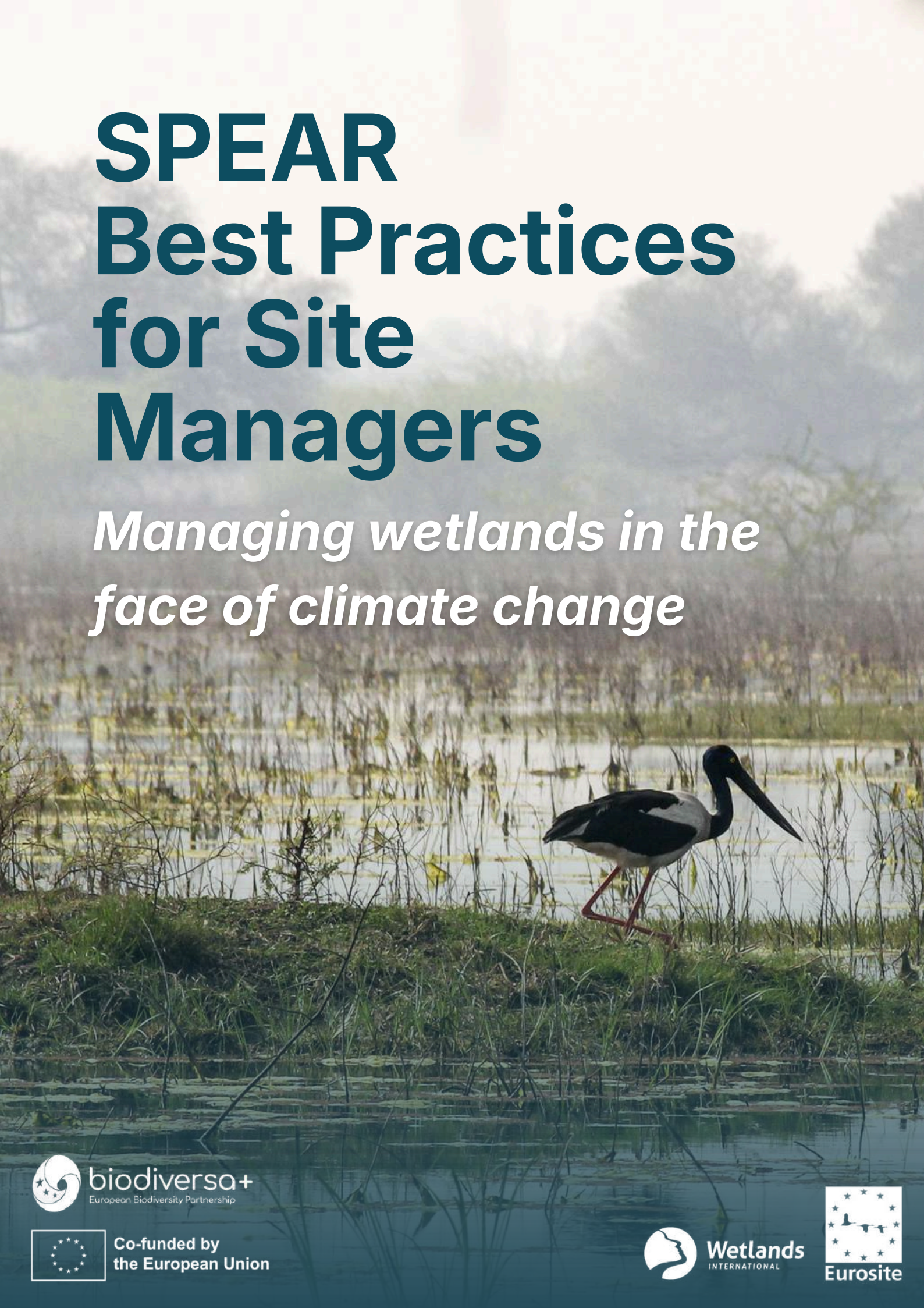
SPEAR Best Practices for Site Managers

Managing wetlands in the face of climate change



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Introduction

Numbers and presence of bird species, especially those of conservation concern, are among the main criteria used to identify wetlands of high ecological value. At the same time, birds are highly responsive to environmental change and likely to change their distribution based on habitat quality. Given the climate-induced decline affecting a large portion of European wetlands, there is an increased risk that previously designated priority areas will be insufficient to provide the necessary level of protection and habitat for bird populations. In the face of climate change, it is important that natural site managers take the right measures to make these areas more resilient for the future. Understanding the impacts of climate change is the key to support those decisions.

The project Biodiversa+ SPEAR[1] - Scenarios for Protecting European Avian Redistributions compiled pan-European data on seabirds, waterbirds, and landbirds to meet five objectives:

1. to identify potential changes in priority areas for bird conservation at land and sea, including critical gaps in the current network of protected areas in Europe needed to build a Trans-European Nature Network,
2. to assess the resilience of European networks to environmental change and identify alternatives that will be robust under future scenarios of threats and pressures,
3. to assess the cost-effectiveness of management plans for protected areas that will facilitate adaptation of birds to climate change,
4. to plan adaptive and sustainable management for harvested species, and
5. to develop new knowledge and governance tools needed for conservation of multifunctional wetlands.

This document captures outcomes of Biodiversa+ SPEAR and the experience gathered by the Eurosite's community of practice to inform and support natural site managers in their efforts to manage the adverse effects of climate change in the areas under their governance.

[1] https://www.biodiversa.eu/2023/04/19/spear/

The future of Natura 2000 under the effects of climate change

Recent EU guidance on Natura 2000[2] and Climate Change emphasises that pressures such as heatwaves, droughts, floods, and wildfires across Europe will only intensify with climate change. These pressures are already driving widespread shifts in species distributions, alter habitat conditions, and in some cases lead to local habitat loss, meaning that the original conservation targets of some Natura 2000 sites may no longer be achievable without taking appropriate restoration measures.

The European Commission explicitly recognises that in many wetlands, restoration measures are urgently needed to improve climate resilience. Moreover, site boundaries, conservation objectives, and management approaches may need to be improved and adjusted over time to reflect changing ecological realities. Adaptive management will be essential for the long-term success of the Natura 2000 network in safeguarding biodiversity and achieving a favourable conservation status for European habitats and species against the effects of climate change.

[2] https://environment.ec.europa.eu/news/commission-future-proofs-natura-2000-against-climate-change-2026-03-25_en

🔍 *What SPEAR says: Prioritisation of bird conservation areas is key* 4

Research[3] highlights that prioritising conservation efforts based on bird abundance performs better than prioritising based only on bird occurrence because it identifies sites that hold the strongest populations of species, especially rare and range-restricted species. From a site perspective, the **most valuable areas** are places that **support core bird populations**.

Habitat-specific prioritisation is an important approach. Where a habitat type is clearly under threat, site selection should ideally be **tailored to the habitat assemblages** involved rather than applying a single general prioritisation across all birds. This was especially clear for tundra, Mediterranean, and coastal species.

The current protected-area network captures some of the high-priority areas, but there are still important gaps. **IBAs** (Important Bird and Biodiversity Areas) aligned better with high-priority bird areas, so they may offer a useful starting point for **identifying sites where stronger protection** or other conservation measures could be considered for birds.

Site-level conservation should not ignore demographic strongholds besides aiming to preserve existing species ranges, use habitat-specific prioritisation where possible, and help fill gaps in the existing network of protected areas.

[3] Y Xu et al. (2026). Continental-wide prioritization of protected areas to address global and habitat-specific goals for avian biodiversity conservation. Conservation Biology, e70324. https://doi.org/10.1111/cobi.70324

Making decisions under climate change

Climate change is forcing site managers to make decisions in increasingly uncertain and dynamic conditions. As habitat conditions shift, maintaining historical ecological states is not always feasible. This challenges traditional conservation approaches that focus on maintaining stability and returning ecosystems to their desired original state.

In this context, the **Resist–Accept–Direct (RAD)**[4] framework offers a practical way for site managers to navigate management choices by recognising that different situations call for different responses: **resisting** change where conservation values are high and persistence is possible, **accepting** change where it is unavoidable, and **directing** ecosystems toward more resilient or desirable future states.

What SPEAR says: Do site managers adapt?

A recent survey conducted by SPEAR partners[5] shows that many site managers already report implementing climate change adaptation strategies aimed not only at resisting but also accepting and directing the effects of climate change. However, some differences across bioregions are worth noting: managers in boreal regions, for instance, seem to perceive these effects less intensely so far.

Many barriers to a more effective implementation were also highlighted everywhere, such as **lack of funding and time**, **difficulties in getting consensus with stakeholders** and some climate change-specific challenges such as **lack of knowledge regarding the site's vulnerability** to climate change and **lack of knowledge on RAD actions**.

Among the main recommendations from the researchers, site-managers should start by evaluating the exposure of their site to climate change, estimate species vulnerability and the plan adaptive management accordingly.

Watch Eurosite's Webinar on Climate Adaptation in Natura 2000 Sites

[4] Schuurman et al. (2020) – Resist-Accept-Direct (RAD) – A framework for the 21st-century Natural Resource Manager
[5] Zavattoni et al. 2026. Vulnerability and adaptations to climate change in EU protected areas: a Natura 2000 managers' perspective. Conservation Letters.

Case Study: Methodology for climate adaptation

LIFE Natur'Adapt (2018-2023) developed a four-phase methodology for site managers to adapt to climate change.

This LIFE project coordinated by Réserves Naturelles de France mainstreams climate change into the management of protected areas by developing a methodology for site managers to adapt to climate change, creating a community of experts and practitioners to share knowledge and practical experiences, and activating all levers for practical implementation (institutional, financial, awareness).

LIFE Natur'Adapt identifies four key phases of adapting natural sites to climate change:

1. Immersion and planning
2. Prospective analysis
3. Adaptation management
4. Reporting and capitalization

This methodology has been tested in 21 Protected Areas in France and is detailed in this **Methodological Guide** (EN).

Watch Eurosite's Webinar on Natur'Adapt's Experience

Wetlands as Nature-based Solutions for biodiversity and climate

According to the European Commission, the Natura 2000 network appears as a strong ally to address climate related threats for nature and society with the careful planning and implementation of Nature-based Solutions (NbS). Well-designed Nature-based solutions **must benefit biodiversity** and support the **delivery of a range of ecosystem services**. However, many interventions are still planned with a limited focus, often missing out on potential synergies with other factors and cross-sector integration.

Wetlands create unique opportunities for **Nature-based Solutions that offer multiple benefits** across a wide range of ecosystem services. Restored wetlands are biodiversity hotspots with the capacity to regulate hydrological regimes, sequester carbon, and improve water quality. This means that wetland targeted Nature-based Solutions have the potential to generate positive outcomes for **biodiversity, climate mitigation and adaptation, disaster risk reduction, and improved human well-being**.

What SPEAR says: Artificial wetlands turn avian paradise

Over the past 25 years, Denmark has created or restored well over 100 wetlands in the country as Nature Based Solutions to capture agricultural runoff and improve down-stream water quality in water courses, lakes and inshore marine waters.

This effort has resulted in improved down-stream water quality, as intended, but despite no intentional design to maximise biodiversity, post intervention monitoring efforts show a clear positive impact in several species of water birds, including the declining Black-headed Gull (*Chroicocephalus ridibundus*).

The restored and created (new) wetlands are outside the SPA network, proving that the impacts of Nature-based Solutions can well extend beyond conservation areas.

This work[6] highlights that artificial wetlands as Nature-based Solutions for nutrient capture may have positive impacts way beyond their original scope but often miss the chance to incorporate biodiversity gains early into their design and planning.

[6] Fox, A. D. et al. (2025). Avian benefits of using Nature Based Solutions to capture agricultural runoff in created wetlands-a case study from Denmark.

Designing Nature-based Solutions for People and Biodiversity

In a recent literature review[7] assessing the challenges of implementing Nature-based Solutions in the Mediterranean, researchers have highlighted that although having become a popular concept, there is still great discrepancy in the definition, use and intended impacts of Nature-based Solutions for both biodiversity and society.

Without a clear framework, and despite the popularity of such interventions, many of the benefits offered by Nature-based Solutions may remain under explored. Unlocking their full potential may require careful planning and coordination among a wide range of actors at the landscape scale to ensure cross-sectoral synergies and knowledge transfer.

This study highlights **participatory processes** aimed at increasing broad stakeholder support, **socio-economic context fit**, and good **public communication** as key factors for NbS implementation success. These success factors must be underpinned by **strong policy support** and **financial mechanisms** to remain viable in the long term.

Ultimately, Nature-based Solutions should be adapted to fit specific social and ecological contexts and respond to trade-offs and inequalities both at the site level and at a large scale.

[7] Ernoul, L., Hetherington, B. (2026) Nature-based Solutions in the Mediterranean Region: A look back and moving forward. Journal for Nature Conservation 89

Case Study: Aquatic Warbler & Climate Change

LIFE4AquaticWarbler and LIFE AWOM are two sister LIFE projects addressing the flyway scale conservation of Aquatic Warbler (*Acrocephalus paludicola*), Europe's rarest passerine.

As an effect of a changing climate and intensified land-use and land conversion, aquatic warbler breeding and staging habitats are disappearing, posing a severe threat for the species. The solution for A. *paludicola* is habitat restoration by returning water to previously drained areas and managing water levels.

Artificially managed sites can support higher numbers of warblers during drought, while at the same time resulting in improved grass yields for farmers, and a possibility to participate in carbon credit schemes.

Figure 1: Artificially managed site in Lithuania. (c) Žymantas Morkvėnas, Baltic Environmental Forum Lithuania, LIFEMagniDucatusAcrola project, meldine.lt.

Restored wetlands and artificially managed wetlands habitats can simultaneously bring benefits to biodiversity, while also delivering Nature-based Solutions for water retention, flood and drought protection.

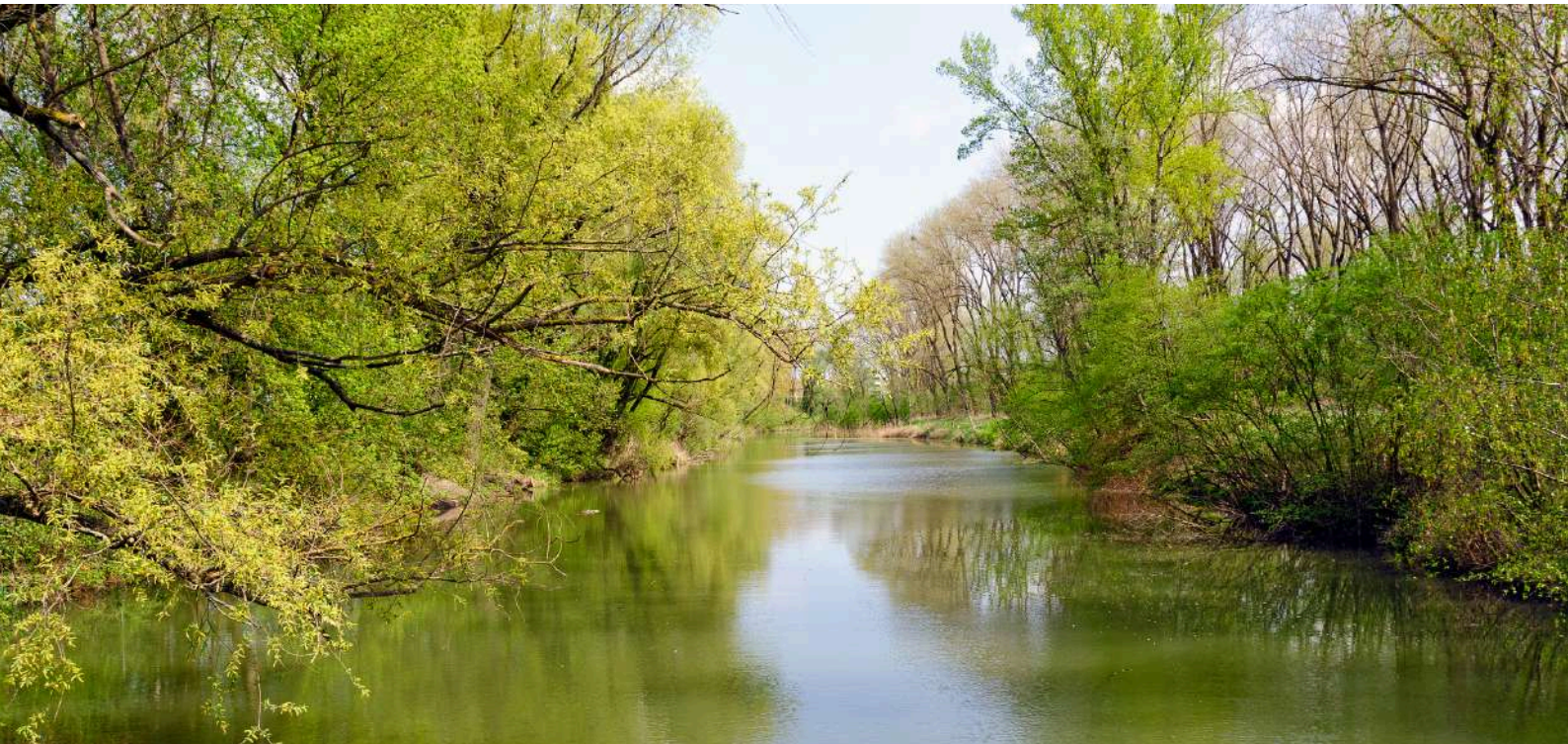
Working beyond your site

Wetlands cannot be looked at in isolation. More than any other type of protected area, any change in the wider landscape is bound to impact the quality of the wetland. This includes for instance sinking ground water tables, surface and subsurface water pollution, or the influx of nutrients from adjacent human activities.

It is therefore of great importance to treat wetlands as interconnected systems and manage them accordingly. This means taking into consideration the surrounding landscape, both from an ecological point of view, but also considering the breadth of ecosystem services they provide to a multitude of stakeholders.

Adapting to climate change will require site managers to look beyond their sites by:

- Implementing measures to **improve connectivity** between wetlands.
- **Sharing knowledge, experiences, and working collaboratively** with local and regional actors, such as water authorities, regional governments, and municipalities, etc.
- Mapping and **engaging with relevant stakeholders** such as tourism offices, farmers, local population, etc.
- **Reduce external non-climate pressures** through smart land-use planning.



Key practical measures for climate resilient wetlands that support waterbird populations

Waterbird populations are dependent on well managed and resilient wetlands for breeding, feeding and staging habitats. Migratory species are particularly affected by changes in habitat conditions across their migratory range, which are much more difficult to control across geopolitical borders. It is therefore of great importance to ensure that specific climate adaptation measures are in place to support waterbirds.

Hydrological restoration (Water retention)

- Re-wetting and water level management (by shallowing ditches, filling in drainage pipes and re-meandering streams).
- Keep dynamic water levels by varying water depth and the timing of flooding and drying out. Ensure controlled inflow and outflow of water to compensate for extremely dry or wet conditions.

Increasing habitat diversity (Food and nesting opportunities)

- Create a mosaic landscape: Ensure a variety of open water, shallow mudflats, reed beds and swamp forests.
- Manage shrubby margins: Maintain riparian vegetation and fruit-bearing shrubs (such as dogwood or elder) to provide shelter and food, and prevent reeds from becoming dominant everywhere.
- Natural grazing: Using grazers (such as cattle or horses) can help keep the landscape open and prevent overgrowth.

Climate-adaptive management (Increasing resilience)

- Monitoring and maintenance: Use sensor data to gain real-time insights into water quality and levels and carry out timely maintenance, such as dredging.
- Control of invasive species: Remove non-native plants that reduce biodiversity.
- Reducing nutrient loading: Prevent eutrophication (excess nutrients) from the surrounding area, for example by installing reed filters or iron sand filters.

Impact monitoring and long-term data

Nature always shows a delayed response to sudden changes. This is also true for the impacts of climate change. Monitoring species and habitats alone is not sufficient to identify changes caused by climate change at an early stage, meaning that monitoring schemes should pay close attention to detecting changes in the abiotic conditions before their impacts are felt at species and habitats level.

Early detection of changes such as lower ground water tables, lower surface water tables, and changes in water quality is only possible with **sturdy long-term monitoring schemes** targeting a variety of abiotic measures, including precipitation and temperature.

EU guidance on Natura 2000 and climate change also highlights the need for **iterative planning, improved monitoring, and the integration of new knowledge into management decisions**.

🔍 *What SPEAR says: Long-term monitoring of rewetted wetlands – a case from Sweden*

Wetland rewetting has the potential to restore several important ecosystem services, both now and in the future. While some studies report relatively rapid recovery of groundwater levels and some plants and animal groups, other aspects, including the re-establishment of peat-forming vegetation and original species communities, may take decades or even up to a century.

Existing research has focused largely on initial rewetting effects, whereas the change of these effects over time is still poorly understood. Negative side effects appear to be most pronounced during the first decade after rewetting, yet **long-term data are scarce**. The current state of knowledge of rewetting effects can be significantly improved through **more systematic and comprehensive effect monitoring**.

A recent report[8] by the Swedish Environmental Protection Agency highlights substantial knowledge gaps regarding time of recovery after rewetting for the ecosystem services and functions once provided by intact wetlands, raising the need for intensively studied field sites where data is collected both before and after rewetting, allowing for detailed, long-term assessments.

[8] Long-term monitoring of rewetting of drained wetlands. Swedish Environmental Protection Agency. Report November 2025.

In a Nutshell

Climate adaptation in Natura 2000 wetlands means prioritising resilience and co-benefits with biodiversity and climate goals. Managers should first secure and restore critical wetland refuges, design multi-benefit Nature-based Solutions, strengthen waterbird measures, connect and engage with cross-sector partners, and implement strong monitoring and adaptive cycles that measure the long-term impacts of management actions. In the coming years, focusing on these actions will be key to safeguarding wetland biodiversity and ecosystem services in a changing climate.

- **Pay close attention to core populations:** Protect and manage sites that support the largest/most critical bird populations, using IBAs and habitat-specific criteria.
- **Close network gaps:** Identify and secure additional sites (or strengthen existing ones) where priority species or habitats are underrepresented.
- **Apply RAD thinking:** Use the Resist-Accept-Direct framework – resist change in high-value areas, accept unavoidable changes, or steer ecosystems toward desired future states.
- **Assess vulnerability:** Evaluate how climate change will affect your site (e.g. water availability, temperature) and identify the most vulnerable species or habitats.
- **Restore wetlands:** Implement targeted wetland restoration or creation to improve hydrological resilience, carbon storage, and habitat quality.
- **Nature-based solutions:** Design interventions (e.g. restoring floodplains, artificial wetlands) to deliver multiple benefits for nature and people, ensuring biodiversity outcomes are integrated from the start.
- **Engage stakeholders:** Work with local communities, farmers, and other sectors to align land-use practices and build support for adaptation measures.
- **Consider the connectivity of your site:** Collaborate with local and regional actors by sharing knowledge and positive (and negative) experiences on climate adaptation.
- **Support waterbird populations:** by rewetting and managing water levels, managing dynamic water levels, increasing habitat diversity (by creating mosaics, maintaining shrubby vegetation, and grazing to prevent overgrowth), Control invasive species and nutrient levels.
- **Monitor and adapt:** Establish long-term monitoring of both species and environmental conditions (e.g. water levels, climate indicators) to detect changes early and adjust management as needed.

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This publication was written by Mónica Vidal, Harm Schoten and Henk Zingstra. It incorporates research findings from Lisa Ernoul, Giorgio Zavattoni, Tomas Pärt, Anthony D. Fox and Yanjie Xu, and was revised by Szabolcs Nagy.

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Eurosite.org

LinkedIn
linkedin.com/company/eurosite-org

Instagram
@eurosite_org

Bluesky
@eurosite.org

Facebook
facebook.com/eurosite.org/

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