **Guidelines on the use of native seeds and plants of herbaceous species in the wild in Germany: Information on the implementation of Section 40 (1) BNatSchG [Leitfaden zur Verwendung von gebietseigenem Saat-und Pflanzgut krautiger Arten in der freien Natur Deutschlands: Hinweise zur Umsetzung des § 40 Abs. 1 BNatSchG].** BfN Skripten 647. https://bfn.bsz-bw.de/frontdoor/deliver/index/docId/1117/file/Schrift647.pdf

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Grasslands	General Guideline	Planning, Implementation	4

9.5.24 Späth, J., Hoiß, B. (2023). **Creating and enhancing species-rich meadows: Practical tips and examples of mower cuttings transfer [Artenreiche Wiesen schaffen und aufwerten: Praxistipps und -beispiele zur Mähgutübertragung].** ANLiegen Natur 45(1): 63–76. https://www.anl.bayern.de/publikationen/anliegen/doc/an45111spaeth_et_al_2023_praxistipps_maehgutuebertragung.pdf

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Grasslands	General Guideline	Planning, Implementation	4, 9

9.5.25 Späth, J., Hoiß, B. (2023). **Upgrading and creating new meadows - practical tips [Wiesen aufwerten und neu schaffen – Praxishinweise].** – ANLiegen Natur 45(2): 71–80. https://www.anl.bayern.de/publikationen/anliegen/doc/an45215spaeth_et_al_2023_wiesen_aufwerten.pdf.

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Grasslands	General Guideline	Planning, Implementation	4, 9

9.5.26 Wagner, A., Wagner, I. (2005). **Guide to fenland restoration in Bavaria [Leitfaden der Niedermoorrenaturierung in Bayern].** Bayerisches Landesamt für Umweltschutz.
https://www.bestellen.bayern.de/application/eshop_app000004. *Not open access.*

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Peatlands, Fens	General Guideline	Planning, Implementation	4

9.5.27 Woesner, E., Mahdavi, P. (2019). **Grassland biotope network - A network for more biodiversity. Instructions for the development of a biotope network in grasslands [Biotopverbund Grasland - Ein Netzwerk für mehr Artenvielfalt. Anleitung zur Entwicklung eines Biotopverbunds im Grasland].** Hrsg: Projektteam „Biotopverbund Grasland“. https://www.gruenlandzentrum.org/wp-content/uploads/2021/04/GRU_20-7012-Projektbroschuere_Web.pdf.

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Grasslands	General Guideline	Planning, Implementation	4

9.5.28 Wolff, C., Schneider, S., Biver, G., Kozlik, T. (2020). **Guidance on grassland restoration methods for species-rich meadows and pastures: "Restoration of lean lowland meadows, FFH habitat type 6510" as a guideline for integration into compensation procedures, among other things [Anleitung zu Grünland-Renaturierungsverfahren von artenreichen Wiesen & Weiden: “Wiederherstellung von mageren Flachlandmähwiesen, FFH-Lebensraumtyp 6510” als Leitfaden u. a. zur Einbindung in Kompensationsverfahren].** Umweltministerium Luxemburg (MECDD) & SICONA. https://sicona.lu/wp/wp-content/uploads/Gr%C3%BCnlandrenaturierungs-Anleitung_05_2020.pdf

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Grasslands	General Guideline	Planning, Implementation	4

9.5.29 Zerbe, S., G. Wiegleb [Hrsg.] (2009). **Restoration of Ecosystems in Central Europe [Renaturierung von Ökosystemen in Mitteleuropa].** Spektrum

Akademischer Verlag, Heidelberg. https://link.springer.com/book/10.1007/978-3-8274-2161-6. *Not open access.*

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	General Guidance	General Guideline	Planning, Implementation	N/A

9.5.30 REWILD_DE (2021-2024). **Sustaining Biodiversity and Creating Ecosystem Service Opportunities through Rewilding – Learning from the Oder Delta [Erhaltung von Biodiversität und Inwertsetzung von Ökosystemleistungen durch Rewilding – vom Oder-delta lernen].** https://www.ufz.de/rewild_de/index.php?en=49448, https://www.feda.bio/en/rewild_de/, https://rewilding-oder-delta.com/en/rewilding-oder-delta/.

Available in German and English.

Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	General Guidance	General Guideline	Planning, Implementation	N/A

9.5.31 Reck, H. (2013). **Ecological necessity and practical demands upon defragmentation in Germany [Die ökologische Notwendigkeit zur Wiedervernetzung und Anforderung an deren Umsetzung].** https://www.researchgate.net/publication/290247768_Ecological_necessity_and_practical_demands_upon_defragmentation_in_Germany.

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	General Guidance	Academic Article	Planning	N/A

9.5.32 UN (n.d.). **Database of Restoration Projects in Germany [Datenbank von Wiederherstellungsprojekten in Deutschland].** https://www.undekade-restoration.de/projekte/.

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	General Guidance	Database	Planning	N/A

9.5.33 Federal Agency for Nature Conservation (2022). **Discussion Paper Monitoring in the context of ecosystem restoration (Diskussionspapier – Monitoring im Kontext von Ökosystemwiederherstellung].** https://www.bfn.de/publikationen/hintergrundpapier/monitoring-context-ecosystem-restoration.

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	General Guidance	General Guideline	Monitoring	N/A

9.5.34 BfN (2021). **BfN Publications 591 - Methodological basis for the Floodplain Status Report 2021: Recording, balancing and evaluation of floodplains [BfN-Schriften 591 - Methodische Grundlagen zum Auenzustandsbericht 2021: Erfassung, Bilanzierung und Bewertung von Flussauen].** https://www.bfn.de/publikationen/bfn-schriften/bfn-schriften-591-methodische-grundlagen-zum-auenzustandsbericht-2021.

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Rivers, Floodplains	General Guideline	Planning	4, 7

9.5.35 Steenken, S., Kleinschmidt, M., Remy, D. (2021). **Testing and development projects for floodplain restoration - monitoring success 20 years later [Erprobungs- und Entwicklungsvorhaben zur Auenrenaturierung – Erfolgskontrollen 20 Jahre später].** BfN. https://www.bfn.de/publikationen/bfn-schriften/bfn-schriften-588-erprobungs-und-entwicklungsvorhaben-zur.

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Rivers, Floodplains	General Guideline	Planning, Monitoring	4, 7

9.5.36 Zughart, W., Reiter, K., Metzmacher, A. (2020). **BfN Schriften 587 - Monitoring on National Natural Heritage Sites [BfN Schriften 587 - Monitoring auf Flächen des Nationalen Naturerbes].** BfN. https://www.bfn.de/publikationen/bfn-schriften/bfn-schriften-587-monitoring-auf-flaechen-des-nationalen-naturerbes.

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Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	General Guidance	General Guideline	Monitoring	N/A

9.5.37 Ackermann, W., Fuchs, D., Tschiche, J. (2020). **BfN Schriften 586 - Ecosystem monitoring on nationally representative sample areas (ÖSM-I) [BfN Schriften 586 - Ökosystem-Monitoring auf bundesweit repräsentativen Stichprobenflächen (ÖSM-I)].** BfN. https://www.bfn.de/publikationen/bfn-schriften/bfn-schriften-586-oekosystem-monitoring-auf-bundesweit-repraesentativen.

Available in German.

Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	General Guidance	General Guideline	Monitoring	N/A

9.5.38 Zughart, W., Stenzel, S., Fritsche, B. (2020). **BfN Schriften 585 - Comprehensive nationwide biodiversity monitoring [BfN Schriften 585 - Umfassendes bundesweites Biodiversitätsmonitoring].** BfN. https://www.bfn.de/publikationen/bfn-schriften/bfn-schriften-585-umfassendes-bundesweites-biodiversitaetsmonitoring.

Available in German.

Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	General Guidance	General Guideline	Monitoring	N/A

9.5.39 Rümmler, MC., Maercher, J., Katzschmann, A., Everding, D. (2023). **BfN publications 665/2 - Biodiversity, nature conservation and green infrastructure in neighbourhoods of "energy-efficient urban redevelopment" [BfN-Schriften 665/2 - Biologische Vielfalt, Naturschutz und grüne Infrastruktur in Quartieren der "Energetischen Stadtsanierung"].** BfN. https://www.bfn.de/publikationen/bfn-schriften/bfn-schriften-6652-biologische-vielfalt-naturschutz-und-gruene.

Available in German.

Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Urban Ecosystems	General Guideline	Planning	6

9.5.40 Hartmanshenn, T. et al. (2023). **BfN Publications 662 - Cities dare wilderness - Diversity [BfN-Schriften 662 - Städte wagen Wildnis – Vielfalt].** BfN. https://www.bfn.de/publikationen/bfn-schriften/bfn-schriften-662-staedte-wagen-wildnis-vielfalt-erleben.

Available in German.

Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Urban Ecosystems	General Guideline	Planning	6

9.5.41 Federal Agency for Nature Conservation (2023). **Riverine and coastal wetlands in Europe for biodiversity and climate [Fluss- und Küstenfeuchtgebiete in Europa für die biologische Vielfalt und das Klima].** BfN.

https://www.bfn.de/publikationen/hintergrundpapier/riverine-and-coastal-wetlands-europe-biodiversity-and-climate.

Available in English.

Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Europe	Rivers, Wetlands, Coastal Ecosystems	General Guideline	Planning	4

9.5.42 Federal Agency for Nature Conservation (2023). **Strengthening synergies for biodiversity and climate [Verstärkung der Synergien für Biodiversität und Klima].** BfN. https://www.bfn.de/publikationen/hintergrundpapier/strengthening-synergies-biodiversity-and-climate.

Available in English.

Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Europe	General Guidance	General Guideline	Planning	N/A

9.5.43 Januschke, K., Hering, D., Stammel, B., Brunzel, S., Scholz, M., Rumm, A., Sattler, J., Fischer-Bedtke, C., Makiej, A., Foecker, F. (2023). **BfN publications 655 - Biocoenotic success monitoring of restoration measures on river banks and in floodplains [BfN-Schriften 655 - Biozönotische Erfolgskontrolle von Renaturierungsmaßnahmen an Gewässerufern und in Auen].** BfN. https://www.bfn.de/publikationen/bfn-schriften/bfn-schriften-655-biozoenotische-erfolgskontrolle-von.

Available in German.

Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Rivers, Floodplains, Rivers, Alluvial Habitats, Riparian Habitats	General Guideline	Planning, Implementation	4, 7

9.5.44 Baum, S., Chalwatzis, D., Böhner, H.G.S., Oppermann, R., Röder, N. (2022). **BfN Schriften 630 - Effect of ecological priority areas on the achievement of biodiversity targets in arable landscapes [BfN Schriften 630 - Wirkung ökologischer Vorrangflächen zur Erreichung der Biodiversitätsziele in Ackerlandschaften].** BfN. https://www.bfn.de/publikationen/bfn-schriften/bfn-schriften-630-wirkung-oekologischer-vorrangflaechen-zur-erreichung.

Available in German.

Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Agricultural Ecosystems	General Guideline	Planning, Implementation	9

9.5.45 Närmann, F., Birr, F., Kaiser, M., Nerger, M., Luthardt, V., Zeitz, J., Tanneberger, F. (2021). **BfN Schriften 616 - Climate-friendly, biodiversity-promoting management of fenland soils [BfN Schriften 616 - Klimaschonende, biodiversitätsfördernde Bewirtschaftung von Niedermoorböden].** BfN. https://www.bfn.de/publikationen/bfn-schriften/bfn-schriften-616-klimaschonende-biodiversitaetsfoerdernde.

Available in German.

Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Peatlands, Agricultural Ecosystems, Soils, Fens	General Guideline	Planning, Implementation	4, 9

9.5.46 Heinicke, K., Bildstein, T., Reimers, H.C., Boedeker, D. (2021). **BfN Schriften 612 - Guidelines for large-scale delineation and mapping of the habitat type "reefs" in the German Baltic Sea (EU code 1170; subtype: geogenic reefs) [BfN Schriften 612 - Leitfaden zur großflächigen Abgrenzung und Kartierung des Lebensraumtyps „Riffe“ in der deutschen Ostsee (EU-Code 1170; Untertyp: geogene Riffe)].** BfN. https://www.bfn.de/publikationen/bfn-schriften/bfn-schriften-612-leitfaden-zur-grossflaechigen-abgrenzung-und.

Available in German.

Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed

Continental	Marine Ecosystems, Reefs	General Guideline	Planning, Implementation	5

9.5.47 Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (BMU) & Bundesamt für Naturschutz (BfN) (2021). **Floodplain status report 2021 [Auenzustandsbericht 2021].** BfN. https://www.bfn.de/publikationen/broschuere/auenzustandsbericht-2021.

Available in German.

Region	Restoration target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic, Continental	Floodplains	General Guideline	Planning, Implementation	4, 7

9.6 Luxembourg

9.6.1 Schmutz, S., Vogel, B. (2018). **Continuum guide - For the selection of suitable fish ladders [Kontinuumsleitfaden – Zur Auswahl geeigneter Fischaufstiegshilfen].** https://eau.gouvernement.lu/dam-assets/publications/kontinuumsleitfaden/RAP-Kontinuumsleitfaden-Finaler-Bericht-ARE-180828-1-0.pdf.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Rivers, River Connectivity	General Guideline	Planning, Implementation	4, 7

9.6.2 Wolff, C., Schneider, S. (2020). **Anleitung zu Grünland-Renaturierungsverfahren von artenreichen Wiesen & Weiden – Wiederherstellung von mageren Flachlandmähwiesen, FFH-Lebensraumtyp 6510 – Als Leitfaden u.a. zur Einbindung in Kompensationsverfahren.** https://sicona.lu/wp/wp-content/uploads/Gr%C3%BCnlandrenaturierungs-Anleitung_05_2020.pdf.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Grasslands, Agricultural Ecosystems	General Guideline	Planning, Implementation	4, 9

9.6.3 Arendt, A., Heumann, S. (2021). **Accompanying document for the restoration of spring biotopes [Begleitdokument zur Instandsetzung von Quellbiotopen].** https://environnement.public.lu/fr/publications/eaux/leitfaden-quellbiotopen.html.

Available in German.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Wetlands	General Guideline	Planning	4, 7

9.6.4 Schleimer, A., Cantú-Salazar, L., Frantz, A. (2022). **Recommendations on the optimal establishment of breeding ponds for the northern crested newt (Triturus cristatus) in southwestern Luxembourg.** *(in prep.)*

Available in English.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Ponds	General Guideline	Planning, Implementation	4

9.6.5 Le Gouvernment du Grand-Duché de Luxembourg, Bureau d'études Micha Bunusevac, Bertrange (2007). **Restoration of watercourses. Restoration of wetland habitats.** https://www.genieecologique.fr/sites/default/files/documents/biblio/renaturation_des_cours_d_eau_-_restauration_des_habitats_humides_-_light.pdf.

Available in French.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Continental	Rivers, Wetlands	General Guideline	Planning, Implementation	4, 7

9.7 Netherlands

9.7.1 Centraal Bureau voor de Statistiek (n.d.). **Natural Capital and Welfare in the Netherlands [Natuurlijk kapitaal en brede welvaart in Nederland].** https://www.deepl.com/translator#nl/en/Natuurlijk%20kapitaal%20en%20brede%20welvaart%20in%20Nederland.

Available in Dutch.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic	General Guidance	Database	Monitoring	N/A

9.7.2 Atlas Natuurlijk Kapitaal (n.d.). **Nature Capital Model [Natuurlijk Kapitaal Model].** https://www.atlasnatuurlijkkapitaal.nl/natuurlijk-kapitaal/nk-model.

Available in Dutch.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic	General Guidance	Database	Planning, Monitoring	N/A

9.7.3 Rijksoverheid (n.d). **Societal Cost-Benefit Analysis Guidance for Nature [Maatschappelijke kosten-batenanalyse richtlijnen voor de natuur].** https://www.rijksoverheid.nl/onderwerpen/ruimtelijke-ordening-en-gebiedsontwikkeling/vraag-en-antwoord/wanneer-kan-ik-een-maatschappelijke-kosten-batenanalyse-mkba-inzetten.

Available in Dutch.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Atlantic	General Guidance	Database	Planning	N/A

9.8 Spain

9.8.1 Ministerio para la Transición Ecológica y el Reto Demográfico (2022). **Guidelines for Ecological Restoration in Spain [Directrices para la Restauración ecológica en España].** https://ssweb.seap.minhap.es/almacen/. *Not open access.*

Available in Spanish.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Mediterranean	General Guidance	General Guideline	Planning, Implementation	N/A

9.9 Sweden

9.9.1 Ministry of the Environment (2021). **Prioritised Action Framework for Natura 2000 in Sweden 2021-2027.** https://www.naturvardsverket.se/4ac400/globalassets/vagledning/skyddad-natur/natura-2000/se-final-paf-22-nov-2021.pdf.

Available in English.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	General Guidance	General Guideline	Planning, Implementation	N/A

9.9.2 Naturvårdsverket (n.d.). **Specis and habitat guides [Art – och naturtypsvisa vägledningar].** https://www.naturvardsverket.se/vagledning-och-stod/skyddad-natur/natura-2000-i-sverige/#E1182925248.

Available in Swedish.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	General Guidance	Database	Planning, Implementation	N/A

9.9.3 Naturvårdsverket (2023). **Nature and culture conservation management of forests [Natur – och kulturvårdande skötsel av skog].** https://www.naturvardsverket.se/vagledning-och-stod/skyddad-natur/natur--och-kulturvardande-skotsel-av-skog/.

Available in Swedish.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	Forests	General Guideline	Planning, Implementation	4, 10

9.9.4 Naturvårdsverket (n.d.). **Action Programme for Threatened Species and Habitats [Åtgärdsprogram för hotade arter och naturtyper].** https://www.naturvardsverket.se/publikationer/atgardsprogram/.

Available in Swedish (often with a summary in English).

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	General Guidance	Database	Planning, Implementation	4

9.9.5 Länsstyrelserna (2022). **Handbook for management and restoration of rich fens [Handbok för skötsel och restaurering av rikkärr Länsstyrelsen Dalarnas rapport 2022:11].** https://catalog.lansstyrelsen.se/store/26/resource/177.

Available in Swedish.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	Wetlands, Fens	General Guideline	Planning, Implementation	4

9.9.6 Skogsstyrelsen (n.d.). **Methods for plugging and cover up of ditches [Metoder för dikespluggning och igenläggning av diken].** https://www.skogsstyrelsen.se/om-oss/var-verksamhet/projekt/grip-on-life/nyheter/metoder-for-dikespluggning-och-dikesigenlaggning/.

Available in Swedish.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	N/A	General Guideline	Planning, Implementation	4, 9

9.9.7 Sveriges geologiska undersökning (n.d.). **Geological guidance for wetland measures [Geologisk handledning för våtmarksåtgärder].** https://www.sgu.se/anvandarstod-for-geologiska-fragor/geologisk-handledning-for-vatmarksatgarder/.

Available in Swedish.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	Wetlands	Website	Planning, Implementation	4

9.9.8 Riksantikvarieämbetet (2021). **Planning of management and restoration of grazed forests [Skötselplanering i skogsbetesmarker – vägledning].** https://www.raa.se/app/uploads/2022/01/Skotselplanering-i-skogsbetesmarker_Vagledning.pdf.

Available in Swedish.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	Forests	General Guidelines	Planning, Implementation	4, 10

9.9.9 Lennartsson, T., Westin, A. (2019**). Meadows and mowing – history, ecology, nature conservation and cultural heritage management [Ängar och slåtter – historia, ekologi, natur- och kulturmiljövård].** https://raa.diva-portal.org/smash/record.jsf?pid=diva2%3A1331194&dswid=8778.

Available in Swedish.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Boreal	Grasslands	General Guidelines	Planning, Implementation	4

10 Appendix 1: Additional Resources

10.1 FIDELIO (2019-2024). **Forecasting Social Impacts of Biodiversity Conservation Policies in Europe.** https://cordis.europa.eu/project/id/802605.

A quarter of EU land is currently covered by protected areas (PAs). Based on the EU Biodiversity Strategy for 2030, terrestrial PAs should cover a minimum of 30 % of EU land. The purpose is to guarantee biodiversity conservation. In this context, the EU-funded FIDELIO project will explore the social impacts that may obstruct the effective management of PAs. It will develop the first paradigm to understand how perceptions of social impacts are formulated. The project will carry out two rounds of social surveys in 4 PAs across Europe and test the framework in 15 PAs. To maximise the social benefits for local communities, FIDELIO will increase our understanding of social impacts and predict their future change.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Europe	General Guidance	Project	Planning	N/A

10.2 Parisi, F., Lee, Y., Bitsch, J., Schmoeker, G., Quenta Herrera, E., Wang, J., Hofer, T., Marchant, R., Chettri, Nakul, Liniger, H. (2022). **Ecosystem restoration in the mountains - Policy brief.** International Centre for Integrated Mountain Development (ICIMOD); Mountain Partnership Secretariat. https://lib.icimod.org/record/36105.

This policy brief focuses on ecosystem restoration in the mountains. It highlights the role of healthy mountain ecosystems and their services and provides a set of recommendations to help design effective restoration plans. It also reflects on the achievements made during the last 20 years.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Global	General Guidance	Policy Brief	Planning	N/A

10.3. ECOPOTENTIAL (2015-2019). **Improving Future Ecosystem Benefits Through Earth Observations.** https://cordis.europa.eu/project/id/641762.

Terrestrial and marine ecosystems provide essential services to human societies. Anthropogenic pressures, however, cause serious threat to ecosystems, leading to habitat degradation, increased risk of collapse and loss of ecosystem services. Knowledge-based conservation, management and restoration policies are needed to improve ecosystem benefits in face of increasing pressures. ECOPOTENTIAL makes significant progress beyond the state-of-the-art and creates a unified framework for ecosystem studies and management of protected areas (PA). ECOPOTENTIAL focuses on internationally recognized PAs in Europe and beyond in a wide range of biogeographic regions, and it includes UNESCO, Natura2000 and LTER sites and Large Marine Ecosystems. Open and interoperable access to data and knowledge is assured by a GEO Ecosystem Virtual Laboratory Platform, fully integrated in GEOSS. Support to transparent and knowledge-based conservation and management policies, able to include information from EO data, is developed. Knowledge gained in the PAs is upscaled to pan-European conditions and used for planning and management of future PAs. A permanent stakeholder consultancy group (GEO Ecosystem Community of Practice) will be created.

Region	**Restoration target**	**Type of Source**	**Stage of Restoration Process**	**NRL articles addressed**
Europe	General Guidance	General Guideline	Planning	N/A

10.4 US Army Corps of Engineers (n.d.). **Kissimmee River Restoration Project.** https://www.saj.usace.army.mil/Missions/Environmental/Ecosystem-Restoration/Kissimmee-River-Restoration/.

The Kissimmee River once meandered for 103 miles through central Florida. Its floodplain, reaching up to two miles wide, was inundated for long periods by heavy seasonal rains. Wetland plants, wading birds and fish thrived there. Between 1962 and 1971, the river was cut and dredged into a 30-foot-deep straightaway called the C-38 canal, harming the river-floodplain ecosystem. The restoration project initiated in 1999 includes construction (restoring physical system), operations (restoring hydrology), and ecological response (monitoring the return of animals and vegetation). When restoration is completed in 2030, more than 40 square miles of river-floodplain ecosystem will be restored, including almost 12,398 acres of wetlands and 40 miles of historic river channel. So far, compared to conditions prior to restoration, the river and its floodplain have improved in remarkable ways, at times surpassing the anticipated environmental response.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Global	Rivers	General Guideline	Planning, Implementation	4, 7

10.5 Wang, Y., Sun, Y., Chang, S., Wang, Z., Fu, H., Zhang, W., Hou, F. (2020). **Restoration Practices Affect Alpine Meadow Ecosystem Coupling and Functions.** In: Rangeland Ecology & Management, Vol. 73, No. 3, pp. 441-451. https://doi.org/10.1016/j.rama.2020.01.004.

This study provides guidelines for herders and policy makers for the urgent task of restoring degraded alpine meadows. The results of this study suggest that comprehensive restoration practices include grazing and agronomy techniques (fertiliser, overseeding, and sward ripping) that result in the greatest level of ecosystem coupling, while the single restoration practice leads to poorly coupled ecosystems. Restoration practice changes in ecosystem functionality are positively related to changes in ecosystem coupling. The results highlight the importance of diversified restoration practices for facilitating ecological coupling and functioning in the degraded alpine meadow.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Europe	Grasslands	General Guideline	Planning	4

10.6 Biodiversa (n.d.). **Marine Protected Areas in a changing climate.** https://www.biodiversa.eu/2022/10/06/marine-protected-areas-in-a-changing-climate/.

This policy brief summarises the research showing that effectiveness of Marine Protected Areas (MPAs) depends on their management objectives, their level of protection, and the proximity to other areas with various human pressures. It demonstrates the importance to include spatially explicit biophysical models, genetic diversity within fish species, and species isolation and dispersal when managing and developing measures for MPAs. The brief also recommends considering the climate change effects in MPA effectiveness and opt for management options that increase climate change resilience.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed

Europe	Marine Ecosys-tems	Policy Brief	Planning	5

10.7 BlueBRIDGE (2015-2018). **Building Research environments for fostering Innovation, Decision making, Governance and Education to support Blue growth.** https://cordis.europa.eu/article/id/236351-a-virtual-platform-for-data-access-analysis-and-publication-helps-shape-blue-growth.

Blue Growth is the term applied to the long-term strategy for sustainable growth in the marine and maritime sectors. The EU-funded BlueBRIDGE project has helped build the necessary knowledge infrastructure for workflows and informed decision making across domains. The potential that seas and oceans hold out for increased European economic growth and innovation, is recognised by the EU's 2020 strategy for smart, sustainable and inclusive growth. The Blue Growth strategy includes developing sectors likely to result in sustainable jobs and growth (e.g. aquaculture), ensuring international cooperation and enabling the cultivation and sharing of knowledge and expertise. The EU-funded BlueBRIDGE project was set up specially to address this last objective, through the leveraging of pre-existing data and e-infrastructures to generate knowledge products and their dissemination. The project team developed 66 web-based platforms, referred to as 'Virtual Research Environments' (VREs), each giving access to tailored data and services providing a better understanding of the marine and maritime environments, their living resources and economies.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**NRL articles addressed**
Europe	Marine Ecosys-tems	Project	Planning	5

10.8 UNEP. (2021). **Guidelines on Seagrass Ecosystem Restoration for the Western Indian Ocean Region.** https://www.unep.org/resources/report/guidelines-seagrass-ecosystem-restoration.

The guidelines in this document describe seagrass ecosystems in the Western Indian Ocean region, considerations for restoration, restoration methods, how to identify restoration sites, principles of best practice, monitoring, and a how to construct a seagrass restoration management plan.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Global	Marine Ecosystems, Coastal Ecosystems, Seagrass	General Guideline	Planning, Implementation, Monitoring	5

10.9 Zepeda-Centeno C., Mariño-Tapia I., McLeod E., Rodríguez-Martínez R., Alvarez-Filip L., Banaszak A. T., Escudero-Castillo M., Silva-Casarín R., Mendoza-Baldwin E., Beck M., and Shaver E. 2018. **Guidance Document for Reef Management and Restoration to Improve Coastal Protection: Recommendations for Global Applications based on lessons learned in Mexico.** The Nature Conservancy, Mexico. https://icriforum.org/wp-content/uploads/2020/11/Zepeda-Centeno-et-al-2018-Guidance-Document.pdf. https://icriforum.org/coralrestoration/

This guidance document aims to provide a review and recommendations on reef management and restoration for risk reduction. It synthesizes evidence of the role coral reefs play in coastal protection and the reduction of risks during disasters. It presents ecological, geological, and oceanographic factors that contribute to the coastal protection capacity of reefs and the factors that reduce this capacity. It also presents an array of risk reduction solutions to restore reef protection services, and management approaches that can help support its coastal protection values.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Global	Marine Ecosystems, Coastal Ecosystems	General Guideline	Planning	5

10.10 UNEP. (2021). **Coral Reef Restoration: A guide to coral restoration method.** https://www.unep.org/resources/report/coral-reef-restoration-guide-coral-restoration-method

The report entitled, Coral reef restoration as a strategy to improve ecosystem services, aims to assist practitioners, managers, and decision-makers to consider whether and how to use coral reef restoration as a strategy to protect coral reefs locally, regionally and globally. The report suggests coral reef restoration strategies follow four critical principles: 1) planning and assessing around specific goals and objectives, 2) identifying adaptive strategies to mitigate risks, 3) engaging local stakeholders and communities in all stages of the restoration efforts, and 4) developing long-term monitoring plans to allow for adaptive management and to improve the understanding of restoration effectiveness for specific goals.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Europe	Marine Ecosystems	General Guideline	Planning	5

10.11U.S. Dept of Commerce. (2019). **Restoration Guidelines for Coral Reefs and Associated Habitats in FKNMS.** https://nmsfloridakeys.blob.core.windows.net/floridakeys-prod/media/docs/20210803-restoration-guidelines-for-coral%20Reefs%20and%20Associated-habitats-in-fknms.pdf

This document provides an overview of activities taking place to restore coral in the Florida Keys National Marine Sanctuary (FKNMS) and restoration criteria used (e.g., species type, potential survivability, and location).

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Global	Marine Ecosystems, Reefs	General Guideline	Planning, Implementation	5

10.12. AtlantOS (2015-2019). **Optimising and Enhancing the Integrated Atlantic Ocean Observing System.** https://cordis.europa.eu/project/id/633211.

The overarching objective of AtlantOS is to achieve a transition from a loosely-coordinated set of existing ocean observing activities to a sustainable, efficient, and fit-for-purpose Integrated Atlantic Ocean Observing System (IAOOS), by defining requirements and systems design, improving the readiness of observing networks and data systems, and engaging stakeholders around the Atlantic; and leaving a legacy and strengthened contribution to the Global Ocean Observing System (GOOS) and the Global Earth Observation System of Systems (GEOSS). AtlantOS will fill existing in-situ observing system gaps and will ensure that data are readily accessible and useable. AtlantOS will demonstrate the utility of integrating in-situ and Earth observing satellite-based observations towards informing a wide range of sectors using the Copernicus Marine Monitoring Services and the European Marine Observation and Data Network and connect them with similar activities around the Atlantic. AtlantOS will support activities to share, integrate and standardize in-situ observations, reduce the cost by network optimization and deployment of new technologies, and increase the competitiveness of European industries, and particularly of the small and medium enterprises of the marine sector. AtlantOS will promote innovation, documentation and exploitation of innovative observing systems.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Europe	Marine Ecosystems	General Guideline	Planning, Monitoring	5

10.13. eBIRDS (2018). **Novel System for Environmental Monitoring Based on the Automatic Detection of Birds.** https://cordis.europa.eu/project/id/816081.

Bird tagging is used for many reasons, from basic research to fighting wildlife crime and monitoring biodiversity and species decline. Current methods rely on capture and marking with metallic rings, and recapture for follow-up purposes. The Spanish SME Inkoa Sistemas has developed a novel approach relying on radio frequency identification (RFID). Birds are marked with an RFID tag and then monitored via RFID readers throughout a system of bird feeders. Data is collected and managed wirelessly with an easy-to-use interface. The EU-funded eBIRDS project will help the team scale up the system, validate it along the complete value chain and prepare the market plan.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Europe	General Guidance	Project	Planning, Monitoring	9

10.14. BIOSPACE (2019-2024). **Monitoring Biodiversity from Space.** https://cordis.europa.eu/project/id/834709.

Biodiversity refers to the variety and variability of all life on Earth and all its levels, from genes to ecosystems. Preservation of biodiversity is therefore vital for all of life. To date, monitoring is primarily derived from field observations, e.g. counting trees and monitoring birds. However, there is a critical need to transform the way we monitor biodiversity in its entirety, in order to prevent further biodiversity loss and restore healthy levels. The EU-funded BIOSPACE project is taking a different approach by combining two cutting-edge techniques: satellite remote sensing and environmental DNA profiling. The result will be a map of biodiversity with a wider taxonomical and functional breadth and depth than human field observation.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed

Europe	General Guidance	Project	Planning, Monitoring	N/A

10.15. FRAMEwork (2020-2025). **Farmer cluster for Realising Agrobiodiversity Management across Ecosystems.** https://cordis.europa.eu/project/id/862731.

Farmer clusters are designed to start life at a bottom-up farmer level, under the guidance of a lead farmer. Although the work is often supplemented by existing agri-environment schemes, several clusters have been set up with no funding. The EU-funded FRAMEwork project is designed to enrich and innovate existing farmer clusters by liaising with local and national stakeholder groups, helping to set up new, multi-actor farmer clusters in different cropping systems in Europe, based on existing collaborations. The project aims to be innovative in the way in which it will implement EU ethics, data protection and gender regulations.

Region	**Restoration Target**	**Type of Source**	**Stage of Restoration Process**	**NRL articles addressed**
Europe	Agricultural Ecosystems	Project	Planning	9

10.16. HNV-Link (2016-2019). **High Nature Value Farming: Learning, Innovation and Knowledge.** https://cordis.europa.eu/project/id/696391.

High nature value (HNV) farmland designates “those areas in Europe where agriculture is a major land use and where that agriculture supports, or is associated with, either a high species and habitat diversity or the presence of species of European conservation concern, or both”. They are an important component of European agriculture, notably in terms of biodiversity, cultural landscape, territorial cohesion, quality products and employment. This consortium, an EIP Agri Focus Group and new partners, propose a network dedicated to supporting HNV farming, networking HNV areas covering a range of different farming systems across the EU, and to focussing on innovations improving simultaneously “socio-economic viability” and “environmental efficiency”. Conceived as a “support service” for knowledge and innovation exchanges, the HNV-Link network will give a decisive new impetus to this sector, and will provide tools to organisations, actors and networks supporting HNV farmlands. The marginality of HNV areas in conventional research and development means that HNV farming-related innovation is rarely discussed in academic exchanges. Our thematic network, both grassroots-based and transnational, can really make a difference, by connecting farmers and innovation actors in line with the vision of the EIP-Agri “operational groups."

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Europe	Agricultural Ecosystems	General Guideline	Planning	9

10.17. NI (2021-2024). **Natural Intelligence for Robotic Monitoring of Habitats.** https://cordis.europa.eu/project/id/101016970.

Global warming and pollution pose significant threats to the environment. Most of the policies put forward aim to restore and preserve ecosystems by increasing the coverage of protected biodiversity-rich land and sea areas, building on the Natura 2000 network. The EU-funded NI project aims to serve the European Green Deal via monitoring the natural habitats belonging to the network with robots able to effectively move in dunes, grasslands, forests and alpine terrains. The robots will be empowered by natural intelligence and will leverage the fusion of artificial cognition and articulated soft-robotics bodies.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Europe	General Guidance	Project	Planning	N/A

10.18. FTA (n.d.). **Online learning resource (self-paced course) on gender and restoration by the CGIAR Research Program on Forests, Trees and Agroforestry (FTA).** https://www.foreststreesagroforestry.org/news-article/new-open-access-e-learning-course-gender-and-inclusion-in-forest-landscape-restoration/.

The Gender and Inclusion in Forest Landscape Restoration course aims to strengthen the skills and knowledge of forest and landscape restoration (FLR) stakeholders about policies, approaches, and practices that strengthen integration of gender and social considerations in FLR. The goal is to help course participants find inspiration and practical guidance to contribute towards more gender-responsive FLR to generate equitable and sustainable restoration outcomes.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Europe	Forests	Project	Planning	4, 10

10.19. Derak M, Silva E, Climent-Gil E, Bonet A, López G, Cortina-Segarra J. (2023). **Multicriteria analysis of critical areas for restoration in a semiarid landscape: A comparison between stakeholder groups.** J Environ Manage. Vol.15;336:117545. doi: 10.1016/j.jenvman.2023.117545. https://pubmed.ncbi.nlm.nih.gov/36871448/.

This papers approach allowed the identification of consensual critical areas for restoration, which were mainly covered by shrublands and rainfed crops, and mostly characterized by low to medium supply of ecosystem services. Our study emphasizes the need to recognize and integrate different social perspectives when identifying critical areas for restoration and highlights the importance of using complementary approaches as decision-making support tools to define these areas.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Global	General Guidance	Academic Article	Planning	N/A

10.20. SILVA, E., et al. (2023). **Prioritizing areas for ecological restoration: a participatory approachbased on cost-effectiveness.** J. Appl. Ecol. https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2664.14395.

This paper designed a new methodology to identify high-priority areas for landscape-scale restoration. This participatory cost-effectiveness analysis model is based on execution and maintenance costs and the potential increase in the supply of multiple ecosystem services.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Global	General Guidance	Academic Article	Planning	N/A

10.21. Mazón, M., Rebolledo, V., Ojeda-Luna, T., & Romero, O. (2021). **Engagement increases people's willingness to sustain restored areas beyond financial incentives. Restoration Ecology, 29, e13352.** https://onlinelibrary.wiley.com/doi/10.1111/rec.13352.

The paper made two practical statements: Firstly, when people are actively involved in all phases of a project (i.e. planning, implementation, and monitoring) and recognize its non-monetary benefits, they are more likely to continue with restoration activities regardless of financial incentives.

Secondly, ecosystem benefits should be emphasized over direct cash payments when socializing the project to the community. The medium- and long-term socioeconomic implications for local stakeholders should be included in project planning.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Global	General Guidance	Academic Article	Planning	N/A

10.22. Fox, Helen, and Georgina Cundill (2018). **"Towards increased community-engaged ecological restoration: A review of current practice and future directions."** Ecological Restoration vol. 36.3: 208-218. https://er.uwpress.org/content/36/3/208.short.

The paper offers a review of community engagement in the ecological restoration literature. It identifies factors, that if ignored, run the risk of undermining the long-term sustainability of restoration projects.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Global	General Guidance	Academic Article	Planning	N/A

10.23. Löfqvist, S., et al. (2023). **How social considerations improve the equity and effectiveness of ecosystem restoration.** BioScience, 73(2), 134-148. https://academic.oup.com/bioscience/article/73/2/134/6865284

In the present article, we outline how social processes that are critical to restoration equity and effectiveness can be better incorporated in restoration science and policy. Drawing from existing case studies, we show how projects that align with local people's preferences and are implemented through inclusive governance are more likely to lead to improved social, ecological, and environmental outcomes.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Global	General Guidance	Academic Article	Planning	N/A

10.24. Elias, M., et al. (2022). **Ten people-centered rules for socially sustainable ecosystem restoration.** Restoration Ecology, 30(4), e13574. https://onlinelibrary.wiley.com/doi/10.1111/rec.13574.

As the UN Decade on Ecosystem Restoration begins, there remains insufficient emphasis on the human and social dimensions of restoration. The potential that restoration holds for achieving both ecological and social goals can only be met through a shift toward people-centered restoration strategies. Toward this end, this paper synthesizes critical insights from a special issue on "Restoration for whom, by whom" to propose actionable ways to center humans and social dimensions in ecosystem restoration, with the aim of generating fair and sustainable initiatives.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Global	General Guidance	Academic Article	Planning	N/A

10.25. HB-BROKER (2015). **An innovative business model, systems and services for market-based habitat banking in Europe.** https://cordis.europa.eu/project/id/698508/results.

The objective was to boost growth potential and internationalisation of innovation for Habitat Banking. Over 100,000 ha of green land are developed each year in the EU, with significant harm to Europe's nature, GDP and wellbeing. Habitat banks (HBs) offer a cost-effective way to deliver this. Phase 1 feasibility study aimed to fill key gaps in feasibility assessment. In England, the project studied legal basis for HBs, market demand, land supply, costs of HB delivery, administrative costs and IP protection. In each of 7 of 8 study areas, it has been found sufficient demand and supply to establish and sell out a 40 ha HB over 5 years. It has been determined a credit price attractive to both landowners and developers, and a model delivering zero net administrative costs for authorities. For Spain, HBs assessed demand and supply for a selected region and the extent to which legislation supports HBs. It has been found that recent legislation establishes a clear requirement for compensation for impacts on nature and clear provision for development of HBs. The project established demand, in the selected region, of at last 2000 ha p.a. and it identified initial supply of over 12500 ha. HB costs per ha were found to be well below that for conventional, developer-led compensation; HBs offer developers savings while offering attractive income to landowners. The project strengthened relations with a key business partner and key users including central and regional governments, landowner and developer associations.

Region	Restoration Target	Type of Source	Stage of Restoration Process	NRL articles addressed
Europe	General Guidance	Project	Planning	N/A

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