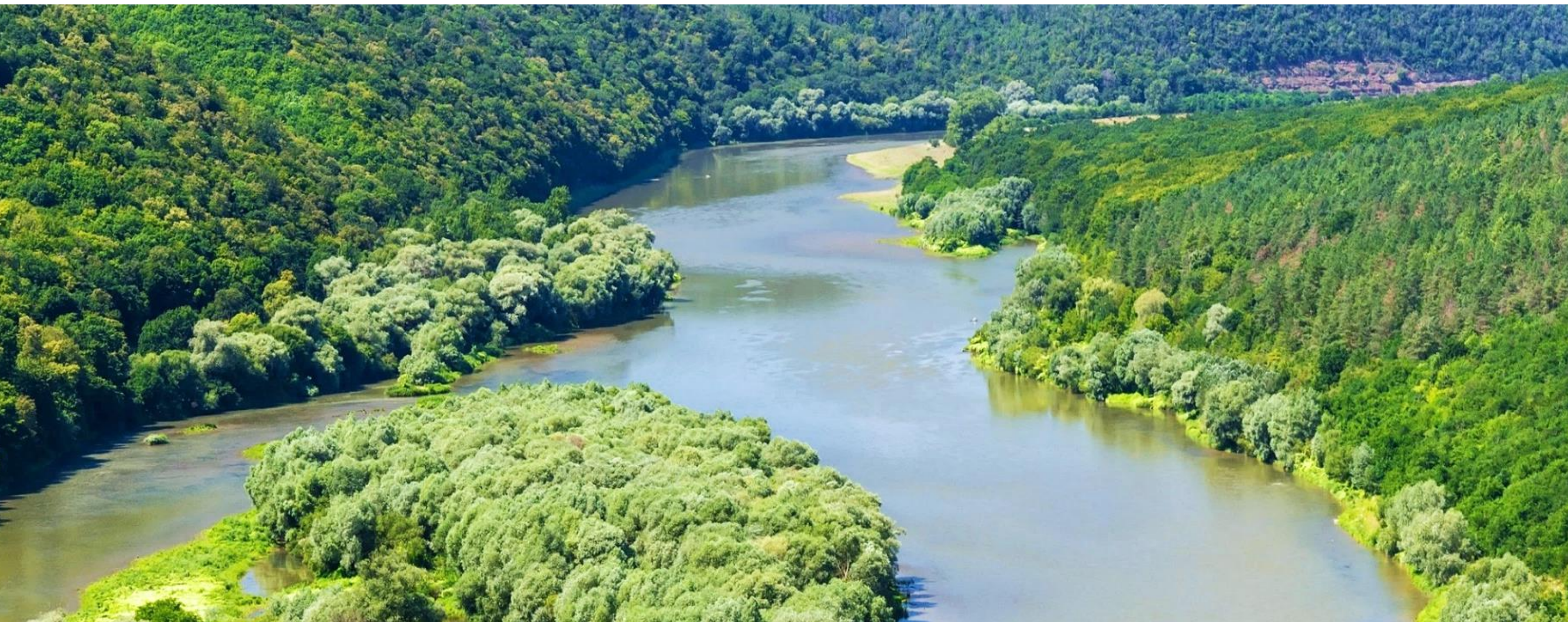
EU4Environment in Eastern Partner Countries:
Water Resources and Environmental Data (ENI/2021/425-550)

CATALOGUE OF NATURE-BASED SOLUTIONS FOR WATER MANAGEMENT IN THE EASTERN PARTNERSHIP COUNTRIES



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Water and Data in Eastern Partner Countries

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ABOUT THIS CATALOGUE

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PHOTOGRAPH ON COVER PAGE

The photograph on the cover page shows the Dniester Canyon, situated in the Dniester River Valley in Ukraine. On 3 February 2010, the regional landscape park "Dniester Canyon" was upgraded to the status of National Nature Park. The photograph was taken by Rbrechko in 2017.

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ABOUT EU4ENVIRONMENT – WATER RESOURCES AND ENVIRONMENTAL DATA

This Programme aims at improving people's wellbeing in EU's Eastern Partnership Countries and enabling their green transformation in line with the European Green Deal and the Sustainable Development Goals (SDGs). The programme's activities are clustered around two specific objectives: 1) support a more sustainable use of water resources and 2) improve the use of sound environmental data and their availability for policy-makers and citizens. It ensures continuity of the Shared Environmental Information System Phase II and the EU Water Initiative Plus for Eastern Partnership programmes.

The programme is implemented by five Partner organisations: Environment Agency Austria (EAA), Austrian Development Agency (ADA), International Office for Water (OiEau) (France), Organisation for Economic Co-operation and Development (OECD), United Nations Economic Commission for Europe (UNECE). The programme is principally funded by the European Union and co-funded by the Austrian Development Cooperation and the French Artois-Picardie Water Agency based on a budget of EUR 12,75 million (EUR 12 million EU contribution). The implementation period is 2021-2024.

https://eu4waterdata.eu

CONTENTS

List of abbreviations

ADA ....Austrian Development Agency

EAA......................Environment Agency Austria

EaP ....Eastern Partnership

EC ....European Commission

EU........................European Union

EUWI+..................European Union Water Initiative Plus

IED.......................Industrial Emissions Directive

IOW/OIEau ....International Office for Water, France

IUCN ....International Union for Conservation of Nature

IWRM ....Integrated Water Resources Management

NBS......................Nature-based solution

NGOs ....Non-Governmental Organisations

NWRM ....Natural Water Retention Measures

OECD ....Organisation for Economic Co-operation and Development

PoM ....Programmes of Measures

RBMP...................River Basin Management Plan

SDGs ....Sustainable Development Goals

SFM ....Sustainable Forest Management

ToR ....Terms of References

UBA ....Umweltbundesamt GmbH, Environment Agency Austria

UNDP ....United Nations Development Programme

UNECE.................United Nations Economic Commission for Europe

UNEP....................United Nations Environment Programme

UWWT ....Urban Wastewater Treatment Directive

VFTW ....Vertical-Flow Treatment Wetlands

WFD.....................Water Framework Directive

WOCAT ....World Overview of Conservation Approaches

WWTP..................Wastewater Treatment Plant

Executive Summary

Nature-based Solutions (NbS) are highly effective in tackling environmental issues and promoting sustainability. NbS are an essential component of today's strategy to address major societal issues, including climate change. They offer an economically viable and sustainable alternative to costly long-term technological investment or the construction and maintenance of infrastructure.

These solutions harness the power of nature to boost natural ecosystems, biodiversity and human well-being. They cover a wide range of actions to protect, restore or sustainably manage landscapes, seascapes, watersheds and urban areas. Nature-based Solutions address challenges such as food and water security, climate change, disaster risks and human health. They can affect the water cycle by slowing the flow of water and increasing its natural retention within the basin. Implementing these solutions at a basin-wide level offers significant benefits for water resources management. These include enhanced water availability, improved water quality and a reduction in the risk of water-related disasters such as floods and droughts.

There are several examples of Nature-based Solutions in Armenia, Azerbaijan, Georgia, Moldova and Ukraine. Local communities have used nature-based solutions for millennia. Examples include sustainable management of pastures and community forests in Moldova's first National Park (Orhei), windbreak/agroforestry system to reduce wind erosion in Georgia, the steppe ecosystem that provides essential habitats for wildlife in Ukraine. All solutions must be people-centred, led by communities and drawn from traditional and local knowledge. Nature-based solutions must be inclusive, transparent, and developed with respect to land rights and local people's views and the benefits should be equally distributed.

These solutions are aligned with the overarching objectives of the EU4Environment – Water Resources and Environmental Data programme.

In the context of the EU4Environment Water and Data programme in Eastern Partnership countries, the implementation of RBMPs (River Basin Management Plans) aims to achieve a good qualitative and quantitative status of water bodies in Armenia, Azerbaijan, Georgia, Moldova and Ukraine. An RBMP comprises several documents, including a programme of measures that identifies a range of actions to be implemented in the basin in order to improve water bodies that have been adversely affected. Among the measures to be included in the programme of measures of an RBMP, Nature-based Solutions are particularly relevant insofar as they address simultaneously societal challenges and the preservation of biodiversity and natural resources.

This Catalogue of Nature-based Solutions for water management in Eastern Partnership Countries provides a comprehensive overview of the various NbS that can be implemented at the river basin scale in Eastern Partnership Countries. It offers documented factsheets (34 Nature-based Solutions) including case studies, direct links to technical references and examples of cost calculations and unit costs. This Catalogue is intended for practitioners, decision-makers, researchers, and other experts seeking to prioritise and select the most relevant solutions for water management.

Reader's Guide

The objective of the present Catalogue is to facilitate the integration of Nature-based Solutions (NbS) into River Basin Management Plans (RBMPs) in Eastern Partnership countries, from the initial selection stage to implementation. This Catalogue is intended for project managers, decision-makers, experts and other stakeholders involved in the selection, design and implementation of NbS at the river basin scale within the context of plans and programmes addressing water, flooding, biodiversity, climate change adaptation, forestry, agriculture and urban development in Eastern Partnership Countries.

For instance, this Catalogue provides:

- A **ranking methodology** to select the most appropriate solutions to be included in the programme of measures, depending on the pressures impacting water bodies and the level of effectiveness of the measures (highly or moderately effective) (Section 3).
- **34 NbS factsheets** which provide an overview of the selected Nature-based Solutions (NbS) and direct links to additional resources including case studies, examples of cost calculation and unit costs and technical references (Section 4). The 34 solutions described in these factsheets were selected as the most relevant in the context of the Eastern Partnership countries.
- **Recommendations to ensure a sound implementation**, based on: a clear identification of the pressure(s), appropriate spatial design (scale of implementation), consideration of environment sustainability (social equity and economic viability), a trade-off between the benefits and impacts of the solution, an adaptative management approach, and the sharing and dissemination of feedbacks (Section 5).
- **Recommendations to effectively promote and scale up finance for NbS** (Section 5).

This Catalogue is designed to evolve as new solutions are developed, shared, discussed, adapted and validated according to the specific context in which they are used.

1. Introduction

1.1. Nature-based Solutions in the European Union

In recent years, global interest in nature-based solutions has increased considerably. 2022 saw a significant shift in the integration of nature-based solutions into key intergovernmental agreements.

In March 2022, the fifth United Nations Environment Assembly adopted 14 resolutions aimed at enhancing efforts for nature conservation to achieve the Sustainable Development Goals. Notably, governments worldwide formally agreed on a definition of nature-based solutions (UNEP/EA.5/Res.5).

During the UNFCCC COP27, nature-based solutions emerged as promising tools to combat climate change, as highlighted in the Sharm el-Sheikh Implementation Plan. The COP27 Presidency of Egypt in collaboration with Germany and IUCN introduced the ENACT initiative with the objective of promoting nature-based solutions.

Nature-based solutions play a key role in the Kunming-Montreal Global Biodiversity Framework, particularly targets 8, 11, and 12, which were adopted at the fifteenth Conference of the Parties to the Convention on Biological Diversity (CBD COP15). This framework sets out an ambitious roadmap to achieve the global vision of a world living in harmony with nature by 2050.

Furthermore, the issue of nature-based solutions was addressed in resolution XIV.17 of the Ramsar Convention on Wetlands COP14.

Both the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Intergovernmental Panel on Climate Change (IPCC) recognise the value of nature-based solutions in addressing the interlinked biodiversity and climate crises.

Figure 1 - Policy areas of the European Green Deal

The EU is pursuing a strategy to establish itself as a global leader in research and innovation by leveraging nature-based solutions to create more sustainable and resilient societies. The objective is to reduce emissions in Europe by 55% by 2030. The green transition presents a significant challenge for the economy, necessitating the implementation of targeted strategies to enhance its resilience (EIB Investment Report 2023/2024).

The European Green Deal for the European Union (EU) and its citizens aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy. This will be achieved by eliminating net emissions of greenhouse gases by 2050 and decoupling economic growth from resource use. The European Green Deal provides a detailed action plan to improve the efficient use of resources, transition to a clean, circular economy and restore biodiversity, while reducing pollution.

According to the European Commission, nature-based solutions are defined as "*Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions*."

In line with the Sustainable Development Goals (SDGs), Nature-based Solutions can contribute to sustainable development because they often address public interest objectives and sustainability dimensions simultaneously. [1]This makes nature-based solutions effective instruments for addressing sustainability-related challenges in an integrated manner. The 2030 Agenda and its 17 SDGs, adopted in 2015 by all United Nations member states, represent a comprehensive global plan of action towards a more sustainable future. The 2030 Agenda addresses all three dimensions of sustainability – environmental, social and economic – and emphasises the need to tackle these dimensions in an integrated manner.

Figure 2 - Sustainable Development Goals in line with EU4Environment Programme

According to Gerstette, Herb and Matei (2020): "*Nature-based solutions are important to this global transformative plan of action. Nonetheless, it is worth noting that nature-based solutions may also contribute directly to achieving some of the specific SDGs. These include, within the EU, in particular 'healthy living and wellbeing' (SDG3), 'water and sanitation' (SDG6), 'cities and human settlements' (SDG11), 'climate change' (SDG13), 'life below water' (SDG14) and 'ecosystems and biodiversity' (SDG15). Therefore, it is no coincidence that some of the policies that support nature-based solutions, for example at the EU level, also refer to the SDGs or sustainable development more broadly as one of their rationales. However, the argument of how and to what extent the SDGs promote the wider uptake.*" (Mainstreaming Nature-Based Solutions: Sustainable Development Goals, NATURVATION Guide, Page 8-9)

[1] Gerstetter, C., Herb, I., Matei, A. (2020) Mainstreaming Nature-Based Solutions: Sustainable Development Goals, NATURVATION Guide

1.2. Nature-based Solutions in the frame of the EU4Environment Water and Data programme in Eastern Partnership countries

The adoption of nature-based solutions (NbS) is rising in Armenia, Azerbaijan, Georgia, Moldova and Ukraine. These solutions are proving to be highly effective in addressing environmental challenges and promoting sustainability. NbS align with the overall objectives of the EU4Environment – Water Resources and Environmental Data programme, as well as the different mandates and expertise of the implementing partners. NbS have a potentially to have a positive impact on water quality and quantity in Eastern Partnership countries. They can slow down runoff and increase infiltration, favour natural retention and clean-up, and create or improve habitats, thus supporting biodiversity.

In the context of the EU4Environment Water and Data programme in Eastern Partnership countries, the implementation of RBMPs (River Basin Management Plans) aims to achieve the good qualitative and quantitative status of water bodies in Armenia, Azerbaijan, Georgia, Moldova and Ukraine. An RBMP comprises a number of documents, including a programme of measures, which identifies a range of actions to be implemented in the basin in order to restore deteriorated water bodies. Among the measures to be included in the programme of measures of an RBMP, nature-based solutions (NbS) are relevant as they simultaneously address societal challenges and the preservation of biodiversity and natural resources. The variety of nature-based solutions that can be implemented in basins is illustrated in Figure 4. Such actions include structural measures, such as targeted afforestation, and management measures, such as the preservation of existing hedges.

This NbS catalogue is designed to provide a comprehensive overview of the various NbS that can be implemented at the river basin scale in Eastern Partnership Countries. It offers valuable insights for practitioners, decision-makers, researchers, and other experts seeking to prioritise and select the most relevant measures in RBMPs.

2. Nature-based solutions into River Basin Management Plans

2.1. Definitions and synonyms of nature-based solutions

Nature-based solutions utilise natural resources to address social, economic and environmental challenges simultaneously. However, there is no single, universally accepted definition of NbS (see box 1). In addition, various terms are used according to the stakeholder and context, despite referring to actions using similar approaches. These include ecosystem-based adaptation, ecosystem-based disaster risk reduction, ecological engineering, natural water retention measures, green infrastructure, sustainable drainage systems, and so on. Although not synonymous, these approaches are closely related.

Figure 3 – Schematic representation of nature-based solutions (© IUCN)

Box 1. Definitions of Nature-based Solutions

There is no single, universally accepted definition of Nature-based Solutions (NbS). Rather, a range of definitions have been developed by various organisations and researchers. In the early 2000s, the International Union for Conservation of Nature (IUCN) provided a definition that placed particular emphasis on the importance of nature conservation and restoration. The European Commission has also provided a definition that is more expansive in scope, with an emphasis on sustainability in general. The OECD has recently proposed a combination of the two definitions. The following definitions of nature-based solutions (NbS) may assist Eastern Partnership countries in understanding how NbS could benefit them:

- **United Nations Environment Assembly**: actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits[2].

- **European Commission**: actions inspired by, supported by or copied from nature and which aim to help societies address a variety of environmental, social and economic challenges in sustainable ways[3].
- **IUCN**: actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits[4].
- **OECD**: measures that protect, sustainably manage or restore nature, with the goal of maintaining or enhancing ecosystem services to address a variety of social, environmental and economic challenges[5].

2.2. The benefits of Nature-Based Solutions for water resources management at the basin scale

Nature-based solutions have the potential to significantly impact the water cycle, slowing the flow of water and increasing its natural retention within the basin. The implementation of nature-based solutions at a basin-wide level offers significant benefits for water resources management. These include enhanced water availability, improved water quality and a reduction in the risk of water-related disasters such as floods and droughts.

These solutions also have a positive impact on society, the economy and the environment. They support food security, provide raw materials, increase carbon storage capacities, support biodiversity and offer recreational areas, among other benefits. Nature-based Solutions offer a range of benefits, making them a no-regret measure for any business when correctly implemented.

For this reason, implementing nature-based solutions also contributes to several European frameworks, including the Flood Directive, the Habitat and Birds Directives, the Nitrate Directive and the Urban Wastewater Treatment Directive. They also align with several European strategies, including the Biodiversity Strategy, the Forest Strategy and the Soil Strategy for 2030.

[2] UN Environment Assembly 5 (UNEA 5.2) Resolutions, UNEP, 2022

[3] Nature-based solutions, European Commission.

[4] Nature-based Solutions, IUCN

[5] Nature-based solutions for adapting to water-related climate risks, OECD, 2020

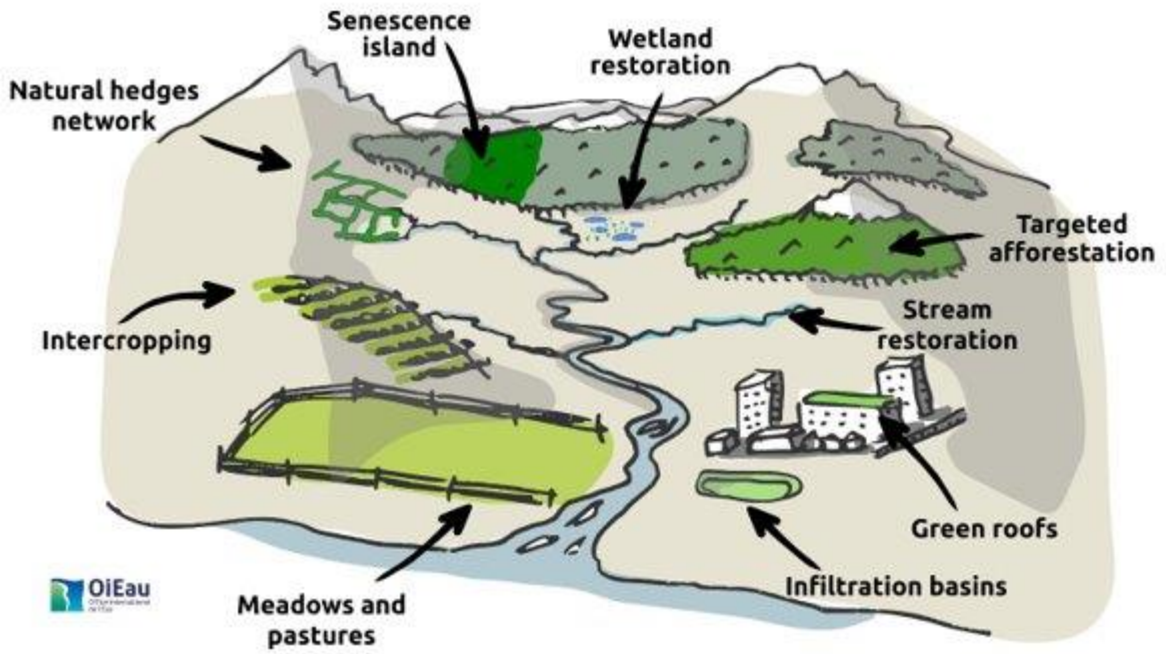


Figure 4 - Examples of nature-based solutions implemented at the catchment scale (© OiEau)

Nature-based Solutions can be applied in a number of ways in the basin (Figure 4). These can take the form of structural actions, such as targeted afforestation, or management measures, such as the preservation of existing hedges.

The relevant solutions for water resources management are of different types:

- Farming practices, such as intercropping
- Forestry practices, such as conservation of senescence islands
- Rainwater management features in urban areas, such as greening of cities
- Conversion of land-use, such as restoring pastures from croplands
- Aquatic ecosystem restoration, such as wetland or stream restoration
- Groundwater recharge, such as managed aquifer recharge through infiltration ponds

2.3. Nature-based Solutions, Programmes of Measures and River Basin Management Plans

The European Union Member States implement the Water Framework Directive through River Basin Management Plans (RBMPs) in six-year cycles. The preparation of a River Basin Management Plan in line with the WFD follows a formal process with different steps for assessment, planning, implementation, and review at regular intervals. The pressures analysis helps to assess the future status of the water bodies. If the impact is significant, measures must be proposed in the Programme of Measures, which is an important chapter of the RBMP. For each pressure, as defined in the WFD guidance documents, a number of measures can be implemented. The assessment process of pressures and impacts is described in detail in [Guidance document n°3 of the Common Implementation Strategy for the Water Framework Directive (2000/60/EC)].

It is essential to understand the nature of the impact that may result from a pressure and to identify appropriate methods to monitor or assess the relationship between impact and pressure. An inventory of pressures may contain the following types :

- Pollution pressures from diffuse and point sources
- Quantitative resource pressures
- Hydromorphological pressures
- Biological pressures

A successful pressure and impacts study requires a clear understanding of the objectives, a comprehensive description of the water body and its catchment area (including monitoring data), and a detailed knowledge of how the catchment system functions.

It is essential to assess the significance of a pressure on a water body by considering the pressures within the catchment area and understanding the functioning of the catchment system. By combining this understanding with the list of all pressures and the specific characteristics of the catchment area, it is possible to identify the significant pressures. One approach is to compare the magnitude of the pressure with a criterion, or threshold, relevant to the water body type. This approach effectively combines pressure identification with an impact analysis, as any threshold that is exceeded results in the water body being assessed as likely to fail its objectives.

Figure 5 - Integrated water resources management cycle (© EUWI + East project)

During the preparation of RBMPs, the relevance of measures is discussed between experts, stakeholders, and decision-makers in order to evaluate their efficiency and feasibility. The programme of measure encompasses a wide range of potential measures, including several nature-based solutions that may be relevant to address one or more pressures affecting water bodies.

3. Selection of Nature-based Solutions

3.1. Methodology

This section provides valuable insight into the process of prioritising and selecting the most relevant measures in RBMPs. In order to select the most appropriate solutions to be included in the programme of measures, two types of tables can be used:

- Part 3.2 presents a table of the most effective nature-based solutions to the pressures affecting water bodies. It links these solutions to the infrastructure and technologies typically used to address the corresponding pressure.
- Parts 3.3 to 3.6 comprise four tables which set out the relevant solutions according to their level of effectiveness (highly or moderately effective), indicating their main co-benefit and their cross-sectoral interest for other EU policies. Furthermore, a link is provided to the detailed technical sheet for each solution (Section 4).

Box 2. Methodology for the determination of effectiveness

Nature-based solutions are multifunctional solutions that have the potential to deliver multiple benefits. The actual effectiveness of these solutions in addressing a specific pressure may vary from one site to another, depending on the context and the implementation of the solution. In order to achieve this, it is essential to adopt an appropriate design and sizing approach, taking into account the specific context, objectives, and local stakeholders involved (for further information, refer to the considerations on implementation in Section 5).

Existing benefit tables provide insights into the effectiveness of nature-based solutions in meeting multiple objectives (among others: NWRM benefit tables, NbS Evidence Platform, etc.). In the present catalogue, the choice was made to rank the potential effectiveness of nature-based solutions for pressures identified in the WFD Reporting Guidance 2022 based on expert judgement. The ranking is as follows:

H – High effectiveness

The solution has the potential to significantly reduce the considered pressure.

Example: conservation agriculture has the potential to reduce sediment fluxes from fields and strongly reduce leaks of nutrients and pesticides, and can therefore be highly effective to tackle diffuse source pollution from agriculture.

M – Moderate effectiveness

The solution has the potential to reduce the considered pressure, but is not a standalone solution.

Example: conservation agriculture has the potential to reduce crops' irrigation needs and sensitivity to drought, although it cannot reduce these irrigation needs on its own. As such, it can be moderately effective to tackle water abstraction by agriculture.

Other cases

Nature-based solutions that are not considered as highly effective or moderately effective for given pressure are either not likely to have an indicative effect on this pressure, or not applicable.

Example: conservation agriculture cannot affect point source pollution from urban wastewater.

Details on rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

3.2. The most effective solutions

Table 1 provides an overview of those nature-based solutions that have been identified as the most effective in addressing the challenges affecting water bodies. It provides an overview of how nature-based solutions can be deployed in the basin to mitigate these pressures.

Note that only the most effective solutions are listed below. Further relevant nature-based solutions can be found in the tables in sections 3.3 to 3.6. While less effective, these solutions should still be considered due to their co-benefits and potential cumulative impact when implemented in the basin.

Table 1 - Most effective NbS per pressure affecting water bodies (© OiEau)

Type of pressure affecting water bodies		Type of nature-based solution	Scale of implementation	Typical grey infrastructure and technology
1. Point source pollution	Agglomeration and industry	Rainwater management public features	City, town, industrial plant	Stormwater infrastructures
		Constructed wetlands for wastewater treatment		Wastewater treatment plants
2. Diffuse source pollution	Agriculture	Improvement of cultivation practices	Agricultural plot	Modern farming equipment
		Conversion to lower impact land-use	Water body	None
		Drainage adaptation	Agricultural plot	
		Restoration of meadows and pastures	Water body	
	Urban run-off	Rainwater management public features	City, town, industrial plant	Stormwater infrastructures
	Forestry	Close-to-nature forestry	Water body and its sub-catchment	None
		Sediment capture ponds and check dams	Stretch of water	None
	Others	Rainwater management public features	Water body	Stormwater infrastructures
3. Abstraction or flow-diversion	Agriculture	Improvement of cultivation practices	Farm	Modern farming equipment
		Managed aquifer recharge	Water body to basin	Dams and groundwater pumps
	Others	Managed aquifer recharge	Basin-scale	
4. Hydro-morphology	Physical alterations	Adapted forestry in floodplains and wet forests	Stretch of water	None
		Restoration of aquatic ecosystems	Stretch of water	None
	Dams and barriers	Removal of barriers	Basin-scale	None
		Restoration of aquatic ecosystems	Stretch of water	
	Hydrological alteration	Drainage adaptation	Water body	Reservoirs
		Improvement of cultivation practices	Water body	None
		Managed aquifer recharge	Water body to basin	Reservoirs

Box 3. EU added value and policy relevance of nature-based solutions

- The IUCN Global standard

An analysis of the impacts of EU-funded projects in the area of nature-based solutions was initiated in 2019. The resulting report provides an overview of the results from projects on nature-based solutions, and how they support the implementation of water quality and waterbody condition policies.

Nature-based solutions, Improving water quality & waterbody conditions, 2021. 68p.

3.3. Point source pollution

Constructed wetlands are the only solution considered to be effective for **urban wastewater** pressure, with a high level of effectiveness.

Rainwater management public features (see #15) represent the most effective solution for addressing point source pollution from **storm overflows**. Other solutions that contribute to the reduction of stormwater can be moderately effective.

With regards to **IED and non-IED plants**, constructed wetlands and rainwater management features can be highly effective in certain instances. Other solutions for reducing stormwater at the plant site can be moderately effective.

It would appear that no nature-based solutions are relevant for **other point source** pollution pressures.

H: high effectiveness; M: moderate effectiveness.

Technical sheet	Effectiveness	Relevant nature-based solutions	Co-benefits			EU policies synergy
			Floods	Drought	Biodiversity	
1.1 Urban wastewater *May or may not be included in the UWWT Directive. Includes discharges from non-manufacturing commercial areas that can largely be assimilated to urban wastewater. Includes discharges of raw or partially treated urban wastewater that are identified as point sources.*						
23	H	Constructed wetlands for wastewater treatment			M	M
1.2 Storm overflows *Overflows from separated or combined sewers identified as point sources (for diffuse see 'Diffuse – Urban run-off' below).*						
15	H	Rainwater management public features	H	M	M	M
11	M	Greening of cities (green roofs, city gardens, etc.)	M		H	M
12	M	Raingardens	M	M		M
13	M	Forested parks	M	M	H	M
14	M	Permeable surfaces	M	M		M
18	M	Soil unsealing (removal of built structures)	M	M	M	M
1.3 IED plants **1.4 Non-IED plants** *Industrial point sources from plants whether or not included in the E-PRTR.*						
15	H	Rainwater management public features	H	M	M	M
23	H	Constructed wetlands for wastewater treatment			M	M
11	M	Greening of cities (green roofs, city gardens, etc.)	M		H	M
12	M	Raingardens	M	M		M
13	M	Forested parks	M	M	H	M
14	M	Permeable surfaces	M	M		M
18	M	Soil unsealing (removal of built structures)	M	M	M	M
1.5 to 1.9 Others *Point sources such as contaminated sites or abandoned industrial sites, water disposal sites, mine waters, aquaculture or other types of point sources.*						
		No measure identified				

Box 4. Case-study 1: Orhei constructed wetland for cost-efficient wastewater treatment, Moldova (2021)

See NbS #23 in the Catalogue

A French vertical-flow treatment wetland (VFTW) has been implemented with the approval of the Water Utility (Apa Canal) in order to reduce operational costs in the city of Orhei. The constructed wetland was designed to serve the population of Orhei Municipality, which has a population of 33,300 and includes a number of small industries. The previous wastewater treatment plant was costly to operate and no longer capable of adequately treating the entire city's wastewater.

The French VFTW is a specific configuration of a constructed wetland, which allows the treatment of raw wastewater after a simple screening process. Sludge and mineralisation accumulate at the surface, while a vertical flow enables a refined treatment process and the completion of nitrification.

Wastewater treatment plants present a potential point source of pollution, as treated effluents are discharged directly into streams or rivers. Inappropriate wastewater treatment can have severe consequences for human health and the environment. Constructed wetlands have a tangible positive impact on water pollution regulation, offering an optimized cost and a high level of efficiency.

Figure 6 - Orhei French VFTW WWTP aerial view (2021)
© Nature-based solutions for wastewater treatment

Lessons learned:

- The deployment of natural technologies for wastewater purification has resulted in a reduction in operational and maintenance costs.
- A well-designed, decentralised strategy could facilitate the adoption of NbS in large cities, reducing the costs associated with the construction, maintenance and operation of grey infrastructure such as sewer systems. Additionally, it could create functional green spaces in urban areas.
- The Orhei treatment wetland has demonstrated that French VFTWs can perform efficiently in cold climates.

Source: [EN] Orhei French VFTW

3.4. Diffuse source pollution

Rainwater management public features (see NbS #15) represent the most effective solution for addressing diffuse source pollution from **storm overflows**. Other solutions that contribute to the reduction of stormwater can be moderately effective.

The most effective solutions to tackle **agricultural diffuse source pollution** are those that reduce inputs of nutrients and pesticides. This can be achieved through cultivation practices that decrease the need for such inputs, as well as through conversion to other land uses that do not require inputs. Drainage adaptation may also be highly effective, as the drainage network can be a major pathway for nutrients and pesticides to enter water bodies. Furthermore, all solutions contributing to the reduction of pollutant pathways in water bodies have moderate effectiveness regarding this pressure. These include structural solutions that enhance the infiltration capacity of soils and facilitate the interception of runoff.

In terms of **forestry diffuse pollution**, the most effective solutions are drainage adaptation, close-to-nature forestry, and sediment capture ponds. The remaining solutions, which are moderately effective, include those that reduce pollution pathways, such as road and track construction in forests and the conversion of forests to input-free ecosystems, such as natural grasslands.

In the case of **other diffuse sources**, rainwater management features are highly effective compared to other non-point source (NPS) measures addressing diffuse source pollution. Solutions that increase the infiltration capacity of soils in the water body are moderately effective. Furthermore, the restoration of aquatic ecosystems and wetlands is also a moderately effective measure, as it increases the self-purification capacity of ecosystems.

H: high effectiveness; M: moderate effectiveness.

Technical sheet	Effectiveness	Relevant nature-based solutions	Co-benefits			EU policies synergy
			Floods	Drought	Biodiversity	
2.1 Urban run-off *Storm overflows and discharges in urbanized areas not identified as point sources.*						
15	H	Rainwater management public features	H	M	M	M
11	M	Greening of cities (green roofs, city gardens, etc.)	M		H	M
12	M	Raingardens	M	M		M
13	M	Forested parks	M	M	H	M
14	M	Permeable surfaces	M	M		M
18	M	Soil unsealing (removal of built structures)	M	M	M	M
24	M	Wetland restoration and management	M	M	H	H
25	M	Floodplain restoration and management	H	M	H	H
26	M	Stream and river restoration	M	M	H	H
33	M	Restoration of buffer strips, riparian forests and gallery forests	M	H	H	H
2.2 Agriculture *Suspended matter, nutrients and pesticides.*						
2	H	Resource saving cultivation practices (similar to conservation agriculture, soil conservation agriculture, etc.).	M	M	M	H
5	H	Drainage adaptation (e.g., dismantling or control)	M	H		M
6	H	Restoration of existing pastures, steppes and natural grasslands	M	M	H	H
16	H	Afforestation	H	M	H	H
17	H	Conversion to meadows and pastures	M	M	H	H
21	H	Semi-artificial wetlands and water bodies				
1	M	Sustainable pasture management	M	M	H	H
3	M	Agroforestry, buffer strips and hedges	M	M	H	H
4	M	Traditional terracing	M	M		M
8	M	Adapted forestry in floodplains and wet forests	M		H	H
19	M	Conservation of existing high environmental value ecosystems		M	H	M
20	M	Natural water harvesting / keyline design	M	H		M
22	M	Sediment capture ponds and checks dams	M			M
24	M	Wetland restoration and management	M	M	H	H
25	M	Floodplain restoration and management	H	M	H	H
26	M	Stream and river restoration	M	M	H	H
33	M	Restoration of buffer strips, riparian forests and gallery forests	M	H	H	H

H: high effectiveness; M: moderate effectiveness.

2.3 Forestry *Suspended matter, nutrients, pesticides and potentially acidification.*						
5	H	Drainage adaptation (e.g. dismantling or control)	M	H		M
7	H	Close-to-nature forestry (similar to continuous cover forestry)	M	M	H	H
22	H	Sediment capture ponds and check dams	M			M
8	M	Adapted forestry in floodplains and wet forests	M		H	H
9	M	Controlled traffic forestry (water-sensitive driving, design, or road and stream crossings)	M			M
17	M	Conversion to meadows and pastures	M	M	H	H
19	M	Conservation of existing high environmental value ecosystems		M	H	M
24	M	Wetland restoration and management	M	M	H	H
25	M	Floodplain restoration and management	H	M	H	H
26	M	Stream and river restoration	M	M	H	H
33	M	Restoration of buffer strips, riparian forests and gallery forests	M	H	H	H
2.4 to 2.10 Others						
Diffuse sources such as transport, contaminated abandoned industrial sites, discharges not connected to the sewerage network, atmospheric deposition, mining, aquaculture, or other types of diffuse sources.						
15	H	Rainwater management public features	H	M	M	M
14	M	Permeable surfaces	M	M		M
18	M	Soil unsealing (removal of built structures)	M	M	M	M
24	M	Wetland restoration and management	M	M	H	H
25	M	Floodplain restoration and management	H	M	H	H
26	M	Stream and river restoration	M	M	H	H
33	M	Restoration of buffer strips, riparian forests and gallery forests	M	H	H	H

Box 5. Case study 2: Integrated land and water management in Moldova to reduce nutrient pollution (2010)

See NbS #1, #2 and #3 in the catalogue

The agricultural sector has been identified as the primary source of pollution for Moldovan water bodies that drain into the Danube River and the Black Sea. Mitigation measures, such as improved watershed management practices, can reduce nutrient loads in water bodies.

In the Hincesti and Orhei districts of the Republic of Moldova, the Government of Moldova has implemented an integrated land and water management strategy with the dual objective of enhancing agricultural productivity and curbing soil erosion and nutrient discharge into water bodies. Two pilot projects have received technical assistance and financial support, including:

- Manure management practices, which **reduce the use of mineral fertilizers** and hence potential sources of diffuse pollution
- Promotion of environmentally friendly agricultural practices
- Shrub and tree planting, which **increase the infiltration capacity of soils**, and **enable the interception of run-off**
- Wetland restoration and the promotion of sustainable management practices in order to **stabilize water levels** and **increase the self-purification capacity of ecosystems**
- Monitoring of soil and water quality and environmental impacts, which **increases the availability of water for downstream users and fisheries**

Figure 7 - Grassed waterway, *Negrea municipality*, Hincesi district – 03/07/2011
© Sergiu Magdil, WOCAT

In total, 8,250 farmers from both project pilot area and other regions of Moldova have adopted at least one environmentally friendly agricultural practice promoted by the project, implemented on up to 14,028 ha of land.

Source : [EN] Agricultural Pollution Control Project

3.5. Water abstraction or flow-diversion

The most effective solutions to tackle **water abstraction or flow diversion** in agriculture are those that significantly increase the amount of water contained in soils. These include drainage adaptation and natural water harvesting. Managed aquifer recharge can also be highly effective, as it has the potential to counteract the impact of abstraction on water bodies. In addition, all solutions that reduce irrigation needs abstracted from water bodies or increase the natural retention of water in soils and aquifers are moderately effective in addressing this pressure.

Similarly, managed aquifer recharge can be highly effective for **other pressures**. In general, all solutions that increase the natural water retention capacity in soils and protect aquifers are moderately effective against this pressure.

H: high effectiveness; M: moderate effectiveness.

Technical sheet	Effectiveness	Relevant nature-based solutions	Co-benefits				EU policies synergy
			Floods	Drought	Biodiversity		
3.1 Agriculture *Includes water transfers and abstractions for irrigation and livestock breeding*							
5	H	Drainage adaptation (eg dismantling or control)	M	H			M
20	H	Natural water harvesting / keyline design	M	H			M
34	H	Managed aquifer recharge		H			
1	M	Sustainable pasture management	M	M	H		H
2	M	Resource saving cultivation practices (similar to conservation agriculture, soil conservation agriculture, etc.)	M	M	M		H
3	M	Agroforestry, buffer strips and hedges	M	M	H		H
4	M	Traditional terracing	M	M			M
6	M	Restoration of existing pastures, steppes and natural grasslands	M	M	H		H
7	M	Close-to-nature forestry (similar to continuous cover forestry)	M	M	H		H
16	M	Afforestation	H	M	H		H
17	M	Conversion to meadows and pastures	M	M	H		H
19	M	Conservation of existing high environmental value ecosystems		M	H		M
24	M	Wetland restoration and management	M	M	H		H
25	M	Floodplain restoration and management	H	M	H		H
26	M	Stream and river restoration	M	M	H		H
3.2 to 3.7 Others *Abstraction or flow diversion such as public water supply, industry, cooling water, hydropower, fish farms or other abstraction or flow diversion*							
34	H	Managed aquifer recharge		H			
1	M	Sustainable pasture management	M	M	H		H
3	M	Agroforestry, buffer strips and hedges	M	M	H		H
6	M	Restoration of existing pastures, steppes and natural grasslands	M	M	H		H
7	M	Close-to-nature forestry (similar to continuous cover forestry)	M	M	H		H
16	M	Afforestation	H	M	H		H
17	M	Conversion to meadows and pastures	M	M	H		H
18	M	Soil unsealing (removal of built structures)	M	M	M		M
19	M	Conservation of existing high environmental value ecosystems		M	H		M
20	M	Natural water harvesting / keyline design	M	H			M
24	M	Wetland restoration and management	M	M	H		H
25	M	Floodplain restoration and management	H	M	H		H
26	M	Stream and river restoration	M	M	H		H

Box 6. Case study 3: Restoring water reserves of underground basins in the mountainous regions of Armenia (2022)

See NbS #34 in the catalogue

The case of the artificial filling of the Ararat artesian basin in the Republic of Armenia demonstrates that, in a mountainous context, where water quality is high and topographical differences in relative altitude mean water can be pumped without powerful pumping stations, it is particularly relevant to divert river flows to recharge groundwater basins.

The estimated financial costs of artificially filling the Ararat artesian basin are 2–3 million dollars (0.05–0.075 dollar/m³) to pump 40 million m³ of water into the underground basin, including the construction of the facility, which comprises a water intake, pipeline, and well cleaning. In a similar context, the capital investment for the construction of a reservoir to collect the same volume of water per year is estimated at approximately 230–250 million dollars (5.75–6.25 dollar/m³). Furthermore, the annual servicing of the reservoir and the transportation of water from the reservoir to points of need via canals necessitate substantial financial resources.

Source: [EN] Restoration Peculiarities of Water Reserves of Underground Basins in the Mountain Relief Regions

3.6. Hydromorphological alteration

The most effective solutions for **hydromorphological alterations** are those that restore the natural characteristics of aquatic ecosystems and floodplains. Other solutions, including the reduction of water-induced erosion, are moderately effective in contributing to more natural channel morphology.

In terms of **dams, barriers and locks**, the most effective solution to tackle hydromorphological alterations is to remove them. In general, any other solutions contributing to the restoration of the natural conditions of channels can only moderately contribute to a reduction in the impact of this pressure on the water body.

It is evident that solutions that are likely to have a strong effect on the flow regime through a higher retention of water in soils and aquifers are also the most effective way to tackle **hydrological alterations**. In general, all solutions that contribute to a better retention of water in the water body are moderately effective in tackling this hydromorphological pressure.

H: high effectiveness; M: moderate effectiveness.

Technical sheet	Effectiveness	Relevant nature-based solutions	Co-benefits			EU policies synergy
			Floods	Drought	Biodiversity	
4.1 Physical alteration of channel/bed/riparian area/shore *Refers largely to longitudinal alterations to water bodies, including land drainage to enable agricultural activities, and other alterations for flood protection, agriculture, navigation, and other reasons.*						
8	H	Adapted forestry in floodplains and wet forests	M		H	H
25	H	Floodplain restoration and management	H	M	H	H
26	H	Stream and river restoration	M	M	H	H
27	H	Reconnection of oxbow lakes	H	M	H	H
28	H	Removal of transversal barriers	M		H	H
30	H	Removal of lateral barriers	H	M	H	H
31	H	Lake restoration		M	H	M
32	H	Re-naturalisation of polder areas	H		H	H
9	M	Controlled traffic forestry (water-sensitive driving, design, or road and stream crossings)	M			M
10	M	Coarse woody debris in rivers and streams	M		M	M
14	M	Permeable surfaces	M	M		M
15	M	Rainwater management public features	H	M	M	M
22	M	Sediment capture ponds and check dams	M			M
24	M	Wetland restoration and management	M	M	H	H
29	M	Natural bank stabilisation			M	M
4.2 Dams, barriers and locks *Refers to dams, barriers and locks related to flood protection, drinking water, irrigation, recreation (small dams are used in rivers to create recreational and angling areas), industry (dams are sometimes created to provide freshwater for large industry, typically for cooling purposes), navigation, and other dams, barriers and locks*						
25	H	Floodplain restoration and management	H	M	H	H
26	H	Stream and river restoration	M	M	H	H
27	H	Reconnection of oxbow lakes	H	M	H	H
28	H	Removal of transversal barriers	M		H	H
30	H	Removal of lateral barriers	H	M	H	H
32	H	Re-naturalisation of polder areas	H		H	H
24	M	Wetland restoration and management	M	M	H	H
29	M	Natural bank stabilisation			M	M
31	M	Lake restoration		M	H	M
33	M	Restoration of buffer strips, riparian forests and gallery forests	M	H	H	H

4.3 Hydrological alteration

Refers to changes in the flow regime due to agriculture (e.g. due to land drainage), transport (e.g. due to inland navigation), hydropower (e.g. hydropeaking), public water supply, aquaculture, or other reasons

5	H	Drainage adaptation (eg dismantling or control)	M	H		M
20	H	Natural water harvesting / keyline design	M	H		M
34	H	Managed aquifer recharge		H		
1	M	Sustainable pasture management	M	M	H	H
2	M	Resource saving cultivation practices (similar to conservation agriculture, soil conservation agriculture, etc.).	M	M	M	H
3	M	Agroforestry, buffer strips and hedges	M	M	H	H
4	M	Traditional terracing	M	M		M
6	M	Restoration of existing pastures, steppes and natural grasslands	M	M	H	H
7	M	Close-to-nature forestry (similar to continuous cover forestry)	M	M	H	H
8	M	Adapted forestry in floodplains and wet forests	M		H	H
9	M	Controlled traffic forestry (water sensitive driving, design, or road and stream crossings)	M			M
11	M	Greening of cities (green roofs, city gardens, etc.)	M		H	M
12	M	Raingardens	M	M		M
13	M	Forested parks	M	M	H	M
14	M	Permeable surfaces	M	M		M
15	M	Rainwater management public features	H	M	M	M
16	M	Afforestation	H	M	H	H
17	M	Conversion to meadows and pastures	M	M	H	H
18	M	Soil unsealing (soils, built structures)	M	M	M	M
22	M	Sediment capture ponds and check dams	M			M
24	M	Wetland restoration and management	M	M	H	H
25	M	Floodplain restoration and management	H	M	H	H
26	M	Stream and river restoration	M	M	H	H
27	M	Reconnection of oxbow lakes	H	M	H	H
31	M	Lake restoration		M	H	M
32	M	Re-naturalisation of polder areas	H		H	H
33	M	Restoration of buffer strips, riparian forests and gallery forests	M	H	H	H

Box 7. Case study 4: Restoring a gallery forest and grasslands in the Iori River Valley, Georgia to preserve biodiversity and increase carbon sequestration (2023)

See NbS #23 in the catalogue

From 2018 to 2022, the project aimed to restore the ecological processes, habitats, and species diversity in the landscape formed by the Iori River valley. The restoration project included the revitalisation of grasslands and a gallery forest, as well as the implementation of key restoration actions for the gallery forest. Measures such as the creation of watering corridors, gabions, and regulated releases from the reservoir were implemented. The project's objectives were to preserve biodiversity, increase carbon sequestration, and establish a sustainable legislative framework.

Figure 8 - Steppe area subjected to over-stocking with livestock in the Iori River valley (2023)
© Sabuko – Society for Nature Conservation

Lessons learned:

- Developing training materials to **strengthen the capacities of** project stakeholders guarantees the sustainability of the project and its long-term results
- **Engaging with relevant stakeholders** early on in the project is important to building strong relationships and avoid potential conflicts
- One of the challenges for SABUKO was **contacting shepherds and raising their awareness** of the importance of rotational grazing. The most efficient way was face-to-face meetings and printed materials
- SABUKO noted the lack of **support in terms of technical expertise and guidance on biodiversity research and monitoring**. Access to scientific methods and experience in this field would have enhanced their efforts to accurately measure and track the impact of their conservation efforts.

Source: [EN] Restoring Gallery Forest and grasslands in the Iori River Valley

4. Thirty-four Nature-based Solutions

A dedicated factsheet has been produced for each solution, providing a summary of the information and access to complementary resources:

- Picture or scheme representing the measure
- Short presentation of the measure and technical description
- Scale of implementation: description of the appropriate spatial design that allows the solution to be effective
- Benefits/co-benefits: interests of the measure for RBMPs
- Pressure efficiency: identification of the pressures to be tackled by the solution and ranking of the level of effectiveness. The pressures are divided into four categories: point source pollution, diffuse source pollution, water abstraction and flow diversion, hydromorphology. The potential effectiveness of pressures is ranked based on expert judgement, with H being high effectiveness and M moderate effectiveness.
- Technical description: description of the means of implementation
- Stakeholders: list of stakeholders that should be engaged in the process of implementation to ensure local ownership.
- Cost calculation: cost elements that should be processed to estimate the cost of implementation of the solution. Specific inputs and associated units are divided into cost categories: land, labour, equipment, and consumables.
- Unit cost examples: cost examples from the Eastern Partnership countries or European countries for the solution
- Examples: case studies of implementation of the solution from the Eastern Partnership countries
- Technical references

#1 Sustainable pasture management

Sustainable pasture management enables temporary flood storage, increased water retention in the landscape and runoff attenuation. Soil cover is maintained at all times with rooted vegetation, which reduces the surface flow of water and allows greater infiltration into the soil. Soil erosion rates are significantly lower than for arable land, with potential benefits for water quality.

Scale of implementation

This measure operates at the field and farm levels. However, its implementation needs to take place at the water body level in order to prevent and mitigate pressures.

CO-BENEFITS

[M] Flood prevention
[M] Drought prevention
[H] Biodiversity

Also contributes to:

[H] Habitat and Bird Directive
[M] Nitrate Directive
[M] Nature Restoration Law
[H] Biodiversity strategy for 2030
[H] Soil Strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
				M			M	M			M

How to implement it

Sustainable pasture management entails adopting measures aimed at preserving the optimal status of vegetation and soil fertility. The condition of the pastures is maintained by establishing permitted loading rates, grazing regimes, and a grazing calendar. A properly managed pasture ensures the provision of sufficient nutrition and energy to livestock during the whole grazing season. Effective pastoral grazing management can be used as a tool not only to improve grassland/rangeland biodiversity but also to prevent land degradation and desertification by maintaining the integrity of rangeland ecosystems.

Stakeholders

- Pasture users (leaseholders, livestock owners, shepherds)
- Pasture private owners
- Government bodies in charge of state-owned pasturelands and other protected areas

Cost calculation

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, item
Consumables	Plant material	Kg/ha
	Fuel	L

Unit cost examples

- *The total cost of establishing a paddock system (fencing, mowing, reseeding) was* ***USD 4,083 for 6.1 ha*** *in a pilot project near the settlement of Kasristskali, Georgia.*
- *Avoided supplementary forage costs vary from* ***89 to 165 GEL/ha/year*** *due to land productivity of winter pastures, based on a case study in Kakheti, Georgia.*

Case studies

- Rotational grazing in 5 communities Armenia, 2017
- Sustainable pasture management plan for 4000 ha in Moldova, 2017
- Paddock system on 6,1 ha in Georgia, 2018
- Integrated pasture management planning in Georgia, 2019

Technical references

[EN] NWRM factsheet A01
[EN] Pasture management in Georgia
[EN] Policies for pasture management in Georgia
[EN] Pasture management in Armenia
[EN] Summer pastures management in Azerbaijan

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#2 Conservation agriculture

Conservation agriculture is a farming system that promotes minimum soil disturbance (i.e. no tillage), maintenance of permanent soil cover, and diversification of plant species. It enhances biodiversity and natural biological processes above and below the ground surface, which contribute to increased water and nutrient use efficiency and to improved and sustained crop production (FAO).

This approach includes e.g. crop rotation, strip cropping, intercropping, no-till and low-till agriculture, green covers, mulching, early sowing, transverse ploughing, deep ploughing/subsoiling, reduced traffic, and soil improvements.

Scale of implementation

Conservation agriculture is a systemic approach rather than a set of practices, that operates at the farm scale. Its implementation must be designed at the watershed scale to prevent and mitigate pressures.

CO-BENEFITS

[M] Flood prevention
[M] Drought prevention
[M] Biodiversity

Also contributes to:

[H] Habitat and Bird Directive
[M] Nitrate Directive
[M] Nature Restoration Law
[H] Biodiversity strategy for 2030
[H] Soil Strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
				H			M				M

How to implement it

Conservation agriculture is implemented in line with local conditions and needs. It reflects three interlinked principles: minimum mechanical soil disturbance (i.e. zero tillage) through direct seed and/or fertiliser placement; permanent soil organic cover (at least 30%) using crop residues and cover crops; and species diversification through varied crop sequences and associations involving a minimum of three different crop species.

Stakeholders

- Farmers

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, item
Consumables	Plant material	Kg/ha
	Fuel	L
	Fertilizers	Kg/l/ha
	Water for irrigation	m^3

Unit cost examples

- *The total cost of the introduction of peas cultivated as an alternative crop in rotation with wheat is **USD 23,393 for 100 ha** of land in the municipality of Dedoplistskaro, Georgia.*
- *The production cost of bed planting in Azerbaijan is about **USD 535/ha** with a profitability rate of 139%.*
- *The total production cost of no-till maize forage crop is about **USD 548/ha** in Kazakhstan, with a benefit-cost ratio of 57.3%.*

Case studies

- Crop Rotation in Dedoplistskaro, Georgia, 2018
- Integrated Land and Water Management, Moldova, 2010

Technical references

[EN] NWRM factsheets A03 to A09 + A13
[EN] WOCAT factsheets
[EN] Guidelines for conservation agriculture in Azerbaijan
[EN] Assessment of potential benefits of CA in Ukraine

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#3 Agroforestry, buffer strips and hedges

Agroforestry refers to a broad range of land use systems and practices where trees and shrubs are deliberately integrated with crops and/or animals on the same land-management units. Buffer strips and hedges delineate fields, transport infrastructures and watercourses. Trees have a positive effect on water infiltration, and protection from wind and sun, and provide a habitat for biodiversity including crop auxiliaries (FAO).

- **Agrisilvicultural** systems are a combination of crops and trees
- **Silvopastoral** systems combine forestry and grazing of domesticated animals on pastures
- The integration of trees, animals and crops is called an **agrosilvopastoral** system

Scale of implementation

This measure operates at field and farm scales, but it must be implemented at the water body scale in order to prevent and mitigate pressures.

CO-BENEFITS

[M] Flood prevention
[M] Drought prevention
[H] Biodiversity

Also contributes to:

[M] Habitat and Bird Directive
[H] Nitrate Directive
[M] Nature Restoration Law
[H] Biodiversity strategy for 2030
[M] Soil strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
				M			M	M			M

How to implement it

Agroforestry includes several land use practices, hence its implementation depends on the specific context, topography, and agricultural activities. It can be obtained by planting trees and shrubs on agricultural lands, or by cropping on forested land after thinning for example.

Stakeholders

- Farmers
- Agricultural land, pasture, and tree plantation owners

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Fuel	L
	Fertilizers	Kg/l
	Water for irrigation	m^3

Unit cost examples

The total cost of the rehabilitation and planting of windbreaks along 6km, located between a road and agricultural fields, to protect the soil from wind erosion is ***GEL 43,395 (= USD 16,072) for 3ha****, in the region of Kakheti in Georgia. The tree species were Pinus, Pistacia, Elm, Wild Almond, Persian Olive and Robinia.*

Case studies

- Integrated Land and Water Management in Moldova, 2010
- Shida Kartli and Kakheti Regions windbreaks in Georgia, 2020
- Rehabilitation of Windbreaks in Shiraki region in Georgia, 2018
- Integrating ecosystem services valuation into land use planning, Ukraine, 2021

Technical references

[EN] NWRM Factsheets A02 and F01

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#4 Traditional terracing

Traditional terraces consist of near-level platforms built along the contour lines of slopes, mostly sustained by stone walls, and used for farming on hilly terrains. By reducing the effective slope of land, terracing can reduce erosion and surface run-off by slowing rainwater to a non-erosive velocity. This also increases the degree of infiltration and improves soil moisture.

The scope of this measure focuses on maintaining terracing where it has historically been part of agricultural systems rather than implementing modern terracing such as extensive levelling or cutting using heavy machinery.

Scale of implementation

This measure operates at field level over hillsides that limit the upstream drainage area, but it must be implemented at water body scale to prevent and mitigate pressures.

CO-BENEFITS

[M] Flood prevention
[M] Drought prevention

Also contributes to:

[M] Habitat and Bird Directive
[M] Soil Strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
				M			M				M

How to implement it

Traditional terracing operates in hilly areas in order to reduce the slope of the land. It can be applied across a wide range of slopes in areas that present a risk of soil erosion.

Stakeholders

- Farmers
- Owners of agricultural land, pastures, and tree plantations
- Local communities
- Government bodies in charge of state-owned lands (national parks)

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Fuel	L

Unit cost examples

The total cost of establishing small wooden structures and terraces on eroded slopes to mitigate sheet or rill erosion and slow down water run-off is USD 6,160 for 0.15 ha, in Aragatsotn and Shirak Marzes provinces, in Armenia.

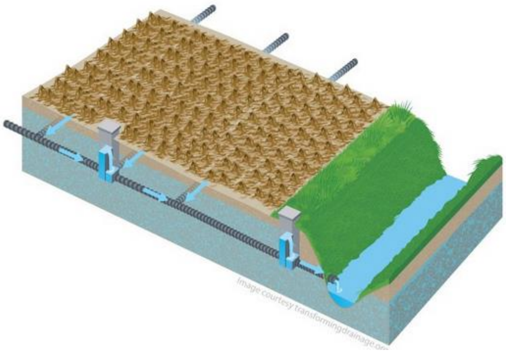
Case studies

- Slope erosion control using wooden pile walls in Aragatsotn and Shirak in Armenia, 2018
- Ecosystem-based erosion control in Azerbaijan, 2017

Technical references

[EN] NWRM Factsheet A10

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.



Source: Transformingdrainage.org

#5 Drainage adaptation

Drainage adaptation involves total or partial removal or adaptation of existing drainage systems to reduce water run-off to increase groundwater levels and extend the growing season. This measure may be redundant with wetland restoration if the removal of drainage results in the creation of a wetland.

Scale of implementation

This measure operates at the field and farm scales, but it must be implemented at the water body scale in order to prevent and mitigate pressures.

CO-BENEFITS

[M] Flood prevention

[H] Drought prevention

Also contributes to:

[M] Nitrate Directive

[M] Nature Restoration Law

[M] Soil Strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
				H	H		H				H

How to implement it

Controlled drainage can be implemented through two methods: (1) surface water (runoff) drainage into open ditches and flashboards; (2) underground connections and drainpipes connected to a collecting pipe, which empties into a 'control reservoir' or control well. By varying the level of the drainage basins, the draining intensity can be regulated.

Stakeholders

- Farmers

Cost calculations

Cost category	Specific input	Unit
Labour	Implementation Maintenance	Person-days
Equipment	Implementation Maintenance	Days, items
Consumables	Construction material	Pieces, kg/ha

Unit cost examples

- *Costs include the construction of the main drain (€ 4-5 per running meter), T-pieces (€ 25-30 each) and the sump (€ 200-300). On average, the system costs € 2400/ha while a conventional drainage system costs about € 1250/ha (The Netherlands).*
- *The construction cost of controlled drainage is estimated to be € 750/h while the construction of conventional drainage is estimated to cost € 140/ha (The Netherlands, 2008).*
- *Costs include purchase of the water control structure, installation of the structure, and management time. Structure costs range from USD 500 to USD 2,000, depending on height, size of tile, structure design, manufacturer, and whether it is automated. Installation costs may be about USd 200 for a basic structure in a new drainage system installation but may increase depending on the size of the structure, the level of automation of the structure, and retrofit situations. Assuming grades are flat enough for one structure to control 20 acres, initial costs would be in the range of USD 20 to USD 110 per acre. A producer should also consider the cost of the time spent on management of the structure. (USA)*

Case studies

No information has been found yet. To be completed.

Technical references

- Controlled drainage [EN]

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#6 Restoration of existing pastures, steppes and natural grasslands

Restoration of degraded pastures, steppes and grasslands provides essential habitats for wildlife, improves ecosystem health, increases carbon sequestration into their soils, and improves the livelihoods of local communities. Restoration through sustainable management (see NbS #1) enables to safeguard steppe biodiversity and to ensure communities have sufficient forage for their livestock.

Scale of implementation

This measure operates at field scale, but its implementation must be made at water body scale in order to prevent and mitigate pressures. It might be implemented in national parks or protected areas.

CO-BENEFITS

[M] Flood prevention
[M] Drought prevention
[H] Biodiversity

Also contributes to:
[H] Habitat and Bird Directive
[M] Nitrate Directive
[M] Nature Restoration Law
[H] Biodiversity strategy for 2030
[H] Soil Strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
				H			M	M			M

How to implement it

Restoration of existing pastures, steppes and natural grasslands entails implementation of measures aiming at restoring ecological processes, biodiversity and productivity and improving the livelihoods of local communities. The restoration of native biodiversity is reached through the introduction of grazing regimes, sustainable pasture management (see NbS #1) and re-seeding of degraded land with native plant species.

Stakeholders

- Landowners
- Land users (leaseholders, livestock owners, shepherds)
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)
- Local communities

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Fuel	L
	Fertilisers	Kg/L/ha

Unit cost examples

- *Rotational grazing has been implemented on over 3000 ha of pasture, lease agreements have been developed with farmers inside protected areas, and progress is being monitored, in the Iori river valley in Georgia.*
- *25,000 hectares (20,000 protected areas and 5,000 private areas) of steppe in the Iori Valley are sustainably grazed, resulting in the recovery of grassland biodiversity and restoration of soil carbon stocks, in Kakheti region in Georgia.*

Case studies

- Restoring grasslands in the Iori Valley in Georgia, 2021
- Restoring steppe grasslands in Ukraine, 2011
- The legislative aspects of pasture restoration in Ukraine, 2022
- Remediation of degraded arable steppe soils in Moldova, 2015
- Restoring Kakheti steppes in Georgia, 2023

Technical references

[EN] NWRM Factsheet A01
[EN] Forest Landscape Restoration in Caucasus and Central Asia
[EN] Restoration of degraded steppe lands, Ukraine
[EN] Manual on improvement of degraded natural grazing lands (pastures and grasslands), Armenia

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#7 Close-to-nature forestry

An overarching ‘umbrella’ covering all approaches and terminologies, under the auspices of Sustainable Forest Management (SFM), supports biodiversity, resilience and climate adaptation in managed forests and forested landscapes. It involves promoting the components, structures and processes characteristic of natural forests and cultural woodlands such as continuous cover forestry, thereby improving the diversity of tree species and structures, the variation in tree size and development stages, and a range of habitats including habitat trees and dead wood.

CO-BENEFITS

[M] Flood prevention
[M] Drought prevention
[H] Biodiversity

Also contributes to:

[M] Habitat and Bird Directive
[M] Nature Restoration Law
[H] Biodiversity strategy for 2030
[H] Forest Strategy for 2030
[M] Soil Strategy for 2030

Scale of implementation

This measure applies to forests (silviculture) and semi-natural areas (natural parks, protected areas). Any location where conventional forestry can be conducted is potentially suitable for close-to-nature forestry implementation which must be carried out at water body scale in order to prevent and mitigate pressures.

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
					H		M	M			M

How to implement it

Close-to-nature forestry entails the adoption of measures aiming at optimising the maintenance, conservation, and utilisation of forest ecosystems in such a way that the ecological and socioeconomic functions are sustainable and profitable. It includes increasing the structural complexity of forests (height, diameter, age, species) and promoting natural forest dynamics (deadwood, habitat trees). It is essential to adopt a forward-looking framework with a long-term vision of what could rather than what should happen, bearing in mind the long time lag between management intervention and the response to that intervention in forests.

Stakeholders

- National forest authorities
- Foresters (silviculturists)
- Local communities

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha

Unit cost examples

- *Increase the amount of deadwood to 20 m3/ha in forests older than 100 years and 40 m3/ha in forests older than 140 years, and retain 155,000 permanent habitat trees (10 trees/ha) in the productive forest area, in Ebrach in Germany.*
- *CNF practices generate low cultivation costs and variable harvest costs (harvesting cost per m^3 decreases with increasing tree size). (Fern, UK)*

Case studies

- Close-to-nature sustainable forest management in Georgia
- Transformation of Forests to CNF Management in Ukraine
- Close-to-nature forestry in Ukraine
- CNF measures in East Polissia region in Ukraine

Technical references

[EN] NWRM Factsheet F06
[EN] European Forest Institute guide
[UA] Forza guide
[EN] Guidelines on Closer-to-Nature Forest Management

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#8 Adapted forestry in floodplains and wet forests

Forestry management practices are adapted to alluvial forest conditions, in order to maintain healthy ecosystems, and benefit from their positive effect on water resources and biodiversity. Riparian forests, floodplains and wet forests are important habitats for birds, fish and other wildlife; they protect riverbanks from erosion and act as a filter for water quality. Furthermore, natural floodplains and riparian forests protect coastal settlements from natural disasters, most notably flooding. Floodplain and wetland forests are present on occasionally or annually flooded sites along streams and rivers and dominated by deciduous trees tolerant of saturated soils, prolonged inundation, frequent erosion and deposition of sediment.

CO-BENEFITS

[M] Flood prevention

[H] Biodiversity

Also contributes to:

[H] Habitat and Bird Directive

[M] Nitrate Directive

[M] Nature Restoration Law

[H] Biodiversity strategy for 2030

[H] Forest Strategy for 2030

Scale of implementation

This measure applies to forests (silviculture) and semi-natural areas (nature parks, protected areas). Any site where conventional forestry can be conducted is potentially suitable for the implementation of near-natural forestry. It must be implemented at the scale of the water body to prevent and mitigate pressures.

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
				M	M				H		M

How to implement it

Forestry management practices in floodplains and wet forests entail measures aiming at protecting and restoring ecosystems. Diverse causes of threats require actions on different administrative, temporal and spatial levels and must be carried out by various actors. Conservation actions can be implemented to stop further degradation of the alluvial forests if not sufficiently protected (filling ditches, abandoning fields, reducting livestock grazing, prohibiting wood cutting).

Stakeholders

- National forest authorities
- Foresters (silviculturists)
- Local communities

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha

Unit cost examples

- *Restoring the natural ecosystem of floodplain forests by clearing the area (manual cutting of the grass) to allow indigenous species to have better access to light, required 90 local villagers hired for the work on 150 ha, in the Chiauri area, Georgia.*
- *Abandonment of fields to allow natural reforestation, filling of useless ditches and channels, securing of damaged stands against livestock with fences, collection of rubbish, and prohibition of illegal wood cutting, in Garayazi reserve, Azerbaijan*

Case studies

- WWF project – adapted forestry, Ukraine
- Conservation of alluvial forests, Kuria River, Azerbaijan
- Floodplain forests of the Transcarpathia, Ukraine

Technical references

[EN] NWRM Factsheet F1

[UA] WWF Factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#9 Controlled traffic forestry

Controlled traffic forestry involves the adaptation of traffic and transport infrastructures to prevent damage to aquatic ecosystems in forested areas, thus reducing erosion and habitat degradation, and improving the natural retention of water in forests.

CO-BENEFITS

[M] Flood prevention

Also contributes to:

[M] Forest Strategy for 2030
[M] Soil strategy for 2030

Scale of implementation

This measure applies to forests (silviculture). Its implementation must be made at water body scale in order to prevent and mitigate pressures. This measure is appropriate to consider wherever there are unpaved roads in the rural landscape. In some cases, existing conditions may usefully be improved, for example, by upgrading the existing road surface or replacing poorly designed culverts that inhibit wildlife migration.

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
					M				M		M

How to implement it

Controlled traffic forestry entails a set of measures such as properly designed roads and stream crossings, and preserved access to spawning habitats. Roads and stream crossings should be designed and built according to available technical instructions. Fords and open-box stream crossings are considered more favourable for the movement of aquatic organisms. The required space depends on the dimensions of the infrastructure under construction and local conditions.

Stakeholders

- National forest authorities
- Foresters (silviculturists)
- Local communities

Cost calculations

Cost category	Specific input	Unit
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Investigations & Studies	Technical/design projects	Study
Consumables	Building material	Kg/ha, pieces

Unit cost examples

There should be no land acquisition costs, as the land will already be owned by the group or individual that isbuilding the road or stream crossing. Field studies are required to ensure that the measures are sustainable. Implementing controlled traffic forestry generally requires high capital costs (longer forest roads to avoid slopes, and stream crossings). This measure may result in lower maintenance costs as roads and stream crossings are less likely to be destroyed by natural events.

Case studies

No information has been found yet. To be completed.

Technical references

[EN] NWRM Factsheet F07 and F08

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#10 Coarse woody debris in rivers and streams

Introducing and maintaining coarse woody debris in watercourses to take advantage of their positive effects on hydromorphology has the effect of slowing down water flow, raising local water level, and improving habitat diversification, etc.

CO-BENEFITS

[M] Flood prevention

[M] Biodiversity

Also contributes to:

[M] Nature Restoration Law

[H] Biodiversity strategy for 2030

Scale of implementation

Introduction and maintenance of coarse woody debris applies to any watercourse but probably has the highest water retention and biodiversity benefits in forest headwater streams. This measure is most effective at moderating the flow regime of relatively small streams and rivers. Above a certain size, rivers will be too big for coarse woody debris to have measurable hydrological benefits. It should be implemented at water body scale in order to prevent and mitigate pressures.

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
									M		

How to implement it

The implementation of this measure consists in maintaining or adding coarse woody debris to rivers and streams in a sustainable way. The debris is generally secured in situ. The positioning of coarse woody debris in the channel must be carefully adjusted to prevent erosion and permit fish migration.

Stakeholders

- National forest authorities
- Foresters (silviculturists)
- Local communities

Cost calculations

Cost category	Specific input	Unit
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items

Unit cost examples

Typically, land is not acquired for introduction and maintenance of coarse woody debris in watercourses, as it is usually owned by the farmer or forest owner who manages adjacent lands. No studies or investigations are needed before implementation, and there are low capital costs apart from removing debris into the channel. Maintenance costs are low.

Case studies

No information has been found yet. To be completed.

Technical references

[EN] NWRM Factsheet

[EN] Managing woody debris in rivers, streams & floodplains

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#11 Greening cities

Diverse solutions, such as green roofs, city gardens, urban farming, and trees can increase the amount of vegetation in urban areas, and improve the infiltration and retention of rainwater. They can be implemented either on roofs or on the ground.

Scale of implementation

Measures to increase the amount of vegetation in urban areas can be applied across spatial scales and settings in and around cities, either at a local/neighbourhood scale or at the larger scale of a city.

CO-BENEFITS

[M] Flood prevention
[H] Biodiversity

Also contributes to:

[M] Flood Directive
[M] Urban Wastewater Treatment Dir.
[M] Nature Restoration Law
[H] Biodiversity Strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
	M	M	M								M

How to implement it

Greening cities entails measures aimed at enhancing integration between cities and nature to improve urban resilience for healthier cities and communities. Examples include small-scale green spaces on buildings, bioswales, green corridors along streets and water bodies, urban parks and forests within city boundaries, and larger areas with wetlands and forests upstream or along the coast, which shelter cities from flooding and improve the availability and quality of water.

Stakeholders

- City administration
- Non-government organisations/Civil society
- Citizens or community groups
- Food producers and cultivators (farmers, gardeners)

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Water for irrigation	L/ha

Unit cost examples

- *Implementing trees in urban areas includes: 1) the capital cost of trees; 2) the costs of pruning and maintaining trees; 3) irrigation in drought-prone areas. (NWRM)*
- *Implementing green roof areas includes 1) capital cost (€25-130/m² extensive green roof area and €130-300/m² intensive green roof area); 2) maintenance cost every 6-12 months for extensive green roofs and regularly for intensive areas (up to €55 /m² of green roof area for each maintenance event). (NWRM).*
- *Preparation and implementation of a development plan for re-vegetation of the city of Yerevan costs €10k/ha (Yerevan Green City Action Plan, 2017).*

Case studies

- Yerevan green City Action Plan, Armenia
- Armenia tree Project
- Tbilisi Green City Action Plan, Georgia

Technical references

[EN] NWRM Factsheet U01 and F12

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#12 Rain gardens

Rain gardens are small-scale vegetated gardens used for storage and infiltration. They are especially relevant where water from roofs is infiltrated instead of being discharged into sewage collection systems.

Scale of implementation

Rain gardens are typically applied at a property level and close to buildings, for example to capture and infiltrate roof drainage. Rain gardens can be scaled to the area available to provide runoff storage and treatment. Used in combination, rain garden components may be incorporated into larger developments such as parks, treating larger drainage areas.

CO-BENEFITS

[M] Flood prevention
[M] Drought prevention

Also contributes to:

[M] Flood Directive
[M] Urban Wastewater Treatment Directive
[M] Nature Restoration Law

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
	M	M	M								M

How to implement it

Individual components of rain gardens are designed only to capture runoff from a small surface area, for example, a roof or car park. In combination, a suite of rain gardens may capture total runoff from a larger area. Rain gardens use a large range of components incorporated into the garden landscape design, such as grass filter strips, ponding areas for temporary storage, organic/mulch areas for filtration, planting soil for infiltration, woody and herbaceous plants to intercept rainfall, and sand beds to provide good drainage.

Stakeholders

- City administration
- Non-government organisations/Civil society
- Citizens or community groups

Cost calculations

Cost category	Specific input	Unit
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Fuel	L
Investigation & studies	Study	Days

Unit cost examples

- *The construction cost of rain gardens will vary depending on the site preparation required and the type of planting selected. If the rain garden is excavated and new growing media installed, costs will be much higher. If the garden is not excavated and entails modification of an existing planted area, costs will be much lower, although the effectiveness of the garden may be compromised. (NWRM)*
- *Maintenance costs are not expected to be onerous. A simple rain garden constructed in a domestic garden will have little maintenance cost while rain gardens at street level will require maintenance by municipal authorities. (NWRM)*

Case studies

- Rain garden in Fayna town, Ukraine
- 90 rain gardens in Chisinau, Moldova

Technical references

[EN] NWRM Factsheet
[UA] WWF Factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#13 Forested parks

Urban forest parks can deliver a broad range of hydrology-related and other ecosystem services. Forests in urban areas have great amenity value, can improve air quality, moderate local microclimates, improve urban biodiversity and contribute to climate change mitigation, along with providing ancillary hydrological benefits. Forested soils often have greater infiltration capacity than other urban land cover and can be an important location for aquifer recharge.

Scale of implementation

By definition, urban forest parks are located in urban areas. This measure can be applied at three levels on an urban scale: street level, neighbourhood/district level, and city level. Occasionally, this measure can be implemented at a peri-urban scale. When planning new urban developments, consideration should be given to the possibility of creating urban forest parks.

It is difficult to place this measure in a catchment context, since forested parks are located in urban areas.

CO-BENEFITS

[M] Flood prevention
[M] Drought prevention
[H] Biodiversity

Also contributes to:

[M] Flood Directive
[M] Urban Wastewater Treatment Dir.
[M] Nature Restoration Law
[H] Biodiversity strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
	M	M	M								M

How to implement it

Planning the creation of forested parks requires a plantation and design methodology (plantation framework, adapted species) that is firmly incorporated into urban landscape criteria and the urban master plan. A programme of maintenance and reuse of by-products should be established.

Stakeholders

- City administration
- Landowners and tenants
- Non-government organisations/Civil society
- Citizens or community groups

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Water for irrigation	L/ha

Case studies

- Armenia tree Project
- Forests and sustainable cities

Unit cost examples

- *Implementing trees in urban areas includes: 1) the capital cost of trees; 2) the costs of pruning and maintaining trees; 3) the cost of irrigation in drought-prone areas. (NWRM)*
- *The final cost is related to the implantation of plants, management cost (planting, pruning, irrigation, insect and disease control, tree removal), programme administration, and infrastructure repair.*

Technical references

[EN] NWRM Factsheet
[EN] Guidelines on urban and peri-urban forestry
[EN] Urban forest – NBS methodology

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

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#14 Permeable surfaces

Permeable paving is designed to allow rainwater to infiltrate through the surface, either into underlying layers (soils and aquifers) or be stored below ground and released at a controlled rate into surface water. Two types of pavement exist: permeable pavements as such and porous pavements.

CO-BENEFITS

[M] Flood prevention
[M] Drought prevention

Also contributes to:

[M] Flood Directive
[M] Urban Wastewater Treatment Dir.

Scale of implementation

Permeable paving is potentially applicable to all artificial surfaces, provided it is suitably engineered for its appointed use (e.g. road traffic). In urban areas, this measure can be applied either at a local/neighbourhood scale or at the larger scale of a city. It is not directly applicable to agricultural land itself but can be applied to artificial surfaces within agricultural areas, e.g. farmyards.

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
	M	M	M			M			M		M

How to implement it

A permeable, or pervious, pavement is created to replace an impervious hardstanding area. Regular inspection and maintenance are important for the effective operation of permeable pavements and to prevent their plugging.

Stakeholders

- City administration
- Non-government organisations/Civil society
- Citizens or community groups

Cost calculations

Cost category	Specific input	Unit
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Construction material (cement, etc.)	Pieces, Kg/ha
	Fuel	L
Investigations & studies	Technical study, geotechnical investigation	Days, study

Unit cost examples

- *The cost range for the implementation of permeable surfaces is estimated as follows: geotechnical studies (€0-5k); capital cost of permeable paving (€40-90/m²); maintenance costs (€1-€5/m²) (NWRM).*

Case studies

- Green Reconstruction in Ukraine

Technical references

[EN] NWRM Factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#15 Rainwater management public features

Drainage solutions that provide an alternative to the direct channelling of surface water through networks of pipes and sewers to nearby watercourses include swales, channels and rills, filter strips, soakaways, infiltration trenches, detention basins, retention ponds and infiltration basins.

Scale of implementation

Any location where drainage solutions can be implemented is potentially suitable for rainwater management public features. Its implementation should be made at water body scale in order to prevent and mitigate pressures.

CO-BENEFITS

[H] Flood prevention
[M] Drought prevention
[M] Biodiversity

Also contributes to:

[H] Flood Directive
[M] Urban Wastewater Treatment Dir.
[M] Nature Restoration Law
[M] Biodiversity Strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
	H	H	H			H			M		M

How to implement it

Rainwater management public features are implemented in line with local conditions and needs. They include a wide range of features such as swales, channels and rills, filter strips, soakaways, infiltration trenches, detention basins, retention ponds and infiltration basins.

Stakeholders

- City administration
- Non-government organisations/Civil society
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)
- Local communities

Cost calculations

Cost category	Specific input	Unit
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Fuel	L
Investigations & studies	Technical study, geotechnical investigation	Days, study

Unit cost examples

- *The cost of permeable landscaping of public areas is estimated at about €43/m², and green roof implementation at private scale is estimated at about €50 /m². The operation and maintenance cost of permeable landscaping in public areas is about €15,000/year, and the operation and maintenance of green roofs is about €6/m²/year. (Green city action plan, Chisinau, 2019)*

Case studies

- Rainwater retention and permeable landscaping in Chisinau, Moldova

Technical references

[EN] NWRM Factsheets U04 to U012

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

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#16 Afforestation

Afforestation is the creation of forest on land dedicated to another land use. Active afforestation involves planting trees, whereas passive afforestation sustains the natural development of forested ecosystems following land abandonment. In the former case, attention should be paid to using local seedlings only.

Reforestation can be considered as a form of afforestation since it restores an area that has been deforested.

Scale of implementation

This measure applies to degraded lands, agricultural land, and semi-natural areas (natural parks, protected areas). Any location where trees can be planted is potentially suitable for afforestation. It should be implemented at water body scale in order to prevent and mitigate pressures.

CO-BENEFITS

[H] Flood prevention
[M] Drought prevention
[H] Biodiversity

Also contributes to:

[M] Habitat and Bird Directive
[M] Nitrate Directive
[M] Nature Restoration Law
[H] Biodiversity strategy for 2030
[H] Forest Strategy for 2030
[M] Soil strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
				H			M	M			M

How to implement it

Afforestation can involve tree planting and seeding in an unforested area. Afforestation entails a large set of measures including natural recovery, industrial plantations, and agricultural forestry (agroforestry).

Stakeholders

- National forest authorities
- Non-government organisations/Civil society
- Citizens or community groups
- Foresters/silviculturists and cultivators

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Fuel	L
	Water for irrigation	L/ha

Unit cost examples

The resources required for 1ha of afforestation are: 2,000-5,000 seedlings; 10-50 t water (for initial irrigation); 40 – 100 working days; shuffles or soil driller; means of transport, with an estimated cost of USD 5,700/ha including fencing (30%), planting (30%) and seedlings (40%), as part of a high-altitude afforestation for erosion control project, in Armenia.

Case studies

- High-altitude afforestation for erosion control in Armenia, 2018
- Afforestation on 34 ha in Gegharkunik region in Armenia, 2013
- Afforestation of 150 ha in Orhei National Park in Moldova, 2013
- Extension and rehabilitation of forests in Moldova, 2023
- Afforestation of degraded land, riverside areas and protection belts in Moldova, 2016
- Reforestation with forestry and fruit trees in Armenia

Technical references

[EN] NWRM Factsheets F03 to F05

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#17 Conversion to meadows and pastures

This type of solution involves the restoration of degraded pastures, steppes and grasslands, on land previously employed for another land use. Meadows and pastures provide good conditions for the uptake and storage of water during temporary floods. They also protect water quality by trapping sediments and assimilating nutrients.

This measure includes restoration of degraded pastures, which refers to cultivated grasslands, while measure #6 refers to the restoration of natural grassland ecosystems (i.e. natural steppes).

CO-BENEFITS

[M] Flood prevention
[M] Drought prevention
[H] Biodiversity

Also contributes to:

[H] Habitat and Bird Directive
[M] Nitrate Directive
[M] Nature Restoration Law
[H] Biodiversity strategy for 2030
[M] Soil strategy for 2030

Scale of implementation

This measure operates at field or farm scale, on land not previously used as meadows or pastures. It must be implemented in all areas where pastures are found. It must be implemented at water body scale in order to prevent and mitigate pressures.

Pressure efficiency

Point source pollution			**Diffuse source pollution**				**Water abstraction and flow diversion**		**Hydromorphology**		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
				H	M		M	M			M

How to implement it

Conversion to meadows and pastures can be done through planting carefully chosen grass species. Meadows are areas or fields whose main vegetation is grass, or other non-woody plants, used for mowing and haying. Pastures are grassed or wooded areas, moorland or heathland, generally used for grazing.

Stakeholders

- Landowners
- Land users (leaseholders, livestock owners, shepherds)
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)
- Local communities

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Fuel	L

Unit cost examples

Converting land from arable to permanent grassland is estimated at about €154/ha, and grassland maintenance costs are estimated at around €159-€420/ha for grazing and around €189-€358/ha for hay. (NWRM)

Case studies

- Restoration of pasturelands in Orhei National Park in Moldova, 2013

Technical references

[EN] NWRM factsheet
[EN] Manual on the improvement of degraded natural grazing lands (pastures and grasslands), Armenia

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#18 Soil unsealing and renaturation (soils, built structures)

Soil unsealing involves removing built and impervious structures to restore permeable land use. It is designed to allow rainwater to infiltrate through the surface.

This solution includes a large set of methods such as [14] Permeable surfaces and [15] Rainwater management public features.

Scale of implementation

Soil unsealing is potentially applicable to all artificial surfaces. In urban areas, this measure can be applied either at a local/neighbourhood scale or at the larger scale of a city. It is not directly applicable to agricultural land itself but can be applied to artificial surfaces within agricultural areas, e.g., farmyards.

CO-BENEFITS

[M] Flood prevention
[M] Drought prevention
[M] Biodiversity

Also contributes to:

[M] Flood Directive
[M] Nature Restoration Law
[M] Biodiversity strategy for 2030
[H] Soil Strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
	M	M	M			M		M			M

How to implement it

Soil unsealing is implemented to replace an impervious hardstanding area, built structures and/or impermeable soils.

Stakeholders

- City administration
- Non-government organisations/Civil society
- Citizens or community groups

Cost calculations

Cost category	Specific input	Unit
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Construction material (cement, etc.)	Pieces, kg/ha
	Plant material	Kg/ha
	Fuel	L
Investigations & studies	Technical studies, geotechnical study	Study, days

Unit cost examples

- *The cost range for the implementation of permeable surfaces is estimated as follows: geotechnical studies (€0-5k); capital cost of permeable paving (€40-90/m²); maintenance costs (€1-5/m²) (NWRM).*
- *The cost of permeable landscaping of public areas is estimated at €43/m², and green roof implementation at private scale is estimated at €50/m². The cost of operation and maintenance of permeable landscaping in public areas is about €15,000/year, and the operation and maintenance of green roofs is about €6/m²/year. (Green City Action Plan, Chisinau, 2019)*

Case studies

- Green Reconstruction in Ukraine
- Rainwater retention and permeable landscaping in Chisinau, Moldova

Technical references

[EN] NWRM factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#19 Conservation of existing high environmental value ecosystems

The conservation, maintenance and preservation of existing high environmental value ecosystems includes grasslands, steppes, orchards, old forests, etc. These ecosystems have a positive effect on water resources (infiltration, purification, low or no inputs of fertilizers and pesticides). They are habitats of interest.

Scale of implementation

The conservation of high environmental value ecosystems is potentially applicable to all habitats of interest. Protected areas can be found in a wide variety of environments, ranging from mountains to the sea, deserts, forests, freshwater lakes, and can even traverse borders.

CO-BENEFITS

[M] Drought prevention
[H] Biodiversity

Also contributes to:

[H] Habitat and Bird Directive
[M] Nature Restoration Law
[M] Biodiversity strategy for 2030
[H] Forest Strategy for 2030
[M] Soil strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
				M	M		M	M			

How to implement it

The conservation of existing high environmental value ecosystems entails a wide range of methods such as the clear definition of geographical space, a range of governance involving individuals and the state, and the recognition of the sites listed on the World Database on Protected Areas (WDPA). Protected areas should be managed in perpetuity and not as a part of a short-term or temporary management strategy.

Stakeholders

- National forest authorities
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)

Cost calculations

Cost category	Specific input	Unit
Investigations & studies	Technical studies, natural resources assessment, etc.	Study, days

Unit cost examples

No information has been found yet. To be completed.

Case studies

- Biosphere Reserves and Climate Adaptation in Ukraine, 2021
- Armenia's third Ramsar site

Technical references

- [EN] Guidelines for establishing protected areas, Turkey (FAO)

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#20 Natural water harvesting/keyline design

This solution involves organising the landscape to efficiently collect rainwater and distribute it through landscape and soils. Keyline design implies using a landscape design parallel to the contour lines. The approach aims to slow down, infiltrate, store and spread water through the landscape.

Scale of implementation

The keyline design method works at field or farm scale. This method refers to a topographical feature related to the natural flow pattern of water through the land. Hence, its implementation must be planned at water body scale in order to prevent and mitigate pressures.

CO-BENEFITS

[M] Flood prevention

[H] Drought prevention

Also contributes to:

[M] Biodiversity strategy for 2030

[M] Soil Strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
				M			H	M			H

How to implement it

Keyline design is a comprehensive farm water management plan that uses natural landscape contours and cultivation techniques to harvest rainwater and build soil fertility. The measure requires defining lines downside and upside to the keyline, parallel to it. Hence, the form and shape of the land determine the layout and position of farm dams, irrigation areas, roads, fences, farm buildings and tree lines.

Stakeholders

- Cultivators/Farmers
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)
- Local communities

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Fuel	L

Unit cost examples

Keyline design includes subsoil ploughing activities that may be mechanic or manual depending on the surface of the terrain and the rockiness of the soil. Small swale can be done manually while keylines require the use of an engine such as a tractor.

Case studies

- Silvopasture and keyline design in the Lum Ha' farm, Mexico

Technical references

- The Keyline Plan, Yeomans P.A.
- The Challenge of Landscape: the development and practice of keyline, Yeomans P.A.

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#21 Semi-artificial wetlands and water bodies

Semi-artificial wetlands and water bodies enable the storage of surface run-off to secure water supply.

It is important to be aware of the drawbacks of this method in terms of the impact on water resources (quantitative and qualitative aspects), at different time scales (cost amortisation, climate change dynamics) and spatial scales (from the farm to the territory and the hydrosystem, as the cumulative effect of the structures remains uncertain), and the risk-benefit ratio, especially for non-users of the project and other water uses. It also raises the question of whether such a solution could hinder the necessary evolution of agricultural systems towards greater water sobriety in the context of climate change. Semi-artificial wetlands and water bodies are sometimes seen as ill-adapted to drought and agricultural challenges.

Scale of implementation

Semi-artificial wetlands and water bodies may apply to large catchment areas and there is no maximum catchment area that can limit their use. Nevertheless, the sizing of the wetland/water body has to be adapted to the drainage area.

CO-BENEFITS

[?] Flood prevention
[?] Drought prevention

Also contributes to:

[?] Flood directive
[M] Biodiversity strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
				H							

How to implement it

Semi-artificial wetlands and water bodies require a large accessible area that is relatively flat and has an appropriately-sized drainage catchment. They can be installed in any type of area (urban, forest, agricultural, etc.). Natural features that could be used to form the basin and/or provide additional storage areas to minimise the need for artificial landscaping should be taken into account.

Stakeholders

- Cultivators/Farmers
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)
- Local communities

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Excavation material	Kg/ha
	Fuel	L
Investigations & studies	Technical studies	Study, days

Unit cost examples

- *Construction costs correspond to the storage volume of the basin/pond are approximately €44,000/ha, while maintenance costs are low (about €60/ha/year). (NWRM)*

Case studies

- Rainwater collection and storage basin for irrigation, Moldova

Technical references

[EN] NWRM Factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#22 Sediment capture ponds and check dams

Sediment capture ponds are engineered ponds placed in networks of forest ditches to slow the velocity of water and cause the deposition of suspended materials. Sediment capture ponds are most useful for managing the effects of ditch construction and maintenance, road works and final filling. Check dams are small dams, usually made from wood structure, used to stabilise the bed of erosion gorges and gullies. They retain sediment and slow down the water flow.

Scale of implementation

Sediment capture ponds are generally small-scale water features in forest ditch networks. The installation of sediment capture ponds in an existing ditch network requires a relatively small area of the total landscape.

This measure is relevant wherever land management activities may produce sediment that can later be mobilized and transported to surface waters. However, the usefulness of sediment capture ponds may be limited by long periods of freezing temperatures.

CO-BENEFITS

[M] Flood prevention

Also contributes to:

[M] Soil strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
				M	H				M		M

How to implement it

The design of sediment capture ponds and check dams requires the identification of an area that might require sediment capture and reduction of water flow. The implementation of sediment capture ponds and check dams may include these steps: excavation of soil material, creation of ditch networks, and construction of a wooden structure.

Stakeholders

- Local authorities (City, region)
- Local communities
- Cultivators/Farmers
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)

Cost calculations

Cost category	Specific input	Unit
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Excavation and construction material	Kg/ha

Unit cost examples

- *Capital costs: There will be slightly higher costs associated with creation of ditch networks when sediment capture ponds are present as the volume of material excavated will be slightly larger than it would be if no ponds were created. (NWRM)*
- *Maintenance costs: There are maintenance costs associated with dredging sediment capture ponds. The frequency of dredging will depend on the sediment load in the ditches. (NWRM)*

Case studies

- Flourishing dams in Jvarboseli and Shenakho in Georgia, 2022
- Community-based approach in Erosion Control in Ehen in Azerbaijan, 2018

Technical references

[EN] NWRM Factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#23 Constructed wetlands for wastewater treatment

As water flows through constructed wetlands, the plant roots and substrate remove the larger particles present in the wastewater. Pollutants and nutrients in the wastewater are then naturally broken down and absorbed by the bacteria and plants, removing them from the water.

Scale of implementation

Constructed wetlands work at neighbourhood and city scales. Note that city-scale constructed wetlands can only be implemented in areas where there is still enough free space for these NbS to be installed, and where the required land can be acquired.

CO-BENEFITS

[M] Biodiversity

Also contributes to:

[H] Urban Wastewater Treatment Dir.
[M] Nature Restoration Law
[M] Biodiversity Strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
H	H	H									

How to implement it

The design of constructed wetlands requires technical knowledge. Two kinds of factors must be considered during this process: 1) ambient factors, ranging from the location and the local weather to the pollutants the constructed wetland will have to deal with; 2) design parameters like plants and substrate selections, and the optimisation of the constructed wetland configuration.

Stakeholders

- Local authorities (City, region)
- Local communities
- Firms and networks of enterprises

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Building materials (cement, gravel, piping, etc.)	Kg/ha, items
	Soil	Tonnes

Unit cost examples

- *Constructed wetlands building costs can be broken down into the following components: excavation, liner, plants, gravel, distribution and control structures, and fencing. The average building cost of FWS-constructed wetlands is USD58k/ha (ranging from USD10k-150k/ha), while the average building cost of subsurface flow constructed wetland is USD388k/ha (ranging from USD80k-2,000k/ha). (MTE)*
- *Operating and maintenance costs of constructed wetlands include energy pumping, compliance monitoring, dike maintenance, and equipment replacement and repairs. The annual cost is estimated to range from USD2.5k-5k/ha/year. (MTE)*

Case studies

- Wetland-based wastewater treatment plant of Orhei, Moldova, 2013

Technical references

[UA] WWF Factsheet
[EN] NbS for wastewater treamtment
[EN] Constructed wetland for wastewater treatment

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#24 Wetland restoration and management

Wetland restoration and management can involve technical, spatially large-scale measures (including the installation of ditches for rewetting and the cutback of dykes to enable flooding); technical small-scale measures such as clearing trees; and changes in land-use and agricultural measures, such as adapting cultivation practices in wetland areas. Measures also include re-moistening peatlands for paludiculture.

CO-BENEFITS

[M] Flood prevention
[M] Drought prevention
[H] Biodiversity

Also contributes to:

[H] Habitat and Bird Directive
[M] Nitrate Directive
[M] Nature Restoration Law
[H] Biodiversity strategy for 2030

Scale of implementation

Wetlands can naturally be located anywhere on a river basin. The scales for restoration and maintenance measures vary, as activities can range from constructing small urban wetlands or wetlands in agricultural areas to restoring wetlands at landscape scale. The scale of measures varies from less than 10ha up to several thousand hectares. Smaller wetlands are generally set up in agricultural areas, while larger ones are most likely created in former peatland areas, or lowland river valleys.

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
			M	M	M	M	M	M	M	M	M

How to implement it

Wetland restoration and management encompasses a set of practices including either re-establishment (rebuilding a former wetland) or rehabilitation (repairing the functions of a degraded wetland).

Stakeholders

- Government bodies in charge of conservation and protected areas (national parks, forest administrations)
- Local communities
- Firms and network of enterprises

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Fuel	L
Investigation & studies	Technical/design projects	Study
Awareness raising	Involvement of stakeholders	Activity

Unit cost examples

Wetland restoration and management includes the costs of land acquisition (from €1,210/ha), investigation and studies (€16-600k/study), capital costs, maintenance costs, and awareness-raising activities (from €1k to 500k). (NWRM)

Case studies

- Wetland restoration in Hincesti and Orhei in Moldova, 2010
- Conservation and sustainable management of wetlands in the Prut River basin, Moldova
- Restoration of wetland areas in the Dniester River downstream, Moldova
- Restoration activities for the Khor Virap Sanctuary, Armenia

Technical references

- [EN] NWRM Factsheet
- [UA] WWF Factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#25 Floodplain restoration and management

The objective of restoring floodplains is to reconnect them to the river and implement other measures that will allow the restoration of their retention capacity and ecosystem functions.

Scale of implementation

This measure is designed to operate in extensive areas, with the aim of aligning with the original floodplain area of the river. To be effective, this measure should be implemented at the water body scale, with the aim of preventing and mitigating pressures. The measure could be implemented in national parks or protected areas, but in some cases, land acquisition may be necessary to proceed with restoration measures.

CO-BENEFITS

[H] Flood prevention
[M] Drought prevention
[H] Biodiversity

Also contributes to:

[H] Habitat and Bird Directive
[M] Nitrate Directive
[M] Nature Restoration Law
[H] Biodiversity strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
			M	M	M	M	M	M	H	H	M

How to implement it

The restoration of floodplains requires the implementation of measures designed to restore their retention capacity and ecosystem functions by reconnecting them to the river. The restoration of floodplains is reached through measures such as modification of the channel, removal of the legacy sediment, creation of lakes or ponds in the floodplain, new/modified of agricultural practices [2], afforestation [16], planting of native grasses, shrubs and trees, creation of grassy basins and swales, creation of wetland [24], removal of invasive species, and installation and development of riparian buffers [8].

Stakeholders

- Local authorities (City, region)
- Local communities
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)
- Cultivators/Farmers

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Fuel	L
	Terracing and excavating material	Items

Unit cost examples

- *Floodplain restoration and management in the Rioni River Basin cost more than €4,000,000. It included: creating bank terracing, vegetative buffers, and tree revetments to address floods related to the Rioni River basin and the localities it traverses.*

Case studies

- Rioni river floodplain restoration in Georgia, 2017
- Restoration of wetland areas in the Dniester River downstream, Moldova
- Water flow restored to entire lake system in Ukrainian Danube Delta

Technical references

[EN] NWRM Factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#26 Stream and river restoration

This type of restoiration comprises measures to restore the hydromorphology of streams and rivers, such as meandering, streambed restoration, restoration and reconnection of seasonal streams, and streambed material restoration.

Scale of implementation

Stream and river restoration is highly dependent on the context. This measure operates in stream and river areas. It should be implemented at water body scale in order to prevent and mitigate pressures.

CO-BENEFITS

[M] Flood prevention
[M] Drought prevention
[H] Biodiversity

Also contributes to:

[H] Habitat and Bird Directive
[M] Nitrate Directive
[M] Nature Restoration Law
[H] Biodiversity Strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
			M	M	M	M	M	M	H	H	M

How to implement it

The restoration of streams and rivers involves the implementation of measures designed to restore flow conditions (e.g., slowing the water flow), correct minor erosion problems, improve sedimentation, and enhance biodiversity and ecosystem functions. Stream restoration is achieved through actions such as stream meandering, streambed restoration, seasonal stream restoration and reconnection, and streambed material restoration.

Stakeholders

- Local authorities (City, region)
- Local communities
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Fuel	L
	Terracing and excavating material	Items

Unit cost examples

- *The capital costs of re-meandering a river are estimated at €400,000/km. Land acquisition and compensation costs for natural areas should be taken into account (NWRM).*

Case studies

- Restoration of wetland areas in the Dniester River downstream, Moldova
- Restoration of coastal territories of rivers, Armenia
- Restoration of riparian zones, Armenia

Technical references

[EN] NWRM Factsheet N03 to N06, N08

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#27 Reconnection of oxbow lakes

An oxbow lake is an ancient meander that was cut off from the river, thus creating a small lake with a U-shaped form. The reconnection of the oxbow lake with the river involves the removal of terrestrial lands between the two water bodies. This will result in the overall functioning of the river being improved by restoring lateral connectivity, diversifying flows and cleaning the river section of the present oxbow. Water retention during floods will also be improved.

Scale of implementation

This measure is applicable in floodplain areas where oxbow lakes and similar features are present. Please note that the area of the existing oxbow lake may vary significantly. Note that the space requirement is only significant if the land use inside the former lake has already been transformed into agriculture, forestry, etc.

CO-BENEFITS

[H] Flood prevention
[M] Drought prevention
[H] Biodiversity

Also contributes to:

[H] Habitat and Bird Directive
[M] Nature Restoration Law
[H] Biodiversity strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
									H	H	M

How to implement it

The reconnection of oxbow lakes can vary from a completely open connection to the construction of a system of inflow and outflow facilities (sluices located at the dyke/embankment). If the proposed solution involves the cutting of a dyke or embankment, it is essential to ensure that flood management requirements are given appropriate consideration, including the potential for flood protection for surrounding areas. In the event of a significant change in land use or land ownership patterns in the old meander, it is imperative to engage with the relevant stakeholders.

Stakeholders

- Local authorities (City, region)
- Local communities
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Fuel	L
	Terracing and excavating material	Items
Investigations & studies	Technical studies	Study, days

Unit cost examples

- *Reconnection of oxbow lakes includes the following costs: land acquisition (€0-60k); investigations and studies (€0-100k); capital costs (€100k-2,000k); maintenance costs (€10k-1,000k) (NWRM).*

Case studies

- Water flow restored to entire lake system in Ukrainian Danube Delta
- Reconnecting the Latorica river floodplain transboundary project, Ukraine

Technical references

[EN] NWRM Factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#28 Removal of transversal barriers

The removal of dams and other transversal barriers entails the destruction of all obstacles, the restoration of the slope and the longitudinal profile of the river, and the re-establishment of fluvial dynamics, as well as sedimentary and ecological continuity.

Scale of implementation

This measure can be undertaken in any kind of watercourse where dams, weirs and other longitudinal barriers have been constructed.

CO-BENEFITS

[M] Flood prevention

[H] Biodiversity

Also contributes to:

[H] Habitat and Bird Directive

[M] Nature Restoration Law

[H] Biodiversity strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
									H	H	

How to implement it

The removal of transversal barriers entails a wide range of methods that may vary depending on the site specifics, and the number and dimensions of existing dams and weirs. If there is evidence of a significant accumulation of polluted sediment behind the dam, it is recommended to remove and safely dispose of these before removing the barrier.

Stakeholders

- Local authorities (City, region)
- Local communities
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Fuel	L
	Terracing and excavating material	Items
Investigations & studies	Technical studies	Study, days

Unit cost examples

- *In Ukraine, the demolition of the Bayurivka dam cost about 42.5 million € to free the Perkalaba river, boost biodiversity and strengthen climate resilience (WWF, 2022).*

Case studies

- Restoration of the Perkalaba River by demolishing a dam, Ukraine
- Multiple dams removed in Ukrainian Danube Delta, Ukraine

Technical references

[EN] NWRM Factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#29 Natural bank stabilisation

River bank restoration consists in recovering the river's ecological components, thus reversing damages and especially allowing banks to be stabilised, allowing river to move more freely. Nature-based solutions such as bioengineering are preferable, but civil engineering must be used in case of strong hydrological constraints.

CO-BENEFITS

[M] Drought prevention

[H] Biodiversity

Also contributes to:

[M] Nature Restoration Law

[M] Biodiversity Strategy for 2030

Scale of implementation

In theory, the measure can be applied to any river with artificial bank reinforcement, thus in various catchment areas, and occur on rivers flowing through land used for any purpose. The space required depends on the length of the bank that needs restoring.

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
									M	M	

How to implement it

Natural bank stabilisation entails a wide range of methods that may vary depending on the size of the river, the topography, and the local context. It consists in stabilising riverbanks to enhance the structure and functioning of the river, as well as to increase biodiversity.

Stakeholders

- Local authorities (City, region)
- Local communities
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Fuel	L
	Excavation & terracing material	Items, kg/ha
Investigations & studies	Technical studies	Study, days

Unit cost examples

- *It is assumed that natural bank stabilisation is less expensive than civil engineering*

Case studies

No information has been found yet. To be completed.

Technical references

[EN] NWRM Factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#30 Removal of lateral barriers

This technique involves removing some parts of bank protection, especially inert parts, to enhance the lateral connections of the river, diversify flows (depth, substrate, and speed) and habitats, and diminish floods in the mainstream.

Removing lateral barriers is a prerequisite for many other measures, like [26] re-meandering or widening, as well as before initiating channel migration and dynamics.

Scale of implementation

This measure can be undertaken on any kind of watercourse whose banks have been modified with constructions to protect the riverside and canalize the river flow. This may potentially be relevant in areas with any kind of land use surrounding the river. However, attention should be paid to artificial surfaces, especially where socio-economic issues exist. It is mainly implemented in downstream reaches of the catchment where the natural floodplain is extensive, but it can be done wherever bank protection exists.

CO-BENEFITS

[H] Flood prevention
[M] Drought prevention
[H] Biodiversity

Also contributes to:

[H] Flood Directive
[H] Habitat and Bird Directive
[M] Nature Restoration Law
[H] Biodiversity Strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
									H	H	

How to implement it

The elimination of riverbank protection entails a wide range of methods that vary depending on the size of the river, the topography, and the local context. It consists in removing some parts of the bank protection to enhance the structure and functioning of the river.

Stakeholders

- Local authorities (City, region)
- Local communities
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Fuel	L
	Excavation & terracing material	Items, kg/ha
Investigations & studies	Technical studies	Study, days

Unit cost examples

No information has been found yet. To be completed.

Case studies

- New riverbank at Hainburg in Danube floodplain area, Austria

Technical references

[EN] NWRM Factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#31 Lake restoration

Restoring lakes means improving their structure and function where they have been drained in the past.

Scale of implementation

The restoration of lakes and surroundings (wetlands, bogs, fens, mires, as well as forests and agricultural lands) can take place anywhere as long as there is a (current or former) lake. The space required is highly variable depending on the size of the lake, the topography, and the contributing rivers and streams. This measure should be imprented at water body scale to prevent and mitigate pressures.

CO-BENEFITS

[M] Drought prevention

[H] Biodiversity

Also contributes to:

[H] Habitat and Bird Directive

[M] Nature Restoration Law

[M] Biodiversity Strategy for 2030

Pressure efficiency

Point source pollution			**Diffuse source pollution**				**Water abstraction and flow diversion**		**Hydromorphology**		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
									H	M	M

How to implement it

Lake restoration entails a wide range of methods that may vary depending on the size of the lake, the topography, and the local context. It consists in enhancing the structure and functioning of lakes.

Stakeholders

- Local authorities (City, region)
- Local communities
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)

Cost calculations

Cost category	Specific input	Unit
Land	Acquisition costs	Ha
	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, pieces
Consumables	Plant material	Kg/ha
	Terracing and excavating material	Pieces, kg/ha
	Fuel	L
Investigations & studies	Technical studies	Study, days

Unit cost examples

- *Habitat restoration at Croxall Lakes Nature Reserve cost about €4,000/ha. Since these lakes have long lifespans, once in operation maintenance costs are minimal. (NWRM)*

Case studies

- Water flow restored to entire lake system in Ukrainian Danube Delta
- Long-term national vision of Lake Sevan, Armenia

Technical references

[EN] NWRM Factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#32 Restoration of polder areas

R<estoring polder areas consists in enhancing polders with sub-natural characteristics, which allows better water storage in watercourses inside the polder, and increases biodiversity.

Scale of implementation

This measure can be undertaken in any kind of polder area where natural characteristics need to be enhanced. In the past, polders tended to be developed in the lower reaches of large rivers with large upstream catchments where high flood storage capacity was desired. Therefore, this is most likely to be relevant in the downstream reaches of major river catchments.

CO-BENEFITS

[H] Flood prevention
[H] Biodiversity

Also contributes to:

[H] Flood Directive
[H] Habitat and Bird Directive
[M] Nitrate Directive
[M] Nature Restoration Law
[H] Biodiversity Strategy for 2030

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
									H	H	M

How to implement it

Polder restoration entails a wide range of methods that may vary depending on the size of the polder area, the topography, and the local context. It results in enhanced water storage, re-wilding and increased biodiversity.

Stakeholders

- Local authorities (City, region)
- Local communities
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)

Cost calculations

Cost category	Specific input	Unit
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha

Unit cost examples

No information has been found yet. To be completed.

Case studies

- Restoring and rewilding former polders in the Danube Delta, Ukraine & Moldova

Technical references

[EN] NWRM Factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

#33 Restoration of buffer strips, riparian forests and gallery forests

Riparian buffers are forested areas along streams and other water bodies. Although most commonly associated with post-harvest closures, riparian buffers can also occur in urban, agricultural and wetland areas. By preserving a relatively undisturbed area adjacent to open water, riparian buffers can serve several functions related to water quality and flow moderation. The trees in riparian areas can efficiently take up excess nutrients and may serve to increase infiltration. Riparian buffers serve to slow water as it moves off the land. This can decrease sediment inputs into surface waters.

CO-BENEFITS

[M] Flood prevention
[H] Drought prevention
[H] Biodiversity

Also contributes to:

[M] Flood Directive
[H] Habitat and Bird Directive
[H] Nitrate Directive
[M] Nature Restoration Law
[H] Biodiversity Strategy for 2030

Scale of implementation

Riparian buffers are most effective at a small spatial scale and are typically located on both sides of a stream in intact forests, harvested forests or agricultural areas. The buffers are implemented at farm scale or water basin scale with a fixed width, ranging from 2 to 50+ m. The width of the buffer may also be determined according to the length or size of the watercourse or waterbody.

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
			M	M	M	M			H	M	M

How to implement it

Riparian buffers can be created or conserved in areas with artificial surfaces or in agricultural areas. In a forestry context, riparian buffers are areas of land adjacent to streams, rivers or lakes, which are not disturbed during forest harvesting.

Stakeholders

- National forest authorities
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)
- Foresters (silviculturists)
- Cultivators/Farmers
- Local communities

Cost calculations

Cost category	Specific input	Unit
Land	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Plant material	Kg/ha
	Fuel	L

Unit cost examples

Typically, land is not acquired for forest riparian buffers, as it is usually owned by the farmer or forest owner who manages adjacent lands. No studies or investigations are needed before implementation, and there are low capital costs apart from tree planting. Maintenance costs are low. The main cost associated with forest riparian buffers is the foregone income associated with land that cannot be harvested for forestry or agricultural purposes.

Case studies

- Rioni River Floodplain Restoration in Georgia, 2017
- Restoration of riparian zones in Armenia, 2021
- Wetland conservation in the Dniester River basin, Moldova

Technical references

[EN] NWRM Factsheet F1
[EN] Riparian Buffer Restoration
[EN] NBS in Forestry, water and agriculture for restoration of Ukraine

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

© Water Alternatives Photo, 2018

#34 Managed aquifer recharge

This solution is the process of deliberately increasing the recharge of groundwater for subsequent recovery or environmental benefits.

Managed Aquifer Recharge is an effective adaptation measure that can help reduce vulnerability to climate change and hydrological variability. This measure can play an important role in controlling over-abstraction and restoring groundwater balance.

CO-BENEFITS

[H] Drought prevention

Also contributes to:

[M] Soil strategy for 2030

Scale of implementation

This approach is only relevant where the underlying solid geology is permeable, i.e. where there is an aquifer. It is essential to plan the implementation of this approach at a water body scale in order to prevent and mitigate pressures.

Pressure efficiency

Point source pollution			Diffuse source pollution				Water abstraction and flow diversion		Hydromorphology		
1.1 Urban wastewater	1.2 Storm overflows	1.3 and 1.4 IED and non-IED plants	2.1 Urban run-off	2.2 Agriculture	2.3 Forestry	2.4 to 2.10 Others	3.1 Agriculture	3.2 to 3.7 Others	4.1 Physical alteration of channels	4.2 Dams, barriers and locks	4.3 Hydrological alteration
							H	H			H

How to implement it

There are a number of techniques that can be employed to recharge an aquifer, either through water infiltration (flooding, ditches, excess irrigation, river/lake bank filtration, well and borehole recharge) or through water interception (subsurface dams, sand dams, runoff harvesting, trenches). The selection of the most appropriate method is dependent on the local hydrogeological conditions. Depending on the chosen approach to infiltration and the source of the water, it may be necessary to pre-treat the water to prevent pollution from reaching groundwater. To guarantee successful implementation, technical studies should be carried out to determine the objectives and methodology to be adopted.

Stakeholders

- Government bodies in charge of water resources management
- Government bodies in charge of conservation and protected areas (national parks, forest administrations)
- Local communities
- Scientific community and researchers in the field of hydrogeology
- Firms and network of enterprises

Cost calculations

Cost category	Specific input	Unit
Land	Land lease costs	Ha
Labour	Implementation/maintenance	Person-days
Equipment	Implementation/maintenance	Days, items
Consumables	Building materials	Kg/ha, items
	Fuel	L
Investigation & studies	Technical/design projects	study
Awareness raising	Involvement of stakeholders	activity

Unit cost examples

The artificial filling of Armenia's Ararat artesian basin cost less than USD 2-3 million (USD 0.05-0.075/m3), involving the construction of a facility to pump 40 million m3 of water per year into the underground basin (water intake, pipeline, well cleaning). This solution was less expensive than the capital costs of constructing a new 40 million m^3 reservoir, its annual maintenance and transportation to the point of consumption (USD 30-250 million or USD5.75-6.25/m3). (Armenia, 2022)

Case studies

- Managing aquifer recharge: 28 case studies around the world, 2021
- Global inventory of Managed aquifer recharge schemes around the world
- Restoration Peculiarities of Water Reserves of Underground Basins, Armenia

Technical references

[EN] NWRM Factsheet

H: high effectiveness; M: moderate effectiveness. For further details, please refer to the Catalogue of Nature-based Solutions in the Eastern Partnership Countries. Details on the rankings for pressure types, co-benefits, and European policy synergies are provided in Annex 1. Note that these rankings are only indicative and may vary locally.

5. Implementing Nature-based Solutions in the Context of River Basin Management Plans

The objective of implementing RBMPs (River Basin Management Plans) is to achieve good qualitative and quantitative status of water bodies in Armenia, Azerbaijan, Georgia, the Republic of Moldova and Ukraine. An RBMP comprises a number of documents, including a programme of measures which identifies a range of actions to be implemented in the basin in order to improve water bodies that have been adversely affected. Among the measures to be included in the programme of measures of an RBMP, nature-based solutions (NbS) are relevant as they simultaneously address societal challenges and the preservation of biodiversity and natural resources.

5.1. Methods and standards for implementation

To ensure the success of nature-based solutions as measures featuring in the programme of measures in the context of RBMPs, it is essential to give due attention to the implementation. Sound implementation of NbS should be based on:

- A clear identification of the pressure(s) to be tackled by the solutions. The selection tool presented in Section 3 provides general information, but further field studies are required to gain a detailed understanding of the pressure(s) to be addressed.
- An appropriate spatial design, which is essential to ensure the effectiveness of the solution. Another crucial element is to consider the consequences and interactions between the solution and the economy, society and ecosystems at an adapted scale.
- Considering the environmental sustainability, social equity and economic viability of the solution to prevent project difficulties due to a lack of local ownership by the concerned population and stakeholders.
- Striking a balance between achieving the desired outcomes and considering the wider benefits and impacts of the solution, both in the short and long terms.
- An adaptive management approach based on evidence in order to enable a response to uncertainty and unexpected social, economic or climate events.
- The sharing and dissemination of feedback, including monitoring and measurement data on the ecological, social and economic effects of the solution, in order to contribute to the building of knowledge and experience in implementing nature-based solutions.

Box 8. Tools for the implementation of nature-based solutions

- The IUCN Global standard

The IUCN Global standard gives a logical framework for designing nature-based solutions and planning their implementation. It can also be used for evaluating the design of solutions already implemented. The standard is based on eight criteria and 28 indicators.

Although very ambitious, this standard is very useful as it provides an extensive view of what needs to be taken into account to guarantee the success of nature-based solutions.

IUCN Global Standard for Nature-based Solutions: first edition, 2020. 21 p.

Guidance for using the IUCN Global Standard for Nature-based Solutions: first edition, 2020. 62p.

- The IWRM tool on nature-based solutions

Elaborated by the Global Water Partnership, this tool provides key elements for effective NbS implementation, among other information on nature-based solutions.

Nature Based Solutions in the IWRM Tools, online.

- The NATURVATION Guide

In this report, Irina Herb and Christiane Gerstetter of Ecologic Institute, as well as Alexandru Matei (ICLEI), present insights on how nature-based solutions can contribute to achieving the Sustainable Development Goals (SDGs), defined in the 2030 Agenda, and recommend several pathways for doing so. They identify five pathways and respective stepping stones (actions) for how nature-based solutions can contribute to achieving the SDGs and be mainstreamed. These pathways involve a wide spectrum of actors, strengthening the local level, addressing multiple sustainability objectives at the same time, making institutional arrangements for integrated sustainable development, and monitoring and assessing sustainable urban transformation.

Mainstreaming Nature-Based Solutions: Sustainable Development Goals, online

Box 9. Recommendations for implementing Nature-based Solutions

Discussions at the 11th OECD Roundtable on Financing Water highlighted the need to adopt a comprehensive approach that addresses the financial, regulatory and operational challenges involved when implementing and scaling up Nature-based Solutions. By understanding these challenges and implementing tailored solutions, the EaP countries can effectively integrate NbS into their water management strategies, benefiting both the environment and society. Some of the key recommendations that came up during the discussion included:

1. Innovative Financing Models: Develop innovative financial instruments, such as land swaps, bridge capital for land restoration, and results-based financing, to address the challenges of land acquisition and project development.

2. Public-Private Partnerships: Strengthen public-private partnerships, utilising combined ecological and financial models to make NbS projects more attractive to private investors.

3. Regulatory Standardisation and Incentives: Standardise regulations and offer incentives to encourage NbS adoption, such as ecosystem payment schemes and user fees (e.g., moving away from the flat-rate payment system of CAP).

4. Tailored Financial Structures: Create diversified financial structures, combining grants, loans, equity investments, and green bonds, customised for NbS projects.

5. Mainstreaming NbS in Utility and Infrastructure Planning: Integrate NbS into the strategic planning of utilities, particularly water utilities, to exploit their potential in ecosystem services.

Source: Discussions during the 11th OECD Roundtable on Financing Water, 30-31 May 2024, Brussels.

5.2. Monitoring and evaluating nature-based solutions

Evaluating the success of nature-based solutions is essential for two reasons:

- Gathering information on whether or not objectives are being met, and why, enables the project to be adapted or even revised to improve the outcomes.
- Building evidence on the effectiveness of nature-based solutions contributes to the continuous improvement of knowledge and helps understand the strengths and weaknesses of these solutions, quantifying their effectiveness and the multiple co-benefits they provide.

A sound evaluation should be based on field data, collected through a monitoring plan before and after the implementation of the solution. This framework should cover water body status and other ecological aspects, but should also take into account other benefits, social aspects, and the economics of the solution.

Box 10. Guidance for building a monitoring and evaluation framework

- Evaluating the impact of nature-based solutions, a handbook for practitioners

This handbook aims to provide practitioners with a comprehensive Nature-based Solutions (NBS) impact assessment framework, and a robust set of indicators and methodologies to assess the impacts of NBS across 12 societal challenges. The accompanying appendix of methods provides a brief description of each indicator and recommends appropriate methods to measure specific impacts, along with guidance for end-users on the appropriateness, advantages and drawbacks of each method in different local contexts.

Evaluating the impact of nature-based solutions: a handbook for practitioners, 2021. 373 p.

Evaluating the impact of nature-based solutions: appendix of methods, 2021. 117 p.

- IUCN's online self-assessment tool for NbS

This online tool consists of eight criteria and associated indicators, which address the pillars of sustainable development (biodiversity, economy and society) and resilient project management. It is made up of the Standard and the associated guidance which will instruct users how to perform a self-assessment to:

- design new Nature-based Solutions,
- upscale pilots by identifying gaps, and
- verify past projects and future proposals.

Once the self-assessment is completed, the system generates a PDF summary report with your results. The output comes in the form of a percentage match compared against good practices, with a traffic light system to identify areas for further work and adherence to the IUCN Global Standard for Nature-based Solutions.

IUCN online Self-assessment tool

5.3. Funding Nature-based Solutions

Financing is a crucial factor in implementing NbS, encompassing both public funding and private-sector investment.

Countries, private-sector entities, and development partners adopt a range of strategies to mobilise finance and investment to advance NbS. For instance, pilot projects offer low-risk opportunities for involvement in NbS financing, demonstrating feasibility and fostering investor confidence.

Blended finance is a strategy that uses a combination of public and philanthropic financing to mitigate investment risk and stimulate private funding. Identifying strategic sectors reliant on ecosystem services, such as the hospitality and beverage industries, can be an effective entry point for demonstrating the potential for private-sector engagement in NbS projects.

To effectively promote and scale up finance for NbS, a robust and practical framework must be established for assessing the qualitative and quantitative benefits of NbS, including for the economy, environment, well-being and local livelihoods. Such assessments are vital for building a strong business case for NbS and informing investment decisions. Furthermore, it is crucial to demonstrate the cost-benefit advantages of NbS in comparison to traditional grey solutions. Furthermore, exploring the potential for integrating NbS with grey infrastructure solutions could empower relevant stakeholders to realise the benefits in terms of resilience, sustainability, and return on investment.

Box 11. Funding opportunities for Nature-based Solutions

- Horizon Europe
- Programme for environment and climate action (LIFE)
- EU funding programmes (2021-2027)
- European Biodiversity Partnership (Biodiversa+)
- COST actions

Source: Nature-based Solutions – European Commission

Box 12. Tools for funding Nature-based Solutions

- Investing in nature-based solutions. State-of-play and way forward for public and private financial measures in Europe. European Investment Bank (2023)
- Assessing the Benefits and Costs of Nature-Based Solutions for Climate Resilience: A Guideline for Project Developers. World Bank (2023)
- A market review of Nature-based Solutions. An emerging institutional asset class. Finance Earth (2021)

Box 13. Case study: opportunities for financing cost-effective NbS in the Alazani-lori RBMP

A forthcoming OECD publication on implementing cost-effectiveness in the EaP countries includes a detailed case study assessing how to implement and finance NbS within the Alazani-Iori River Basin Management Plan (RBMP). The case study found that there was significant potential for NbS deployment, but that it would require a strategic approach to financing, leveraging diverse funding sources and partnerships to ensure both effectiveness and sustainability. Below are the key strategies recommended to facilitate financing for NbS in the Alazani-Iori RBMP:

1. Identify Financial Pathways:

- Explore Global Environmental Facility (GEF) and Green Climate Fund (GCF) as primary funding sources
- Consider involvement in the International Climate Initiative (IKI)
- European Structural and Investment Funds (ESIF)
- Water Funds
- Corporate Environmental Responsibility Initiatives
- Crowdfunding and Community-based Initiatives

2. Engage with Local and International Partners:

- Foster partnerships with local government entities such as the Municipal Development Fund of Georgia and the Ministry of Regional Development and Infrastructure of Georgia
- Collaborate with private sector stakeholders like the United Water Supply Company of Georgia and Georgian Amelioration to integrate private investment in public projects
- Involve non-governmental organisations such as ELKANA (Organic Farming & Rural Tourism Network in Georgia), which could support NbS through community-based projects and sustainable tourism

3. Incorporate NbS into Programmes of Measures (PoMs):

- Align NbS with the Water Framework Directive (WFD) requirements as part of PoMs emphasising holistic water management approaches that address both point and diffuse source pollution
- Design interventions that restore natural ecosystems and manage environmental pressures effectively, as outlined in the WFD's 5th Implementation Report, which advocates for the broad use of NbS

4. Leverage Successful Case Studies:

- Reference successful financial models like the restoration of the Emscher Landscape Park in Germany, the Danube River Basin, and the Murray-Darling Basin in Australia
- Adapt these models to local contexts within the Alazani-Iori basin, ensuring that financial strategies are tailored to the specific environmental and socio-economic conditions of the region

5. Conduct Comprehensive Feasibility Studies:

- Undertake feasibility studies to identify additional stakeholders, assess the economic benefits of NbS, and define specific project needs

6. Develop a Monitoring and Evaluation Framework:

- Implement a robust monitoring system to track the effectiveness of funded projects, ensuring accountability and facilitating ongoing support from financial partners

Source: OECD 2025 (forthcoming). "Cost Effective Nature-based Solutions in the Eastern Partnership Countries"

5.4. Recommendations for better integration of Nature-based Solutions in the Programme of Measures of River Basin Management Plans

The integration of NbS into the PoM of RBMPs is strongly encouraged. The process of generalising NbS entails:

- Developing further knowledge and gathering feedback from existing NbS. Operators need to rely on specific guidance and comparison between different types of solutions (i.e. 'grey' versus 'NbS') regarding their implementation cost, funding sources, advantages and drawbacks in the face of a particular issue. In that sense, the present catalogue is a powerful tool for the diffusion of NbS and a source of knowledge on types of solutions, technical characteristics and costs.
- Collecting data on the cost-effectiveness of NBS and building strong arguments, in order to convince various stakeholders.
- Designing appropriate training courses and communication tools to raise awareness among all stakeholders, through presentations or dedicated working groups. Sharing a precise definition of climate change adaptation, mitigation, and nature-based solutions, and describing the potential maladaptation risks associated with certain solutions.

6. References

6.1. Technical and methodological guidance

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UNEP, 2022. *Resolution adopted by the United Nations Environment Assembly on 2 March 2022*. Fifth session, Nairobi (hybrid) 22 and 23 February 2021 and 28 February – 2 March 2022. https://wedocs.unep.org/bitstream/handle/20.500.11822/39864/NATURE-BASED%20SOLUTIONS%20FOR%20SUPPORTING%20SUSTAINABLE%20DEVELOPMENT.%20English.pdf

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IPCC, 2024. The Intergovernmental Panel on Climate Change. https://www.ipcc.ch/

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6.2. Case studies and technical references specific to Eastern Partnership countries

The table below gives the reader direct access to the case studies and technical references mentioned in this catalogue, sorted by nature-based solutions (#NbS). The country in which the nature-based solutions have been implemented are mentioned.

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
NA	REG	International Office for Water (IOW), in consortium with Actéon Environment (France), AMEC Foster Wheeler (United Kingdom), BEF (Baltic States), ENVECO (Sweden), IACO (Cyprus/Greece), IMDEA Water (Spain), REC (Hungary/Central & Eastern Europe), REKK inc. (Hungary), SLU (Sweden) and SRUC (UK)	NWRM project	53 NWRM illustrated	2013	http://nwrm.eu/measure/53-nwrm-illustrated
NA	REG	World Bank	World Bank	A catalogue of Nature-based solutions for urban resilience	2020	https://openknowledge.worldbank.org/entities/publication/c33e226c-2fbb-5e11-8c21-7b711ecbc725

[6] Country where the Nature-based Solution mentioned in the case study or technical reference has been implemented. "REG" is indicated when it does not refer to a particular country but to the regional level.

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
NA	REG	Clara Veerkamp (PBL, ETC/CCA), Emiliano Ramieri (Thetis, ETC/CCA), Linda Romanovska (FT, ETC/CCA), Marianne Zandersen (DCE-AU, ETC/CCA), Johannes Förster (UFZ, ETC/CCA), Magdalena Rogger (FT, ETC/CCA), Louise Martinsen (DCE-AU, ETC/CCA)	European Environment Agency	Assessment frameworks of nature-based solutions for climate change adaptation and disaster risk reduction	2021	https://www.eionet.europa.eu/etcs/etc-cca/products/etc-cca-reports/tp_3-2021
NA	REG		European Environment Agency	Nature-based solutions in Europe: Policy, knowledge and practice for climate change adaptation and disaster risk reduction	2021	https://www.eea.europa.eu/publications/nature-based-solutions-in-europe
NA	REG	Salvatore Martire, Eva Enyedi, Margaretha Breil, Monserrat Budding-Polo Ballinas, Daniel Zimmer, Ellie Tonks, Suvi Vikstrom, Ville Turunen	European Environment Agency	Understanding the scaling potential of Nature-based Solutions	2022	https://www.eionet.europa.eu/etcs/etc-ca/products/etc-ca-products/etc-ca-report-2-22-understanding-the-scaling-potential-of-nature-based-solutions
#1 SUSTAINABLE PASTURE MANAGEMENT						
#1	REG	International Office for Water (IOW), in consortium with Actéon Environment (France), AMEC Foster Wheeler (United Kingdom), BEF (Baltic States), ENVECO (Sweden), IACO (Cyprus/Greece), IMDEA Water	NWRM project	Meadows and pastures	2013	http://nwrm.eu/measure/meadows-and-pastures

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
		(Spain), REC (Hungary/Central & Eastern Europe), REKK inc. (Hungary), SLU (Sweden) and SRUC (UK)				
#1	GE	Anja Salzer, International Expert, Germany (Team Leader), Ana Rukhadze and Kakha Artsivadze, National Experts, Georgia	REC Caucasus, prepared under the German government supported GIZ Programme “Integrated Biodiversity Management in the South Caucasus (IBiS)”	Pasture Management in Georgia: Situation Analysis and Main Challenges, Recommendations for Development of Sustainable Pasture Management Programme / Document of Desk-based Research (Background Study) for Facilitation of Establishment of the State Programme for Sustainable Pasture Management in Georgia	2019	https://rec-caucasus.org/wp-content/uploads/2020/08/1574947976.pdf#%5B%7B%22num%22%3A173%2C%22gen%22%3A0%7D%2C%7B%22name%22%3A%22XYZ%22%7D%2C70%2C770%2C0%5D
#1	AM, AZ, GE, MD	Silvija Kalnins, Andrea Egan	The United Nations Development Programme (UNDP) and the European Union (EU)	Clima East – Shifting ground Redefining the challenge of climate change by piloting low-carbon development to save ecosystems and improve the well-being of citizens in the Eastern Partnership countries and Russia	2017	https://www.adaptation-undp.org/sites/default/files/resources/undp-climaeastpublication_web_final_pages_1_0.pdf#page=42

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#1	GE	Kety Tsereteli	WOCAT	Establishment of a paddock system and improvement of degraded pastureland	2018	https://qcat.wocat.net/en/wocat/technologies/view/technologies_4276/
#1	GE	Natia Kobakhidze, Christian Goenner, Jonathan Etzold	WOCAT	Integrated Pasture Management Planning in Mountainous Regions	2019	https://qcat.wocat.net/fr/wocat/approaches/view/approaches_5490/
#1	AZ	Jonathan Etzold, Regina Neudert	GIZ	Monitoring Manual for Summer Pastures in the Greater Caucasus in Azerbaijan	2013	https://www.researchgate.net/publication/329119016_Monitoring_Manual_for_Summer_Pastures_in_the_Greater_Caucasus_in_Azerbaijan
#1	AM	Pr. G. Tovmasyan	GIZ	Manual for monitoring of pastures, Armenia. Sustainable management of biodiversity, south Caucasus.	2015	https://biodivers-southcaucasus.org/uploads/files/GIZ%20WP%20eng%20.pdf
#1	GE	Caucasus network for sustainable development of mountain regions (sustainable Caucasus)	SDC-funded project “Strengthening the Climate Adaptation Capacities in the South Caucasus (SCAC)” implemented by the Caucasus Network for Sustainable	The need to introduce sustainable pasture management in Georgia	2021	https://sd-caucasus.com/assets/uploads/documents/Policy_Brief_NIG_Georgia_24:11:2021.pdf

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
			Development of Mountain Regions (Sustainable Caucasus)			
#1	AM	Gagik Tovmasyan	GIZ	Manual on Improvement of Degraded Natural Grazing Lands (pastures and grasslands)	2020	https://mineconomy.am/media/11657/GIZ-Degradation_eng.pdf
#1	GE	Vanja Westerberg, Sarah Robinson, Emily Stebbings, Luis Costa and Pietro Visetti	ELD	The economics of pasture management in Georgia	2021	https://www.eld-initiative.org/fileadmin/ELD_Filter_Tool/Case_Study_Georgia_2021/Georgia_2021_Pasture_Management_ELD_Scientific_Interim_Report_EN.pdf
#1	MD	Tamara Leah		Grasslands and forage crops - important factors for remediation of degraded soils in the Republic of Moldova	2013	http://www.uaiasi.ro/revagrois/PDF/2013-2/paper/2013-56(2)_02-en.pdf
#1	AZ	Elisabeth Dresen	GIZ	Final Report for project 18.2062.0-003.00 in the frame of the programme “Management of natural resources and safeguarding of ecosystem services for sustainable rural development in the South Caucasus”	2019	
#2 CONSERVATION AGRICULTURE						

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#2	REG		FAO	Conservation agriculture	2022	https://www.fao.org/conservation-agriculture/overview/what-is-conservation-agriculture/en/
#2	REG		WOCAT	WOCAT SLM DATABASE, search term "conservation agriculture"		https://qcat.wocat.net/en/wocat/list/?type=wocat&q=conservation%20agriculture
#2	UA	Bernoux,Martial Michel Yoric; Fileccia, Turi; Guadagni,Maurizio; Hovhera, Vasyl	World Bank	Ukraine: Soil fertility to strengthen climate resilience. Preliminary assessment of the potential benefits of conservation agriculture	2014	https://documents.worldbank.org/en/publication/documents-reports/documentdetail/755621468319486733/main-report
#2	MD	Boincean Boris, Rurac Mihail, Ignat Anatolie, Grama Marin		Promovarea Sistemului Conservativ De Agricultură În Republica Moldova	2019	https://ibn.idsi.md/vizualizare_articol/89207
#2	MD	Boincean B. P., Cebotari M. V., Cebanu D. P.	ICARDA, IFAD	Conservation agriculture for winter cereal crops on Chernozem soils of the steppe region in the Republic of Moldova	2019	https://repo.mel.cgiar.org/handle/20.500.11766/10480?show=full
#2	MD	Anatolie Ignat, Victor Moroz	National Institute for Economic Research	Conservative cultivation technologies: a new challenge for the agriculture of the republic of Moldova	2014	https://www.ingentaconnect.com/content/doaj/22847995/2014/00000014/00000002/art00025;jsessionid=1gts7nazcnhgq.x-ic-live-01
#2	MD	Boris Boincean, Amir Kassam, Gottlieb Basch, Don Reicosky, Emilio Gonzalez, Tony Reynolds, Marina Ilusca, Marin Cebotari, Grigore Rusnac,	AIMS Agriculture and Food	Towards conservation agriculture systems in Moldova	2016	https://ibn.idsi.md/vizualizare_articol/111183

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
		Vadim Cuzeac, Lidia Bulat, Dorian Pasat, Stanislav Stadnic, Sergiu Gavrilas, and Ion Boaghii				
#2	MD	Murat Sartas, Boris Boincean, Mihail Rurac, and Akmal Akhramkhanov	ICARDA, IFAD	Scaling readiness of the conservation agriculture system in Moldova	2021	https://repo.mel.cgiar.org/handle/20.500.11766/13303
#2	AZ	Aziz Nurbekov, Amir Kassam, Dossymbek Sydyk, Zokhidjon Ziyadullaev, Imran Jumshudov, Hafiz Muminjanov, David Feindel, Jozef Turok	FAO	Practice of conservation agriculture in Azerbaijan, Kazakhstan and Uzbekistan	2016	https://agris.fao.org/search/en/providers/122621/records/64746e09d2d44cfaede23cd3
#2	AM	A. Markosyan, H. Ghazaryan , S.Kroyan	Armenian National Agrarian University Foundation 'Scientiic Center of Soil sciences, Agrochemistry and Melioration after Hrant Petrosya'	Challenges and opportunities of minimizing tillage mountain-steppe regions of the Republic of Armenia	2010	https://cyberleninka.ru/article/n/challenges-and-opportunities-of-minimizing-tillage-mountain-steppe-regions-of-the-republic-of-armenia/viewer

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#2	GE	Kety Tsereteli	WOCAT	Introduction of crop rotation	2018	https://qcat.wocat.net/en/wocat/technologies/view/technologies_4275/
#2	MD	Valentin Ciubotaru, UNCCD PRAIS	WOCAT	Integrated land and water management	2017	https://qcat.wocat.net/en/wocat/technologies/view/technologies_1817/
#3 AGROFORESTRY, BUFFER STRIPS AND HEDGES						
#3	REG		FAO	Agroforestry	2015	https://www.fao.org/forestry/agroforestry/80338/en/
#3	GE		IFAD/GEF/AMMAR	Land Restoration Measures to Prevent Land Erosion and to Maintain the Fertility of about 650 ha of Arable Land in Vulnerable Municipalities of Shida Kartli and Kakheti Regions	2020	https://rec-caucasus.org/project/land-restoration-measures-to-prevent-land-erosion-and-to-maintain-the-fertility-of-about-650-ha-of-arable-land-in-vulnerable-municipalities-of-shida-kartli-and-kakheti-regions/
#3	GE	Kety Tsereteli	WOCAT	Rehabilitation of windbreaks	2018	https://qcat.wocat.net/en/wocat/technologies/view/technologies_4274/
#3	GE	Christian Gönner, Olga Weigel, Amiran Kodiashvili, Giorgi Kolbin and Albina Muzafarova	Integrated Biodiversity Management, South Caucasus (IBiS)	Approach for "rehabilitation of windbreaks in East Georgia"	2019	https://biodivers-southcaucasus.org/uploads/files/Approach%20Windbreak%20Rehabilitation%20Georgia.pdf

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#3	UA	Soloviy, I.; Kuryltsiv, R.; Hernik, J.; Kryshenyk, N.; Kuleshnyk, T.		integrating Ecosystem Services Valuation into Land Use Planning: Case of the Ukrainian Agricultural Landscapes	2021	https://www.mdpi.com/1999-4907/12/11/1465
#3	MD	Vitalie Gulca	COFORD	Opportunity for small-scale forestry in Moldova		http://www.coford.ie/media/coford/content/publications/projectreports/small-scaleforestryconference/Gulca.pdf
#3	AZ	S. Ghanbari, M.M. Aghai		The Way towards Getting Back Financial Benefits from Agroforestry Systems and Improving Food Security (The Case of Arasbaran Biosphere Reserve)	2021	https://ecopersia.modares.ac.ir/article-24-42057-en.html./r
#4 TRADITIONAL TERRACING						
#4	AM	Artur Hayrapetyan	WOCAT	Slope erosion control using wooden pile walls [Armenia]	2018	https://qcat.wocat.net/en/wocat/technologies/view/technologies_4092/
#4	AZ	Markus Koeppler	GIZ	Ecosystem-based erosion control in Azerbaijan	2017	https://panorama.solutions/en/solution/ecosystem-based-erosion-control-azerbaijan
#4	UA	Yuriy S. Kravchenko		Conservation agriculture on Ukrainian chernozems	2017	https://journals.ukim.mk/index.php/jafes/article/view/1109/941

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#4	AZ	Prof. Dr. Z. H. Aliyev	Institute of Soil Science and Agrochemistry of NAS of Azerbaijan	Scientifically based measures to combat erosion of slope lands in Azerbaijan		https://gphjournal.org/index.php/as/article/view/1070
#5 DRAINAGE ADAPTATION						
#5	MD	Oprea Radu, Razvan Teodorescu, Corduneanu Flaviana, Sorin Mihai Cimpeanu		Technical Efficiency of the Subsurface Drainage on Agricultural Lands in the Moldova River Meadow	2017	https://www.researchgate.net/publication/314195369_Technical_Efficiency_of_the_Subsurface_Drainage_on_Agricultural_Lands_in_the_Moldova_River_Meadow
#5	The Netherlands		STOWA	Controlled drainage		https://www.stowa.nl/deltafacts/zoetwatervoorziening/delta-facts-english-versions/controlled-drainage
#5	AZ		World Bank	Azerbaijan: Managing Irrigation Systems through Water User Associations	2019	https://www.worldbank.org/en/results/2019/10/10/azerbaijan-managing-irrigation-systems-through-water-user-associations
#5	USA			Drainage water adaptation management for the midwest		https://www.extension.purdue.edu/extmedia/WQ/WQ-44.pdf
#5	USA		USDA	Drainage water management	2020	https://transformingdrainage.org/wp-content/uploads/2020/12/Drainage_Water_Management_CPS_10_2020.pdf

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#5				Controlled drainage		https://transformingdrainage.org/practices/controlled-drainage/
#6 RESTORATION OF EXISTING PASTURES, STEPPES AND NATURAL GRASSLANDS						
#6	GE		SABUKO (Society for Nature Conservation)	Restoring Gallery Forest and Grasslands in the Iori River Valley	2021	https://www.sabuko.org/en/restoring-gallery-forest-and-grasslands-in-the-iori-river-valley/
#6	UA	Vladimir Kricsfalusy	University of Saskatchewan	Bringing back the steppe: advancing sustainability through grasslands restoration in Ukraine	2011	https://www.researchgate.net/profile/Vladimir-Kricsfalusy/publication/256537067_Bringing_back_the_steppe_advancing_sustainability_through_grasslands_restoration_in_Ukraine/links/00b7d525a09ad025fb000000/Bringing-back-the-steppe-advancing-sustainability-through-grasslands-restoration-in-Ukraine.pdf?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6Il9kaXJlY3QiLCJwYWdlIjoicHVibGljYXRpb24ifX0
#6	UA	Oleksii Vasyliuk and Eugene Simonov	Ukraine War Environmental Consequences Work Group	Restoring nature on agricultural lands: a comparative analysis of legislative innovation in Ukraine and Russia	2022	https://uwecworkgroup.info/restoring-nature-on-agricultural-lands-a-comparative-analysis-of-legislative-innovation-in-ukraine-and-russia/

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#6	GE	Natia Javakhishvili, director of Sabuko	Cambridge Conservation initiative	Restoring gallery forest and grasslands in the Iori River Valley, Georgia	2021	https://www.endangeredlandscapes.org/project/iori-river-valley/
#6	GE		Cambridge Conservation initiative	A fragile balance between a living landscape or a future desert		https://www.endangeredlandscapes.org/project/kakheti-steppes/
#6	MD	M. Wiesmeier, M. Lungu, R. Hübner, and V. Cerbari		Remediation of degraded arable steppe soils in Moldova using vetch as green manure	2015	https://d-nb.info/1142829871/34
#6	REG		UNECE and FAO	Forest Landscape Restoration in the Caucasus and Central Asia	2019	https://unece.org/fileadmin/DAM/timber/meetings/2019/20191216/Forest_Landscape_Restoration_in_Central_Asia_and_the_Caucasus.pdf
#6	GE		UNEP-WCMC, RSPB and Fauna & Flora	Case study, Kakheti steppes	2023	https://www.endangeredlandscapes.org/wp-content/uploads/2023/07/Iori_River_CaseStudy.pdf
#6	UA	T. van der Sluis J.M.J. Gosselink P.A. Slim A. Verhagen H. van Keulen		Restoration of degraded steppe lands	2009	https://edepot.wur.nl/51005

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#6	AM		World Bank	Armenia Forest Landscape Restoration Note	2023	https://documents.banquemondiale.org/fr/publication/documents-reports/documentdetail/099090523175040850/p17173805d072503008f460b8c8ded40056
#6	AM	Gagik Tovmasyan	GIZ	Manual on Improvement of Degraded Natural Grazing lands (pastures and grasslands)	2020	https://mineconomy.am/media/11657/GIZ-Degradation_eng.pdf
#7 CLOSE-TO-NATURE FORESTRY						
#7	REG		EU	Guidelines on Closer-to-Nature Forest Management	2023	https://op.europa.eu/en/publication-detail/-/publication/2d1a6e8f-8cda-11ee-8aa6-01aa75ed71a1
#7	REG		NWRM project	Natural water retention measures	2013	http://nwrm.eu/measure/continuous-cover-forestry
#7	REG	J.B. Larsen, P. Angelstam, J. Bauhus, J. F. Carvalho, J. Diaci, D. Dobrowolska, A. Gazda, L. Gustafsson, F. Krumm, T. Knoke, A. Konczal, T. Kuuluvainen, B. Mason, R. Motta, E. Pötzelsberger, A. Rigling, A. Schuck		Closer to nature forest management	2022	https://efi.int/publications-bank/closer-nature-forest-management
#7	UA		FORZA	Forza guide	2014	www.forza.org.ua/sites/default/files/closetonatureforestry_ukr_web_0.pdf

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#7	GE		GIZ	Environment, climate, opportunities for people and nature: Close to nature forestry in Georgia		https://biodivers-southcaucasus.org/countries/georgia
#7	UA	Zibtsev, Sergiy ; Goldammer, Johann Georg ; Soshenskii, Olexandr ; Gumeniuk, Vasyl	EGU	Transformation of Forests to Close-to-Nature Forest Management in Ukraine: Nature-based silvicultural and fire management methods for increasing the resilience of pine stands to drought and wildfire	2022	https://ui.adsabs.harvard.edu/abs/2022EGUGA..2413361Z/abstract
#7	UA	H. T. Krynytskyi, M. V. Chernyavskyi, O. H. Krynytska, A. M. Dejneka, B. I. Kolisnyk, Ya. P. Tselen	Ukrainian National Forestry University	Close-to-nature forestry as the basis for sustainable forest management in Ukraine	2017	https://nv.nltu.edu.ua/index.php/journal/article/view/1210
#7	UA	Anatoly Mykolayovych Zhezhkun, Serhiy Kubrakov, Ihor Porokhniach, Ihor Kovalenko, Tetiana Melnyk	South East European Forestry	Close-to-Nature Forestry Measures in East Polissia region of Ukraine	2023	https://doi.org/10.15177/seefor.23-04
#8 ADAPTED FORESTRY IN FLOODPLAINS AND WET FORESTRY						
#8	REG		NWRM project	Forest riparian buffers	2013	http://nwrm.eu/measure/forest-riparian-buffers
#8	UA		WWF	Technical factsheet		https://nbs.wwf.ua/methodology/zberezhennia-ta-menedzhment-zaplavnykh-lisiv/

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#8	UA	Stephanie Mansourian Neli Doncheva Kostadin Valchev Daniel Vallauri	WWF	Lessons Learnt from 20 Years of Floodplain Forest Restoration: the Lower Danube Landscape	2019	https://wwfeu.awsassets.panda.org/downloads/lessons_learnt_from_20years_of_floodplain_forest_restoration_the_lower_danube_landscap_1.pdf
#8	GE		EuropEan Tropical ForEsT rEsEarch nETwork	Forests and Climate Change: adaptation and mitigation	2009	https://edepot.wur.nl/175460
#8	AZ	Jan Peper		Conservation of alluvial forests at the Kura river in the Garayazi Reserve (Western Azerbaijan)	2007	https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=4a93c0e080115a28eafe0e3a53c8bd5f87e6ff55
#8	UA	Bohdan Prots		Floodplain forests of the transcarpathia living close to humans	2010	https://www.researchgate.net/profile/Bohdan-Prots/publication/317957352_Floodplain_forests_of_the_Transcarpathia_living_close_to_human/links/59539a82aca272a343e5eac0/Floodplain-forests-of-the-Transcarpathia-living-close-to-human.pdf
#9 CONTROLLED TRAFFIC FORESTRY						
#9	REG		NWRM project	Appropriate design of roads and stream crossings		nwrm.eu/sites/default/files/nwrm_ressources/f8_-

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
						_appropriate_design_of_roads_and_stream_crossings_0.pdf
#9	REG		NWRM project	Water-sensitive driving		http://nwrm.eu/measure/water-sensitive-driving
#10 COARSE WOODY DEBRIS IN RIVERS AND STREAMS						
#10	REG		NWRM project	Coarse woody debris		nwrm.eu/sites/default/files/nwrm_ressources/f10_-_coarse_woody_debris.pdf
#10	REG		Water for wildlife	Managing woody debris in rivers, streams and floodplains	2006	https://www.therrc.co.uk/MOT/References/WT_Managing_woody_debris.pdf
#11 GREENING CITIES						
#11	REG		NRWM	Green roofs	2013	http://nwrm.eu/measure/green-roofs
#11	REG		NRWM	Trees in urban areas	2013	http://nwrm.eu/measure/trees-urban-areas
#11	AM		City of Yerevan	Yerevan green city action plan	2017	https://www.yerevan.am/uploads/media/default/0001/72/e7224f93ad7096478f9aaddb96ba61ea0ca693c9.pdf
#11	AM		Armenia tree project (NGO)	Armenia tree project		https://una.city/nbs/yerevan/armenias-tree-project
#11	AM		EBRD	Report: implementation of Yerevan's green city action plan	2023	https://bankwatch.org/publication/implementation-of-yerevan-s-green-city-action-plan

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#11	GE		Tblisi city	Tbilisi green city action plan	2017	https://www.tbilisi.gov.ge/page/green-city?lang=en
			#12 RAINGARDENS			
#12	REG		NWRM project	Rain gardens	2013	http://nwrm.eu/measure/rain-gardens
#12	UA		WWF			https://nbs.wwf.ua/solutions/180/
#12	UA	Dmytro Vasiljev (1978 Ukraine); Aleksandr Popov (1975 Ukraine); Mykola Morozov (1988 Ukraine); Varvara Bebeshko (1979 Ukraine); Anna Kornilova (1987 Ukraine); Samir Khuder (1991 Ukraine)	Eumiesaward	Rain garden in Faya town	2024	https://miesarch.com/work/5243
#12	MD		European Bank	€20 million financing package to act against floods in the Moldovan capital		https://www.ebrd.com/news/2023/20-million-financing-package-to-act-against-floods-in-moldovan-capital.html
			#13 FORESTED PARKS			
#13	REG		NWRM project	Urban forest parks	2013	nwrm.eu/sites/default/files/nwrm_ressources/f1_-_urban_forest_parks_0.pdf
#13	REG		FAO	Guidelines on urban and periurban forestry	2016	https://www.fao.org/3/a-i6210e.pdf

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#13	REG		FAO	Forests and sustainable cities		https://www.fao.org/3/I8838EN/i8838en.pdf
#13	REG		MTE	Urban forests		https://www.adaptation-changement-climatique.gouv.fr/sites/cracc/files/inline-files/Urban_Forest.pdf
#14 PERMEABLE SURFACES						
#14	REG		NWRM project	Permeable paving	2013	http://nwrm.eu/measure/permeable-surfaces
#14	UA			"Green" reconstruction: solutions that are already functioning in other European countries	2023	https://rubryka.com/en/article/rishennya-dlya-ekologichnoyi-vidbudovy/
#15 RAINWATER MANAGEMENT PUBLIC FEATURES						
#15	MD			Rainwater retention and permeable landscaping in Chisinau	2019	https://ebrdgreencities.com/assets/Uploads/PDF/GCAP_Chisinau-ENG.pdf
#16 AFFORESTATION						
#16	AM		GIZ	WOCAT: High-altitude afforestation for erosion control	2018	https://qcat.wocat.net/en/wocat/technologies/view/technologies_4101/
#16	AM	Silvija Kalnins, Andrea Egan	Clima east	Clima East Pilot Project in Armenia: afforestation		https://www.adaptation-undp.org/sites/default/files/resources/undp-climaeastpublication_web_final_pages_1_0.pdf#page=43

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#16	MD	Silvija Kalnins, Andrea Egan	Clima east	Clima East Pilot Project in Moldova: afforestation		https://www.adaptation-undp.org/sites/default/files/resources/undp-climaeastpublication_web_final_pages_1_0.pdf#page=65
#16	REG		NWRM project	NWRM: forests	2013	http://nwrm.eu/forest
#16	MD		Republic of Moldova	Moldovan government approves national programme on extension, rehabilitation of forests for 2023-2032	2023	https://gov.md/en/content/moldovan-government-approves-national-programme-extension-rehabilitation-forests-2023-2032
#16	MD	Gesine Haensel, International Consultant; Liliana Spitoc, National Consultant	UNDP	Afforestation of degraded lands, riverside areas and protection belts in Moldova	2016	https://www.uncclearn.org/wp-content/uploads/library/undp-moldova-report-nama-2016.pdf
#16	AM	A tree for you		Armenia – Dzoraglukh: reforestation with forestry and fruit trees		https://www.atreeforyou.org/en/armenia-reforestation-in-the-village-of-dzoraglukh-forestry-and-fruit-trees/
#17 CONVERSION TO MEADOWS AND PASTURES						
#17	REG		NWRM project	Meadows and pastures	2013	http://nwrm.eu/measure/meadows-and-pastures
#17	MD	Silvija Kalnins, Andrea Egan	Clima east	Clima East Pilot Project in Moldova: meadows and pastures		https://www.adaptation-undp.org/sites/default/files/resources/undp-

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
						climaeastpublication_web_final_pages_1_0.pdf#page=65
#17	AM	Gagik Tovmasyan	GIZ	Manual on Improvement of Degraded Natural Grazing lands (pastures and grasslands)	2020	https://mineconomy.am/media/11657/GIZ-Degradation_eng.pdf
#18 SOIL UNSEALING (SOILS, BUILT STRUCTURES)						
#18	UA			"Green" reconstruction: solutions that are already functioning in other European countries	2023	https://rubryka.com/en/article/rishennya-dlya-ekologichnoyi-vidbudovy/
#18	MD			Rainwater retention and permeable landscaping in Chisinau	2019	https://ebrdgreencities.com/assets/Uploads/PDF/GCAP_Chisinau-ENG.pdf
#19 CONSERVATION OF HIGH ENVIRONMENTAL VALUE ECOSYSTEMS						
#19	Turkey		FAO	Guidelines for establishing protected areas		https://openknowledge.fao.org/server/api/core/bitstreams/f98ec718-234d-4cbc-b347-ba3ad1099bed/content
#19	UA			Biosphere reserves and climate adaptation in Ukraine	2021	https://www.eba-ukraine.net/Publications.html
#19	AM			Armenia's third Ramsar site		https://www.ramsar.org/news/armenias-third-ramsar-site
#20 NATURAL WATER HARVESTING/KEYLINE DESIGN						

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#20	Mexico		Yontonte	Silvopasture and keyline design in the Lum Ha' farm		https://yontonte.org/en/keyline-design/
#20	USA			NRCS Technical Guide		https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/fotg/
#20	REG	P.A. Yeomans		The challenge of landscape		https://web.archive.org/web/20150503150410/http://www.soilandhealth.org/01aglibrary/010126yeomansII/010126toc.html
#20	REG	P.A. Yeomans		The keyline plan		https://soilandhealth.org/book/the-keyline-plan/
#21 SEMI-ARTIFICIAL WETLANDS AND WATER BODIES						
#21	REG		NWRM project	Ponds	2013	nwrm.eu/sites/default/files/nwrm_ressources/n1_-_basins_and_ponds_0.pdf
#21	MD		UN	Rainwater collection basin for irrigation	2021	https://www.undp.org/moldova/press-releases/rainwater-collection-and-storage-basin-was-launched-operation-antonesti-ada-and-undp-assistance
#22 SEDIMENT CAPTURE PONDS AND CHECK DAMS						
#22	REG		NWRM project		2013	http://nwrm.eu/measure/sediment-capture-ponds
#22	GE		UN	Mountains ADAPT - Solutions from the South Caucasus	2022	https://wedocs.unep.org/bitstream/handle/20.500.11822/39788/MASSC.pdf#page=26

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#22	AZ		WOCAT	Community-based approach in Erosion Control	2019	https://qcat.wocat.net/en/wocat/approaches/view/approaches_5571/
#23 CONSTRUCTED WETLANDS FOR WASTEWATER TREATMENT						
#23	REG			Constructed wetland for wastewater treatment		https://www.adaptation-changement-climatique.gouv.fr/sites/cracc/files/inline-files/Constructed_wetland_for_water_treatment.pdf
#23	UA			WWF factsheet		https://nbs.wwf.ua/solutions/vykorystannia-sporud-bioplato-dlia-ochystky-stichnykh-vod-malykh-naselenykh-punktiv/
#23	MD		IWA	Nature-Based Solutions for Wastewater Treatment		https://iwaponline.com/ebooks/book-pdf/929917/wio9781789062267.pdf#page=132
#24 WETLAND RESTORATION AND MANAGEMENT						
#24	REG		NWRM project	Wetland restoration and management	2013	http://nwrm.eu/measure/wetland-restoration-and-management
#24	UA			WWF factsheet		https://nbs.wwf.ua/methodology/paludykultura-povtorne-vykorystannia-vidnovlenykh-torfovyshch-bolit-dlia-silskoho-chy-lisovoho-hospodarstva/
#24	MD	Valentin Ciubotaru, UNCCD PRAIS	WOCAT	Integrated land and water management	2017	https://qcat.wocat.net/en/wocat/technologies/view/technologies_1817/

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#24	MD		RAMSAR	Moldova project for Dniester restoration completed	2003	https://www.ramsar.org/news/moldova-project-dniester-restoration-completed
#24	MD		UNDP	Conservation and sustainable management of wetlands with a focus on high-nature value areas in the Prut River basin	2022	https://www.undp.org/moldova/projects/conservation-and-sustainable-management-wetlands-focus-high-nature-value-areas-prut-river-basin
#24	AM		Caucasus Nature Fund	Restoration Activities for the Khor Virap Sanctuary (Armenia)	2023	https://www.caucasus-naturefund.org/restoration-activites-for-the-khor-virap-sanctuary-armenia/
#25 FLOODPLAIN RESTORATION AND MANAGEMENT						
#25	REG		NWRM project	Floodplain restoration and management	2013	http://nwrm.eu/measure/floodplain-restoration-and-management
#25	GE			Slowing the flow in the Rioni River Basin		https://una.city/nbs/samtredia/slowing-flow-rioni-river-basin
#25	MD		RAMSAR	Moldova project for Dniester restoration completed	2003	https://www.ramsar.org/news/moldova-project-dniester-restoration-completed
#25	UA			Water flow restored to entire lake system in Ukrainian Danube Delta	2023	https://rewildingeurope.com/news/water-flow-restored-to-entire-lake-system-in-ukrainian-danube-delta/
#26 STREAM AND RIVER RESTORATION						

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#26	MD		RAMSAR	Moldova project for Dniester restoration completed	2003	https://www.ramsar.org/news/moldova-project-dniester-restoration-completed
#26	UA		WWF	WWF removes 120-year-old obsolete dam in Ukraine to restore rivers in the Carpathian mountains	2022	https://wwf.panda.org/es/?6165966/WWF-removes-120-year-old-obsolete-dam-in-Ukraine-to-restore-rivers-in-the-Carpathian-mountains
#26	AM		GIZ	Restoration of coastal territories of rivers in Armenia	2022	https://diasporarm.org/fr/portfolio/restoration-of-coastal-territories-of-rivers-in-armenia/
#26	AM		GIZ	Restoration of riparian zones in Armenia	2021	https://biodivers-southcaucasus.org/uploads/files/GIZ_leaflet_digital_new%202021%C2%A0%E2%80%94%20ENG_compressed(1).pdf
#27 RECONNECTION OF OXBOW LAKES						
#27	UA			Water flow restored to entire lake system in Ukrainian Danube Delta	2023	https://rewildingeurope.com/news/water-flow-restored-to-entire-lake-system-in-ukrainian-danube-delta/
#27	UA			Reconnecting the Latorica river floodplain-transboundary project in Slovakia and Ukraine awarded planning grant	2023	https://europe.wetlands.org/news/reconnecting-the-latorica-river-floodplain-transboundary-project-in-slovakia-and-ukraine-awarded-planning-grant/
#27	REG		NWRM project	Reconnection of oxbow lakes and similar features	2013	http://nwrm.eu/measure/reconnection-oxbow-lakes-and-similar-features
#28 REMOVAL OF TRANSVERSAL BARRIERS						

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#28	UA		WWF	WWF removes 120-year-old obsolete dam in Ukraine to restore rivers in the Carpathian mountains	2022	https://wwf.panda.org/es/?6165966/WWF-removes-120-year-old-obsolete-dam-in-Ukraine-to-restore-rivers-in-the-Carpathian-mountains
#28	REG		NWRM project	Removal of dams and other longitudinal barriers	2013	http://nwrm.eu/measure/removal-dams-and-other-longitudinal-barriers
#28	UA		WWF	Rewilding progress as multiple dams removed in Ukrainian Danube Delta	2019	https://rewildingeurope.com/news/rewilding-progress-as-multiple-dams-removed-in-ukrainian-danube-delta/
#29 NATURAL BANK STABILISATION						
#29	REG		NWRM project	Natural bank stabilisation	2013	http://nwrm.eu/measure/natural-bank-stabilisation
#30 REMOVAL OF LATERAL BARRIERS						
#30	REG		NWRM project	Elimination of riverbank protection	2013	http://nwrm.eu/measure/elimination-riverbank-protection
#30	Austria		LIFE nature project	The new riverbank at Hainburg	2006	http://archive.iwlearn.net/icpdr.org/icpdr-pages/dw0603_p_10.htm
#31 LAKE RESTORATION						
#31	REG		NWRM project	Lake restoration	2013	http://nwrm.eu/measure/lake-restoration

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#31	UA		Rewilding Europe	Water flow restored to entire lake system in Ukrainian Danube Delta	2023	https://rewildingeurope.com/news/water-flow-restored-to-entire-lake-system-in-ukrainian-danube-delta/
#31	AM		UNDP	Presentation of the Long-term National Vision of Lake Sevan	2023	https://www.undp.org/armenia/press-releases/presentation-long-term-national-vision-lake-sevan
#32 RE-NATURALISATION OF POLDER AREAS						
#32	REG		NWRM project	Re naturalisation of polder areas	2013	http://nwrm.eu/measure/re-naturalisation-polder-areas
#32	UA & MD		Rewilding Europe	Danube delta		https://rewildingeurope.com/landscapes/danube-delta/
#33 RESTORATION OF BUFFER STRIPS, RIPARIAN FORESTS AND GALLERY FORESTS						
#33	REG		NWRM project	Forest riparian buffers	2013	http://nwrm.eu/measure/forest-riparian-buffers
#33	AM			Restoration of riparian zones in Armenia		https://www.armeniatree.org/uploads/images/TFLVol4Issue1.pdf#page=8
#33	GE			Slowing the flow in the Rioni River Basin		https://una.city/nbs/samtredia/slowing-flow-rioni-river-basin
#33	REG			Riparian buffer restoration		https://www.stormwaterpa.org/assets/media/BMP_manual/chapter_6/Chapter_6-7-1.pdf

#NbS	Country[6]	Authors	Produced by	Title	Year	Link
#33	AM			Restoration of Riparian Zones in Armenia		https://issdngo.com/en/projects/completed/restoration-of-riparian-zones-in-armenia/
#33	UA		WWF	Nature-based solutions in forestry, water and agriculture for restoration of Ukraine and climate change adaptation		https://wwfcee.org/pdf_collections/29/NATURE-BASED%20SOLUTIONS%20IN%20FORESTRY,%20WATER%20AND%20AGRICULTURE%20FOR%20RESTORATION%20OF%20UKRAINE%20AND%20CLIMATE%20CHANGE%20ADAPTATION.pdf
#33	MD		RIOB	Biodiversity and wetland conservation and transboundary cooperation in the Dniester River basin		https://www.riob.org/sites/default/files/Session_2_4_Jeleapov.pptx%20%281%29.pdf
#34 MANAGED AQUIFER RECHARGE						
#34	REG		NWRM project	Restoration of natural infiltration to groundwater	2013	http://nwrm.eu/measure/restoration-natural-infiltration-groundwater
#34	REG		UNESCO	Managing aquifer recharge: a showcase for resilience and sustainability	2021	https://www.unesco.org/en/articles/managing-aquifer-recharge-showcase-resilience-and-sustainability
#34	AM	Samvel V. Sahakyan, Tatevik V. Yedoyan, Arevshad A. Vartanyan, Eleonora V. Avanesyan		Restoration Peculiarities of Water Reserves of Underground Basins in the Mountain Relief Regions	2021	https://www.researchsquare.com/article/rs-2112127/v1

7. Annexes

Annex 1. Effectiveness ranking explained

The method of ranking the potential effectiveness of nature-based solutions for pressures identified in the WFD Reporting Guidance 2022 is based on expert judgement, and described in Box 2 – section 3. Section 3 section provides useful information on how to prioritise and select the most relevant measures in RBMPs.

This annex provides details on how to interpret the effectiveness rankings from the tables described in section 3.

Point sources

Urban wastewater

Description: May or may not be included in the UWWT Directive. Includes discharges from non-commercial manufacturing areas that can largely be assimilated to urban wastewater. Includes discharges of raw or partially treated urban wastewater that are identified as point sources.

Highly effective: A solution that can be used to collect wastewater and purify it.

Moderately effective: In this case, no solution is considered to be moderately effective.

Not applicable: A solution that cannot affect wastewater management.

Storm overflows

Description: Overflows from separated or combined sewers identified as point sources (for diffuse see 'Diffuse – Urban run-off' below).

Highly effective: Solutions that have the potential to avoid stormwater overflow.

Moderately effective: Solutions that have the potential to reduce the amount of stormwater overflow.

Not applicable: Solutions that cannot affect stormwater overflow.

IED plants and non-IED plants

Description: Industrial point sources from plants may or may not be included in the E-PRTR. Nature-based solutions can only be effective for accidental stormwater emissions at the plant.

Highly effective: Solutions that have the potential to avoid stormwater overflow.

Moderately effective: Solutions that have the potential to reduce the amount of stormwater overflow.

Not applicable: Solutions that cannot affect stormwater overflow.

Others

Description: Point sources such as contaminated sites or abandoned industrial sites, water disposal sites, mine waters, aquaculture or other types of point sources.

Not applicable: No nature-based solution is considered to have an impact on point source pollution originating from these cases.

Diffuse sources

Urban run-off

Description: Storm overflows and discharges in urbanized areas not identified as point sources.

Highly effective: Solutions that have the potential to avoid runoff.

Moderately effective: Solutions that have the potential to reduce runoff.

Not applicable: Solutions that have little or no effect on runoff.

Agriculture

Description: Suspended matter, nutrients and pesticides.

Highly effective: Solutions that have the potential to avoid the transfer of pollutants, strongly restore the self-purification capacity of ecosystems, strongly restore soil resistance to erosion, and/or stop the input of fertilizers and pesticides.

Moderately effective: Solutions that have the potential to reduce the transfer of pollutants, increase the self-purification capacity of ecosystems, increase soil resistance to erosion, and/or reduce the input of fertilizers and pesticides.

Not applicable: Solutions that have little or no effect on the transfer of pollutants, self-purification capacity of the ecosystem, soil resistance to erosion, and/or use of fertilizers and pesticides, or solutions that cannot be implemented in an agricultural context.

Forestry

Description: Suspended matter, nutrients, pesticides and potential acidification.

Highly effective: Solutions that have the potential to avoid nutrient and sediment loss (e.g., after clear-cuts), stop pesticide use, and strongly restore the self-purification capacity of ecosystems.

Moderately effective: Solutions that have the potential to reduce nutrient and sediment loss, reduce pesticide use, and increase the self-purification capacity of ecosystems.

Not applicable: Solutions that have little or no effect on the transfer of pollutants, self-purification capacity of the ecosystem, soil resistance to erosion, and/or the use of fertilizers and pesticides, or solutions that cannot be implemented in a forestry context.

Others

Description: Diffuse sources such as transport, contaminated abandoned industrial sites, discharges not connected to sewerage networks, atmospheric deposition, mining, aquaculture, or other types of diffuse sources.

Highly effective: Solutions that have the potential to avoid runoff.

Moderately effective: Solutions that have the potential to reduce runoff.

Not applicable: Solutions that have little or no effect on runoff.

Abstraction of flow diversion

Agriculture

Description: Includes water transfers and abstractions for irrigation and livestock breeding.

Highly effective: Solutions that have the potential to shut down or strongly reduce irrigation needs, or to compensate for the effects of water abstraction.

Moderately effective: Solutions that have the potential to reduce irrigation needs, increase the water retention capacity of soils and ecosystems, increase water infiltration in the basin, and reduce evapotranspiration.

Not applicable: Solutions that have little or no effect on irrigation needs and water retention in the basin.

Others

Description: Abstraction or flow diversion such as public water supply, industry, cooling water, hydropower, fish farms or other abstractions or flow-diversion.

Highly effective: Solutions that have the potential to compensate for the effects of water abstraction.

Moderately effective: Solutions that have the potential to increase the water retention capacity of soils and ecosystems, increase water infiltration in the basin, and reduce evapotranspiration.

Not applicable: Solutions that have little or no effect on water retention in the basin.

Hydromorphology

Physical alteration of channel/bed/riparian area/shore

Description: Refers largely to longitudinal alterations to water bodies, including land drainage to enable agricultural activities, and other alterations for flood protection, agriculture, navigation, and other reasons.

Highly effective: Solutions that have the potential to physically restore the channels of rivers and streams, the shore and bottom of lakes, and polder areas.

Moderately effective: Solutions that have the potential to reduce the physical alteration of channels and prevent future physical alteration.

Not applicable: Solutions that have little or no effect on the physical conditions of rivers and streams.

Dams, barriers and locks

Description: Refers to dams, barriers and locks related to flood protection, drinking water, irrigation, recreation (small dams are used in rivers to create recreational areas and angling areas), industry (dams are sometimes created to provide fresh water for large industry e.g. typically for cooling purposes), navigation, and other dams, barriers and locks.

Highly effective: Solutions that have the potential to restore ecological continuity.

Moderately effective: Solutions that have the potential to mitigate ecological discontinuity.

Not applicable: Solutions that have little or no effect on ecological continuity.

Hydrological alteration

Description: Refers to changes in the flow regime due to agriculture (e.g. due to land drainage), transport (e.g. due to inland navigation), hydropower (e.g. hydropeaking), public water supply, aquaculture, or other reasons.

Highly effective: Solutions that have the potential to shut down or strongly reduce irrigation needs, or to compensate for the effects of water abstraction.

Moderately effective: Solutions that have the potential to increase water retention in the basin or to reduce peak flow due to runoff.

Not applicable: Solutions that have little or no effect on water flow.

Co-benefits

Flood prevention

Highly effective: Solutions that have the potential to strongly reduce the amount of runoff entering streams and rivers or low lands, and to favour the spread of water in non-stake areas.

Moderately effective: Solutions that have the potential to improve the infiltration capacity of soil, increase the hydrological roughness of soils, and slowdown runoff and water flow.

Not applicable: Solutions that have little to or effect on the water dynamics in the basin.

Drought prevention

Highly effective: Solutions that have the potential to increase rainfall, groundwater recharge, and natural low-water support.

Moderately effective: Solutions that have the potential to reduce runoff and favour infiltration, and to increase the capacity of soils to retain water.

Not applicable: Solutions that have little or no effect on water retention in soils and ecosystems.

Biodiversity

Highly effective: Solutions that are identified as being potentially highly effective for EU Biodiversity strategy implementation.

Moderately effective: Solutions that have the potential to sustain natural habitats.

Not applicable: Solutions that have little or no effect on natural habitats.

EU laws and strategies

Description: The laws and strategies taken into account in this analysis are the Flood Directive, Habitat and Birds Directive, Nitrate Directive, Urban Wastewater Treatment Directive, Nature Restoration Law (based on the version available in summer 2023), the Biodiversity Strategy for 2030, Forest Strategy for 2030 and Soil strategy for 2030.

Highly relevant: Solutions that can be implemented in the frame of the directive or strategy.

Moderately relevant: Solutions that have the potential to contribute to the objectives of the directive or strategy, although not identified as such therein.

Not applicable: Solutions that have little or no effect on contributing to the law or strategy objectives.

Drought prevention

Highly effective: Solutions that have the potential to increase rainfall, groundwater recharge, and natural low-water support.

Moderately effective: Solutions that have the potential to reduce runoff and favour infiltration, and to increase the capacity of soils to retain water.

Not applicable: Solutions that have little or no effect on water retention in soils and ecosystems.

Biodiversity

Highly effective: Solutions that are identified as being potentially highly effective for EU Biodiversity strategy implementation.

Moderately effective: Solutions that have the potential to sustain natural habitats.

Not applicable: Solutions that have little or no effect on natural habitats.

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