Conservation of wetland habitats across the **Transboundary Prespa basin**

prespaNET
A NETWORK OF ENVIRONMENTAL NGOS FOR PRESPA

SOCIETY FOR THE PROTECTION OF PRESPA

PPNEA
PROTECTION AND PRESERVATION OF NATURAL ENVIRONMENT IN ALBANIA
•SINCE 1991•

MACEDONIAN ECOLOGICAL SOCIETY

CONTENTS

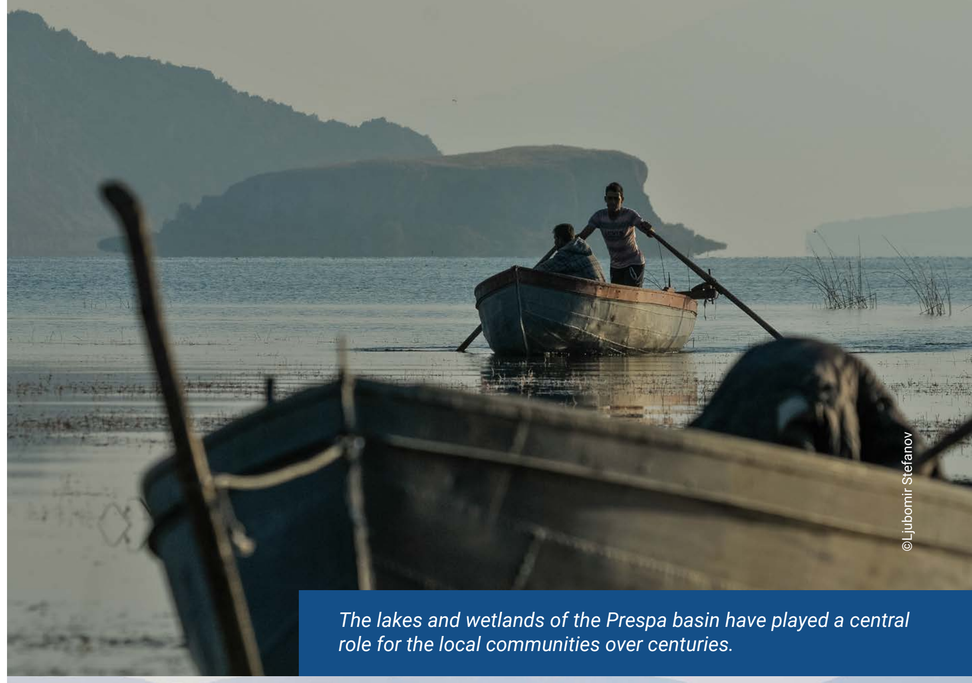
Chapter 1: Introduction to the wetlands of Prespa

identifying values and benefits

The wetlands of the Prespa basin have long been recognized for their value for biodiversity, and their central role in the welfare of the local communities that have evolved around them over centuries.

Wetlands in Prespa are characterised by different ecological conditions and include littoral areas of both Great and Lesser Prespa Lakes and riparian sites along streams and coasts. In delineating this "**wetland zone**" in Prespa, habitats are selected across various gradients, starting from habitats completely immersed in water at the inner parts of the littoral land, all the way up to the outer habitat formations on drier land that was previously flooded or is periodically flooded depending on hydrological conditions. The width of this zone ranges from a few meters up to three kilometers. On the eastern side of the lake, the zone may also extend into riparian ecosystems of streams and stream mouths, completing the mosaic with hydrologically connected habitats. This delineation also includes areas that were formerly dependent on water and inundation but have now resumed a drier form in higher elevations, such as sites along the former shore of Great Prespa.

More often than not, it is human activities along the littoral zone that have shaped and helped conserve important wetland habitats in the past. Nonetheless, the lakes are not impervious to human-induced pressures, particularly including land-use changes and climate change, coupled with abandonment of traditional activities and water abstraction, which lead to significant changes in wetlands, especially documented in recent years. Long-term drought events, reduced annual precipitation and subsequent effects on water resources and a long-standing water level decrease in Great Prespa, are just some of the effects of the climate crisis that increasingly affect the Prespa basin.



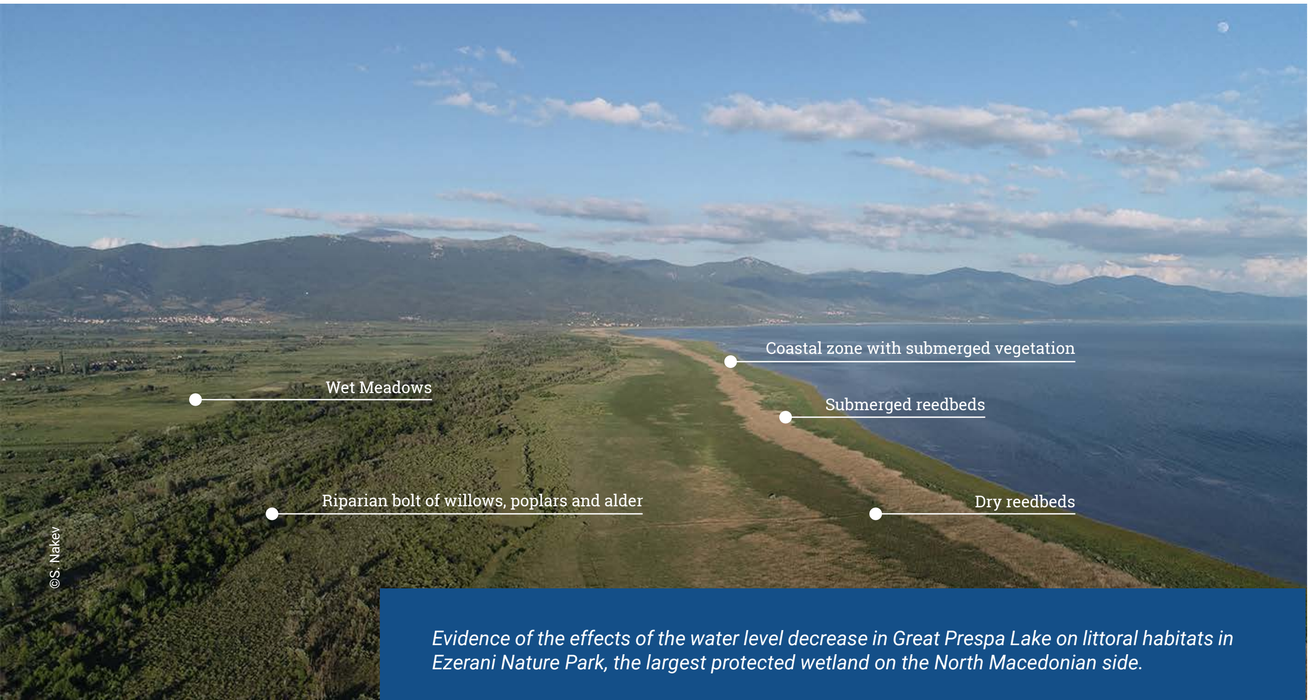
The lakes and wetlands of the Prespa basin have played a central role for the local communities over centuries.

The wetland zone often lies at the interface between agricultural activity and the lake.

Recent estimations show that Great Prespa has lost almost 10 meters in depth and 7% of its surface area over the last 30 years, as an effect of the decreasing water level, with subsequent changes in littoral wetlands and vegetation.

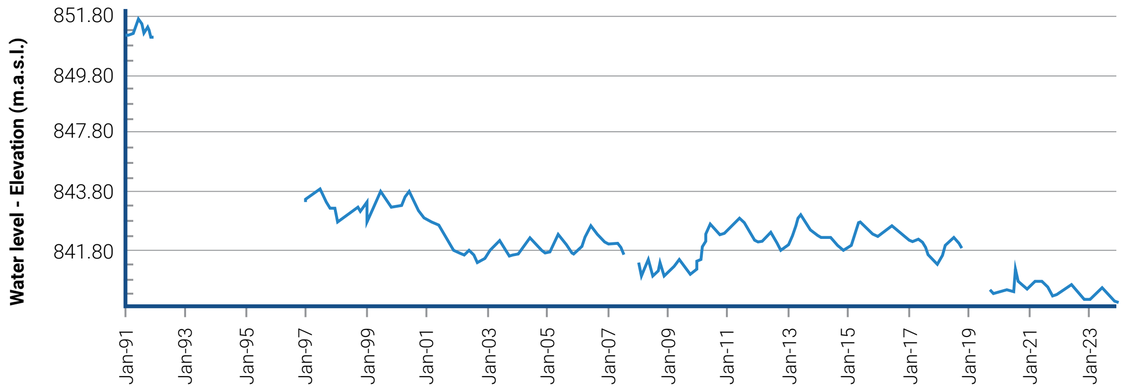
In Lesser Prespa Lake, a high water level in spring allows the inundation of littoral land and reedbeds, i.e., the important feeding and breeding habitats for waterbird species, and supports fish and amphibian habitats. Water management is in place in Greece with agreed-upon thresholds for the maximum water level, based on conservation objectives and irrigation needs, while a sluice gate is operated when water level exceeds these. However, in recent years, drought conditions and low spring water levels have been experienced, significantly affecting wetland functions; notably the sluice gate has been operated only three times over the last ten years, none in the last five.

In view of dynamic changes along this defined "**wetland zone**" and the Prespa basin, and the importance of these areas for biodiversity and livelihoods, it was rendered necessary to document the distribution of habitats within this zone, between the years 2018 – 2021. PrespaNet partners worked jointly on defining and evaluating Prespa's wetlands, recognizing their values and functions and, more importantly, identifying the threats they face.



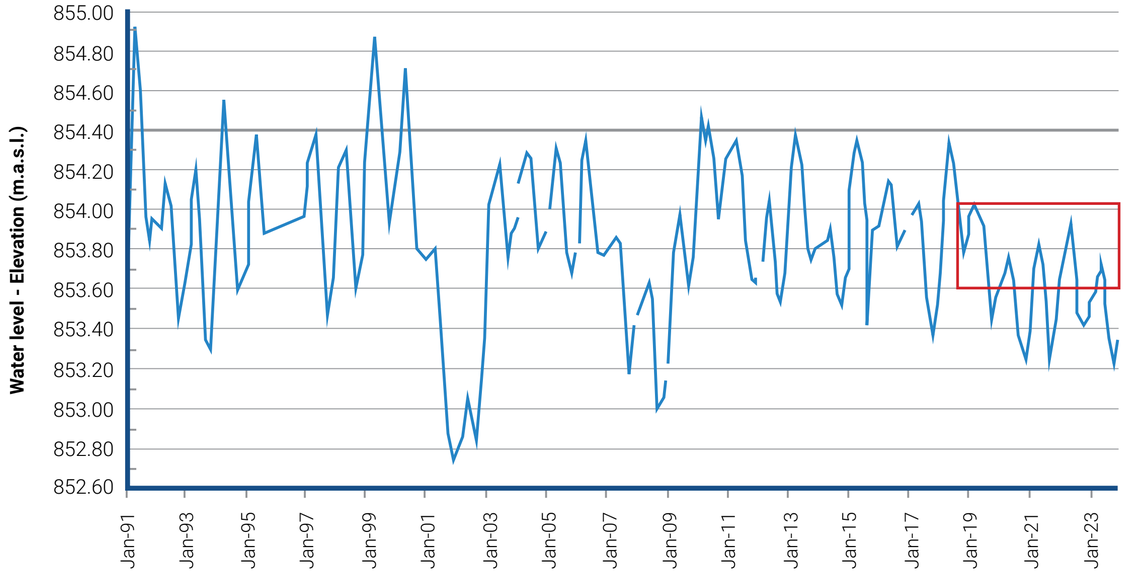
Evidence of the effects of the water level decrease in Great Prespa Lake on littoral habitats in Ezerani Nature Park, the largest protected wetland on the North Macedonian side.

Great Prespa Lake



After an initial drop in water level by 6 meters in the 1990s, the water level of Great Prespa Lake remained relatively stable within a range of two meters, before plummeting to today's water level. Today the water level is at its lowest recorded level for more than 30 years, almost at 10 meters lower than in the early 1990s.

Lesser Prespa Lake



In Lesser Prespa Lake, high water level in spring reaching an elevation of 854.4 m.a.s.l, allows the inundation of littoral land and reedbeds. However, in recent years, droughts and low spring water levels have been experienced; in the absence of effective flooding, wetland functions increasingly being affected.

Chapter 2: Current outlook on the wetlands of Prespa

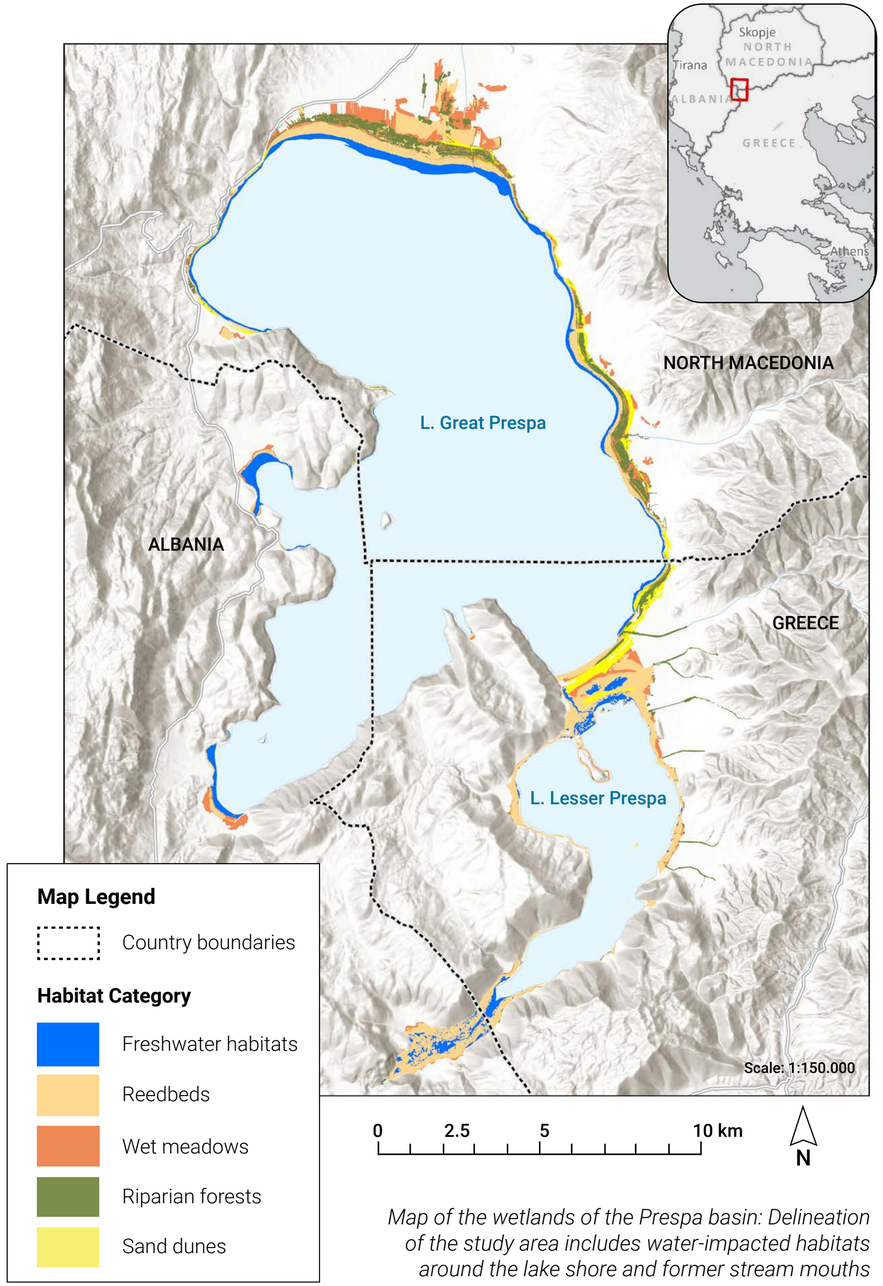
documenting dynamic changes and main pressures

Largely based on characterization according to the EU Habitats Directive (92/43/EEC) guidelines and other vegetation assessment methods, the mapping completed at the transboundary level delineated 5,050 ha of wetlands and revealed an extensive habitat mosaic, with 13 habitats of diverse ecological value and multiple functions, 7 of which are common to all littoral countries. These habitats are classified in clusters of "functional"* categories depending on their degree of inundation and correspondingly their proximity to the lake.

Habitat category	Habitat description	Albania	Greece	North Macedonia	Surface area/ habitat category (ha)	% Surface area
Freshwater	Natural freshwater lakes, shallow waters with floating vegetation	277.20	208.55	532.47	1,018.22	20
Reedbeds	Reedbeds	419.38	811.90	846.56	2,077.84	41
Wet meadows	Water-level dependent meadows in littoral land	32.02	68.62	45.42	146.06	3
	Underground/rain-fed meadows	56.90	57.50	509.13	623.53	12
Riparian forest	Streams and littoral land with forests (alder woodland, willow and poplar galleries)	2.41	159.00	620.70	782.11	15
Sand dunes	Sand steppes		209.04	195.25	404.30	8

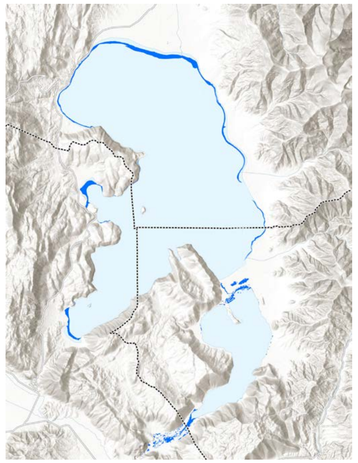
Table: Wetland habitat categories, a functional classification of wetland habitats across the Prespa basin.
*In **Annex I**, a full account on the classification of habitat and vegetation types into functional categories is presented.*

*The Habitats Directive employs the functions of habitats, as one of the main components for habitat assessment. Here, the wetland habitats have been classified in groups mainly according to their recorded functions, which relate also to inundation conditions.



Map of the wetlands of the Prespa basin: Delineation of the study area includes water-impacted habitats around the lake shore and former stream mouths

Freshwater habitats



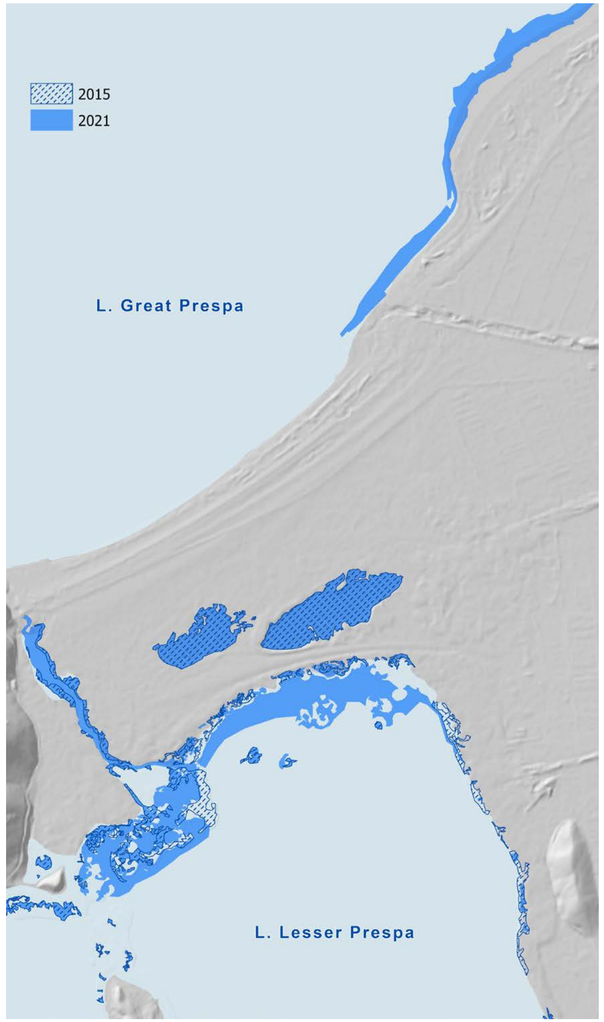
Open water is the dominant freshwater feature for both lakes, whereas wetlands and freshwater habitats appear in the shallows. Freshwater habitats are mainly characterized by plants that appear in open and deeper water, consisting of submerged aquatic macrophytes or free-floating species. They are located principally around the lake shore, usually extending from and/or forming on open water surfaces within reedbeds (other habitat, see below), while reedbeds provide them protection from wind and wave action. These habitats thrive in high nutrient conditions, exhibit high productivity and are typically species rich. The most pronounced change in both lakes has been observed for freshwater habitats at the inner part of the wetland zone.

In Lesser Prespa, on the Greek side alone, the habitat almost doubled from 2015 to 2021. This expansion is clearly an effect of the stabilization of the water level, with low water levels persisting in spring and thus creating conditions for the habitats to flourish in previously deeper open water.

Freshwater habitats contribute to the overall functioning of the lake ecosystem and serve several functions for wetland biodiversity, hosting many important fish and bird species. Additionally, freshwater habitats hold many different vegetation types, and important or endangered plant species at the regional and European level.

Nonetheless, the recent expansion of freshwater habitats should also be considered indicative of both the unfavourable hydrological regime of recent years and increased eutrophic conditions. In Great Prespa, Greece, the habitat appeared for the first time over 30 ha, in the new shallow areas along the receding line of the water level, signaling a change in conditions along the shore of the lake.

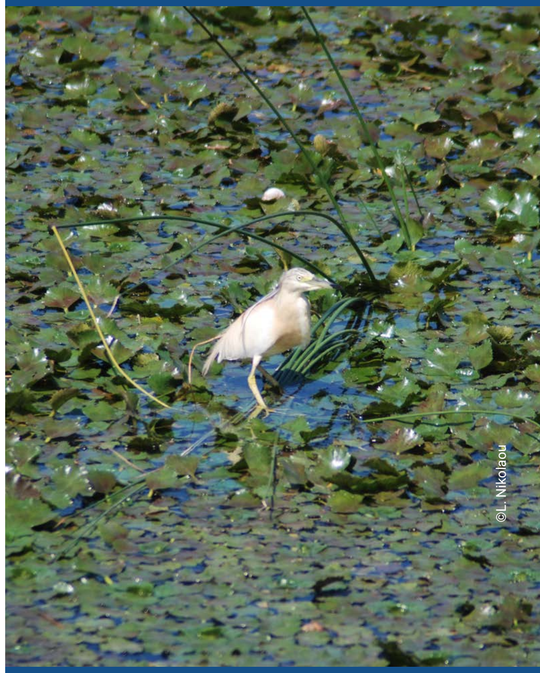
Today, freshwater habitats comprise 20% of mapped wetlands in Prespa (just over 1,000 ha), second only to the extensive reedbeds dominating the landscape.



Map: Illustration of the dynamic changes in freshwater habitats in the Greek part of Prespa

©A. Strid

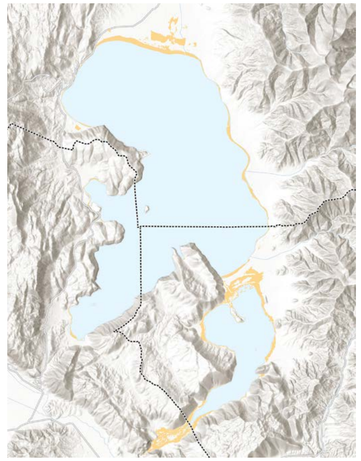
Aldrovanda vesiculosa, an aquatic carnivorous plant species which is endangered at European level and included in Annex II of the Habitats Directive (92/43/EEC). Prespa is the only place that has recently confirmed collections of this species for both Greece and North Macedonia.



©L. Nikolaou

Feeding in freshwater habitats: squacco heron on water lilies, a typical species of the habitat

Reedbeds



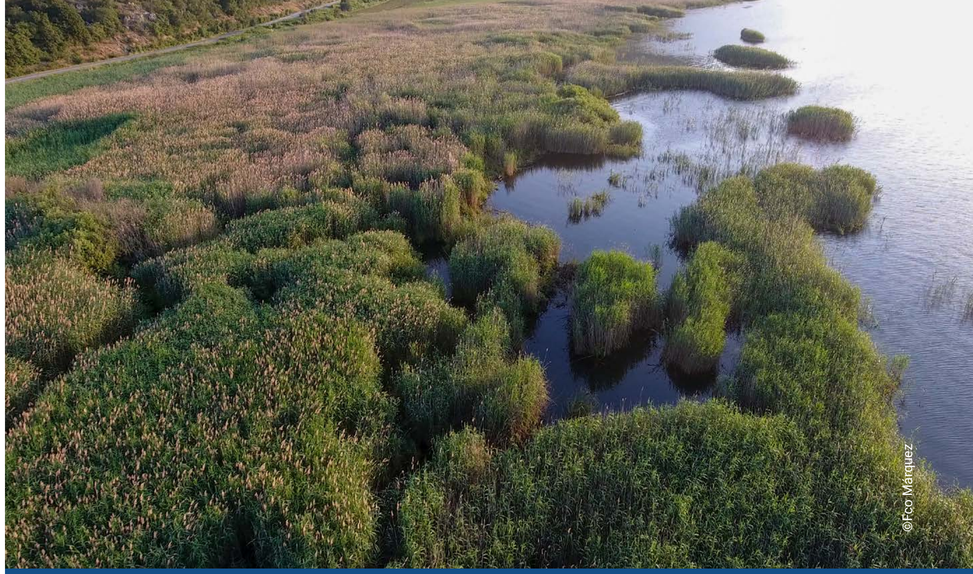
The most distinctive feature of Prespa's wetlands, i.e. reedbeds, spread across 2,000 ha, taking up 40% of shoreline habitats. Right at the interface between dry and inundated land, reedbeds expand in dry land, in stagnant or slowly flowing waters of varied water levels, and sometimes in water-saturated soils and deeper water. The reedbeds, highly adaptable to varied conditions, usually form monotypic or mixed communities of reed and reedmace.

Among others, reedbeds are very important primarily because they provide safe nesting habitat for rare waterbirds when flooded, as well as protect the outer freshwater habitats from wave and wind actions. Additional functions include the provision of supplementary fodder for cattle, the retention of nutrients from agricultural land and settlements, as well as increasing bank stability.

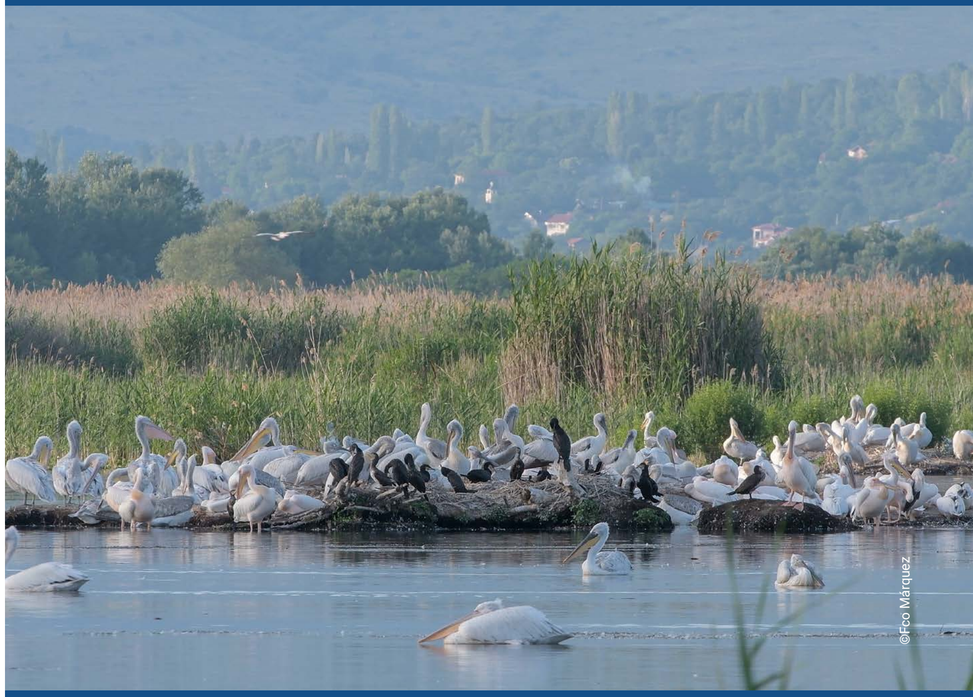
The influx of nutrients prompts the growth and expansion of reedbeds, while their ability to survive on varied inundation levels allows their establishment in changing conditions. Through their aggressive propagation they tend to occupy abandoned littoral land, where human activities would otherwise restrain them (e.g. vegetation management through grazing and cutting, as well as wildfires). In Lesser Prespa Lake, in many areas where cattle grazing and the cutting of vegetation have been reintroduced, the reedbed gives way to meadow–like vegetation.

Reedbeds have only seen a small increase in Great Prespa, compared to other habitats of the littoral zone. Although no significant increase has been observed in either lake, observations for Great Prespa in Greece and North Macedonia confirm that reedbeds are increasingly extending over dry land, owing to the decrease of water level and the shifting of inundated conditions. The recent sudden decrease in water level has not allowed for the immediate colonization of reeds in the littoral zones, and in the absence of expansion reedbeds remain on drier parts of the littoral areas.

Although overgrazing was locally identified as a pressure on reedbeds in Albanian Great Prespa (2019), according to the recent Grazing Management Plan (2023) for the littoral zone, this does not seem to be the case anymore. This reduction in pressure on reedbeds, may be explained as an effect of the receding waterline exposing more areas to grazing, relieving this pressure locally and/or to a reduction in cattle numbers in recent years.

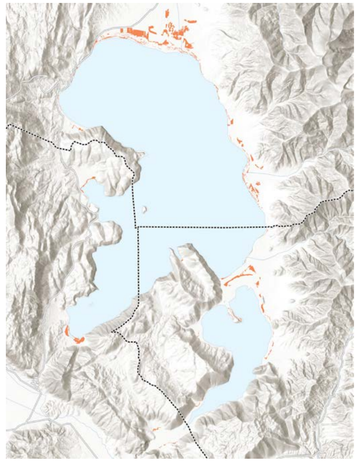


Reedbeds are highly adaptable to varied conditions, prosper on dry and inundated land and take up 40% of shoreline habitats.



Pelicans breeding on sturdy substrates on reed rhizhomes

Wet Meadows



Wet meadows include seasonally flooded (up to 40 cm) meadows, which are particularly productive with high floristic diversity, owing to varied soil conditions. Vegetation types, as well as values and functions may differ across gradients and flooding conditions.

Littoral wet meadows are found along the shoreline of Lesser Prespa Lake and normally they flood seasonally by the high spring water level of the lake and become important grounds for fish spawning, amphibian reproduction and waterbirds' feeding, thus sustaining important functions for the wetland ecosystem.

They are characterized by high floristic diversity, especially compared to other wetland habitats. Littoral wet meadows are very diverse and may be comprised of different vegetation and habitat types: they can be muddy banks or grasslands with tall herbs or sedges, contributing to the landscape diversity of the wetland ecosystems. Their multiple functions render them important for the wetland ecosystems, particularly in Lesser Prespa Lake, where they form a small but distinctive zone along the reedbeds. In addition, they provide high quality fodder and constitute important grasslands for cattle, while their extent depends largely on the degree of management taking place annually.

Additionally, hay meadows that remain inundated or humid for large parts of the year but may not be affected directly by lake levels are also included in this category. These appear to be dependent on the underground aquifer and they may be close to the littoral zone, following the receding lake level or further away, where they may well be relicts of extensive hydrological networks of streams and underground water flows that are now lost to agricultural land. These wet meadows also hold diverse flora and contribute to the diversity of the landscape. Moreover, they are also important for cattle grazing and for the provision of fodder, when they are not encroached or substituted by agricultural land.

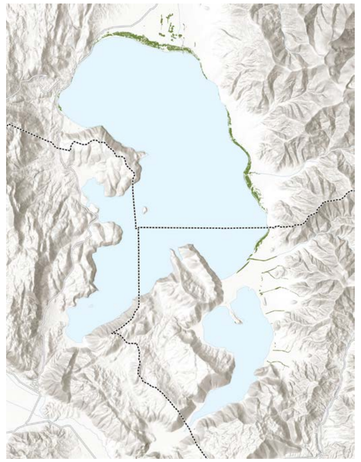
Wet meadows are the most diverse category of habitats, including types that differ in function and vegetation. In Lesser Prespa, this habitat of low herbaceous vegetation has seen an increase (13%) in recent years, mainly owing to conservation action and vegetation management interventions by cutting and grazing in the reedbed. However, in Great Prespa wet meadows, and in particular sedge communities have seen a shrinkage of 90%, particularly giving way to sand dunes, as the soil dries out with the receding water line. In North Macedonia, in the northern part of the lake, a clear succession of specific wet meadow habitats (*Calamagrostis epigeios* communities) towards willow communities is taking place.

Wet meadows along the shores of Lesser Prespa Lake in Greece can only be maintained through vegetation management and flooding in spring.

Underground/rain-fed meadows with Narcissus poeticus are found at a distance from Lesser Prespa Lake, in Greece.

Wet meadows in North Macedonia are located at a distance from the lake and require management action for their conservation.

Riparian forests



Riparian forests extend on alluvial land along the shores of both lakes, as well as along rivers and canals, mainly in North Macedonia and Greece, with small stands also present on the Albanian side. These habitats may be dominated either by alders along streams and former extensive stream mouths, or by willow and poplar forming galleries along streams or exposed littoral land along the lakeshore. Along the coast of Great Prespa Lake, willow and poplar stands are also interspersed with silver birch stands, a species recorded at the southern limit of its distribution in Greek Prespa. Alders often form stands with relatively humid conditions and a thick canopy cover, with understorey vegetation unique to this vegetation association.

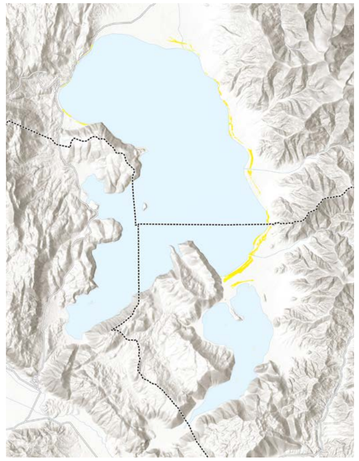
Alder forests are classified as a priority habitat (*91E0) according to the EU Habitats Directive and they host a number of plant species that are not recorded in other habitat types. Mature alder forests probably occupied larger areas and have now been fragmented to a large extent, with their cover reducing because of the expansion of agricultural land in recent decades. Riparian forests are important for the stability of the hydrological cycle, protect against bank erosion and provide in-stream water temperature regulation, while in recent years they have become important corridors for large-mammal dispersal and movements. Along the coast of Great Prespa, riparian forests have evolved on sand dunes that have been exposed with the gradual decrease of the water level over the last 25 years. In North Macedonia, they are under pressure from expanding agricultural crops, tourism-related activities and forestation with alien species, while in general they are subject to changes in the hydrological regime (e.g. water level) and vegetation succession. In Lesser Prespa, remnants of riparian forests can be found along streams and at their outlets, on the eastern side of the lake and the southern tip in Albania.

At first glance, riparian forests appear to hold the same extent since the first mapping efforts took place, and this is largely attributed to the longer time needed for changes in forest habitats overall. However, structural changes may be at work, with a small increase in riparian forest relating to willow stand expansion, the shrinkage of the alder stand surface area as a result of wildfires or the substitution of alder stands by oak trees in increasingly dry soil conditions. In recent years, the expansion of alien species within riparian forests has also been identified as an upcoming threat. Notably, afforestation actions within the transboundary area are addressing the restoration of alder habitat.

Riparian forests extending along alluvial land in Ezerani Nature Park, North Macedonia

One of the types of riparian forests is dominated by alder Alnus glutinosa; recent research identifies another species, the Balkan alder Alnus rohlenae within the Prespa basin.

Sand dunes



Characteristic habitat type of the outer parts of wetlands, where the lack of inundation due to receding water levels or drought conditions allows the exposure of sandy soils. Primarily to be found on the shores of Great Prespa in Greece and North Macedonia, sand dunes have also been exposed along the isthmus between the two lakes in Greece. Annual species which survive in dry conditions mostly dominate in the vegetation composition of these grasslands, although wet meadow species might occur locally due to high levels of sub-surface water, or even the fluctuation of water level in Lesser Prespa Lake some years.

Sand dunes have also been exposed along the shore of Lake Great Prespa, following the receding water line. The current extent of 400 ha (8% of littoral land) is comprised of the most recently exposed shoreline or previously abruptly exposed shoreline, where vegetation succession did not progress as an effect of dry conditions or grazing management.

Although sand dunes are favoured by drought conditions taking up formerly inundated land, this habitat is of great importance due to its rarity – at a national level in both North Macedonia and Greece it has only been recorded in Prespa – as well as for the occurrence of several plant taxa, some of which are endemic to the Balkan Peninsula, while its presence contributes to landscape diversity. Notably, it is a priority habitat type according to the EU Habitats Directive and it is classified as Critically Endangered at European level, according to the Red List of European Habitats.

Sand dunes have increased at the outer edges of wetlands in both lakes, reflecting the low inundation of the soil as an effect of receding water level in Great Prespa Lake. Comparative data in Greece indicate a recent increase of the habitat of more than 40 ha, primarily over previously inundated sedge vegetation communities. In Lesser Prespa Lake, a few more hectares have appeared on the permanently dry soils of the outer edges of the lake. At higher elevations across the lake, where the habitat remains dry for longer periods of time, organic matter increases, and vegetation succession leads to the substitution of its typical vegetation by shrubs and tree species. Management through grazing and/or ploughing could reverse this trend, in cases where it is rendered necessary.

Sand dunes spread over dry soil, following the reduction of water level in Great Prespa and drought conditions in Lesser Prespa. Vegetation succession may lead to the substitution of annual therophytes by shrubs and tree species.

Typical species of sand dunes, including Onosma heterophylla, a protected species by Greek law

Mosaic of habitats, multitude of functions

The mosaic of habitats revealed by the transboundary study across the wetland zone of the lakes reflects both species richness and the diversity of vegetation types along the littoral zone, as well as the differentiation of habitats across different gradients, relating to the water level of the lakes, the water table and across different management regimes. This mosaic of habitats contributes to an impressive landscape diversity, which in turn supports a multitude of functions for the wetland ecosystem and related biodiversity. All of these habitats support differing functions of the lake, acting as feeding and breeding grounds for important waterbirds species and other fauna species, while some hold additionally high value for floristic diversity and others are considered important conservation elements at the European or national level. Some habitats contribute to bank stability and retain nutrients from agricultural run-off, while other functions can only be retained through management interventions (e.g. cutting, grazing) and thus provide biomass and space to stockbreeding.

The functions of some habitats are affected by hydrological conditions, while interventions and protection measures are needed to support other important functions. Notably, some habitats may be negatively affected by receding water levels, but as the substrate becomes drier other habitats may be favored providing habitat to important mammal species, while even eutrophic conditions in shallow water favor freshwater habitats.

In any case, this diversity of conditions creates a diverse wetland landscape. This rich mosaic is especially affected by human interventions, land use patterns and eutrophication, while this landscape has seen significant changes over the last decades. Imminent dynamic changes are expected further because of hydrological shifts, namely the water level issues that have been observed for both lakes over the last five years, which affect inundation levels and habitat extent.

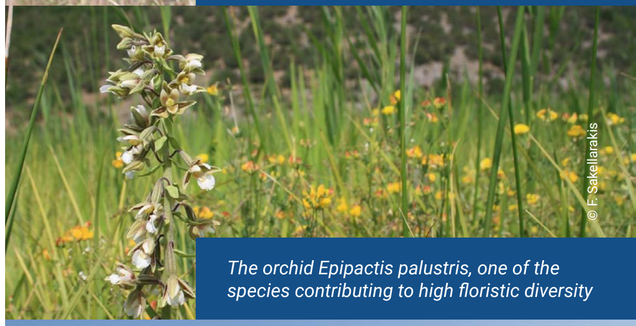
As revealed in these documented habitat shifts, changing conditions will tend to favor different habitats, sometimes leading to the expansion of specific habitats with important species, over the shrinkage of other habitats which are also important for ecosystem functions or even the appearance of transient habitats, which take advantage of ephemeral conditions. Under the climate crisis, potentially increasing eutrophic conditions and land-use changes, among several other threats, the challenge lies in identifying and retaining a balance that preserves the important functions of the wetland to the maximum extent possible.

In agreement with the high diversity of habitat types, pressures and threats to the wetland ecosystems are equally diverse and range from localized anthropogenic impacts, such as waste disposal, to more generic and long-term pressures relating to land-use change, such as the abandonment of low-impact traditional activities and the expansion of agricultural activity. Moreover climate-related effects, such as reduced water level, reduced littoral land inundation and increased fire intensity, may alter habitat configuration creating new dynamics along the shorelines of the lakes and streams.

Wetland ecosystems are known to hold abundant important functions;
here we show just a few important functions of wetlands of the Prespa watershed

Carp spawning in submerged vegetation

Feeding Glossy ibises in flooded meadows



The orchid Epipactis palustris, one of the species contributing to high floristic diversity

Fodder collection along littoral habitats and meadows in Lesser Prespa Lake, Greece

Chapter 3: Conservation of the wetlands of Prespa
facing challenges under the climate crisis

The long-standing pressures and changes in the wetland mosaic, along with newly arising overarching climate change effects that are at work render transboundary coordinated action necessary. At this stage and time, it is necessary to organize joint action at local and regional level and address common issues that affect biodiversity, wetlands, and related ecosystems equally. In addition to the geographical scope, there is now a need to carry out work at multiple levels, spanning from advocacy action to protect sites to implementing active restoration and conservation measures, simultaneously increasing knowledge, understanding the ecosystem, and raising awareness on its functions and values. At a time that fast structural changes are expected, conservation of wetland habitats and the mosaic becomes increasingly important to maintain important wetland functions.

Integrated water resource management

The effects of altered hydrological conditions observed in recent years necessitate a thorough understanding of the underlying causes and mechanisms of these changes. It is crucial to develop plans based on transboundary consensus, to mitigate these effects and should this prove unfeasible, adaptation strategies should be considered, for the benefit of both local livelihoods and biodiversity.

A common understanding of the water bodies' status is necessary for the design and planning of ecological restoration actions, especially for wetland habitats and biodiversity, while cross-border dialogue is necessary and should engage stakeholders, strengthening the existing collaboration platforms. Processes of information exchange through cross-border dialogue should bring together the scientific community, policy makers, practitioners, local stakeholders and conservationists dealing mostly with aquatic ecosystems to share state-of-the-art research and an updated outlook on related issues. This process will gradually enable the implementation of climate change adaptation and mitigation measures, building resilience of aquatic ecosystems, habitats and species at the transboundary level.

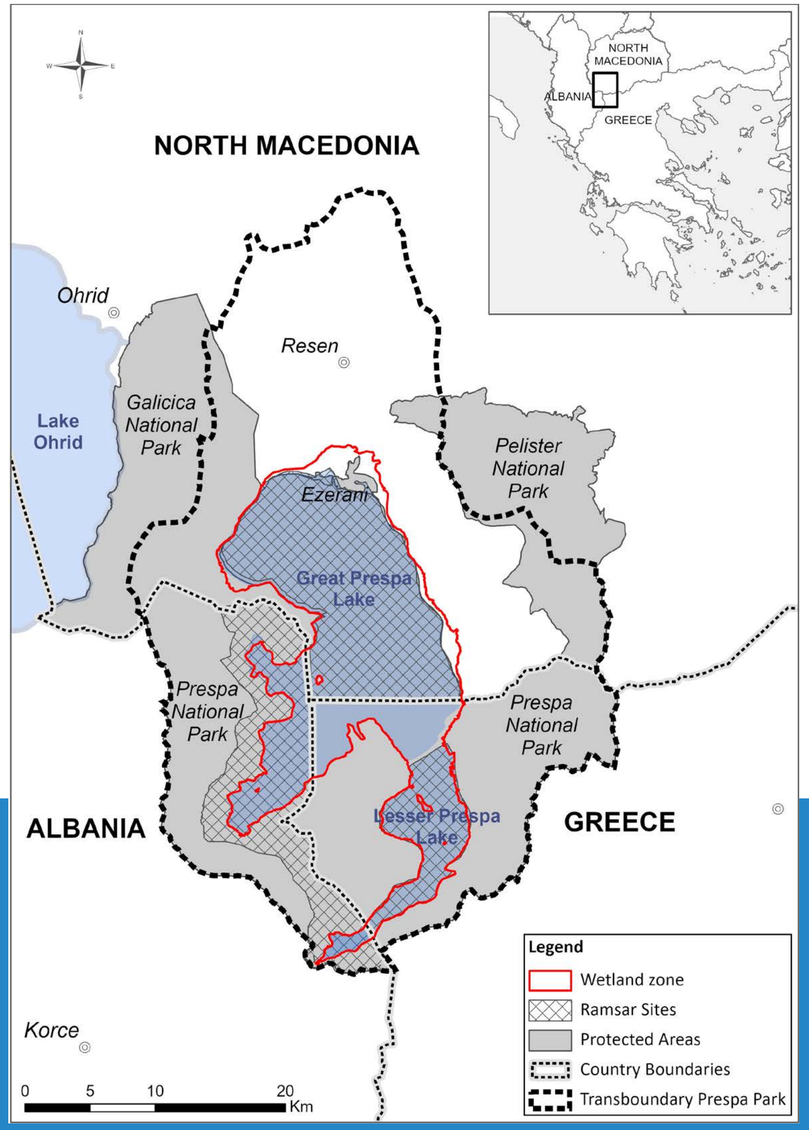
A transnational view into Great Prespa Lake, from Albania: water resources management requires a watershed approach and transboundary coordination.

Protection status and delineation of important areas

The largest part of shoreline habitats falls within international designation (80%), while an even larger area (95%) falls within national protected area legislation. Although the features of both lakes are subject to international recognition and nationally acknowledged as protected areas, under the increased pace of change, there is a need to specifically designate areas of conservation interest within the wetland zone.

In Greece and Albania, the protected areas encompass the littoral zones of both lakes, but in the North Macedonian part specific important habitats (such as alder forest and sand dunes) do not always fall under any national protection status and there is a need for designation of additional protected sites. Nonetheless, strengthening the protection of the wetland landscape would include defining and assessing existing land uses, defining the limits of wetland ecosystems and preventing the implementation of detrimental activities, such as the expansion of agricultural activity and sand extraction, especially in areas that have been exposed owing to the drop of water level in Great Prespa Lake.

A first step would be to delineate the outer limits of the wetland landscape mosaic, especially those parts situated outside protected areas in the case of North Macedonia, and review provisions and zonation for important wetland habitats within protected areas in all littoral states. Designation of “no intervention” or “special conservation” zones, as well as marking and raising awareness of important wetland habitats, their functions, and threats, would enhance their protection status, especially where conservation and protection measures are not yet clearly defined. Similarly, sites for “tourism development” should be designated, to limit uncontrolled pressure on shoreline habitats and especially sand dune areas and promote sustainable uses of land use.



Map: Protected area designations across the three countries

Ramsar Convention designations across the Prespa basin

The Ramsar site designation on the Greek side does not include Lake Great Prespa. In North Macedonia, the lake, including most of the Ezerani Nature Park, is a designated Ramsar site. The designation approach undertaken in Albania, which not only includes the designation of surface water, but clearly extends to wetlands and associated terrestrial habitats that affect the lake, is an example of a holistic approach encouraged by the Ramsar Convention.

Efforts should concentrate on revising limits of the designated Ramsar sites, to include Great Prespa Lake in Greece and additional areas in North Macedonia. In effect, it may be beneficial for both countries to follow the example of the Ramsar designation in Albania, possibly even extending to a watershed approach to include streams of the eastern side of the basin within designation limits.

Regulation of activities, adhering to legislation and prevention of negative human impacts along the shoreline

The wetland zone may be subject to regulations under the provisions of protected area zonation, while a respective management plan may be in place providing guidelines and laying down conservation measures. It is imperative that conservation management plans are reviewed regularly and adapted to changing conditions and that proposed protection actions are also extended and well implemented even outside protected areas (e.g. in North Macedonia). It is a good coincidence from the viewpoint of governance that on the side of North Macedonia, where a large part of the Prespa territory falls outside protected areas, the authority responsible for managing both types of land is one and the same, namely the Municipality of Resen.

Examples of adverse human impacts along the wetland zone and the shoreline, include the expansion of reedbed fires across large areas and solid waste accumulation.

Uncontrollable solid waste deposition is a characteristic problem of the transboundary area. Restoration of littoral sites requires synergies among local authorities, stakeholders and even volunteer groups to remove solid waste and prevent further accumulation. To ensure a lasting effect further structural improvements would be needed in municipal waste management, coupled with awareness raising, on all three sides of the basin. Throughout long-term cooperation, municipalities across the three countries have worked together to advance their mechanisms for waste management, energy saving or the promotion of sustainable tourism, mainly through bilateral projects of transboundary collaboration. Although progress has been made towards the direction of adhering to management provisions and improved implementation of legislation by local authorities, it is necessary that local governance is strengthened, and appropriate resources are allocated (e.g. for equipment/ infrastructure, processes, and staff) to implement all the necessary actions.

Reedbed fires are a common threat along the littoral zone of the lakes, often spilling over from adjacent agricultural land; Vegetation management along the littoral zone for the conservation of wet meadows, also creates "fire breaks" between the reedbeds and the agricultural land, preventing the spread of fire into the reedbeds.

Solid waste accumulation is a common threat across many habitats; restoration of sites requires synergies among local authorities, stakeholders and volunteer groups.

Restoration and conservation of habitats and habitat functions

Restoration action and conservation measures targeting specific habitats have been proposed in related studies across the basin. As prescribed in these studies, restoration action is already underway for alluvial alder forests with the implementation of reforestation, and for wet meadows through the implementation of grazing and cutting. At the same time, proposals have already been put forward for mild, traditional, and more active forms of management and action for freshwater habitats, sand dunes and reedbeds.

Restoration and conservation actions are variable and may include mild forms of management, often containing a reinstatement of traditional activities. Examples include (a) the implementation of regulated grazing and vegetation cutting for the conservation of wet meadows and hay meadows or (b) the creation of openings in reeds for the restoration of freshwater habitats, i.e. vegetation communities of *Nuphar lutea, Nymphaea alba and Trapa natans*. Other active forms of management measures may include the direct removal of invasive species along shoreline habitats, especially targeting sand dunes and riparian forests in the future.

Alder forest restoration is under way across the basin; Successful production of alder seedlings in controlled environments is key to implementing reforestation action in Ezerani Nature Park, North Macedonia and in selected locations in Greece and Albania.

Ecosystem services, biomass production and reedbed management

Building upon two decades of wetland management in Lesser Prespa Lake, Greece, the implementation of conservation action has been designed to confer benefits to the local community and beyond, largely accredited to the fact that most activities relate directly to the primary sector. Direct and clear benefits to local society from managing littoral land and wetland areas are provided mainly to stockbreeders through the use of biomass and the availability of rangeland, to farmers through the use of biomass as soil conditioner, and secondarily to fishermen through improved fish spawning. Indirectly, or rather in a less evident way, the local community benefits through the maintenance of populations and habitats, i.e. their inherent existential value, which confers multiple benefits pertaining to the increased popularity of the protected area to visitors.

Stockbreeders, as well as the protected area authority, are both part of wetland restoration work carried out in Ezerani by PrespaNet partner MES, in North Macedonia, acting as implementing stakeholders and benefitting from the actions.
A similar model of regulating activities, and especially grazing, is being developed in the Albanian part of Prespa.

Long-term solutions that are applied by stakeholders (grazing and/or cutting vegetation as in the above examples) are always more preferrable, because they ensure the continuation of actions beyond the scope of a project, and in Prespa they have been key to maintaining wetland conditions or functions. Participation by stakeholders is largely driven by the incentives provided, i.e. the provision of ecosystem services which are beneficial for their activities. While this participation is key to the successful implementation of wetland management, it should always be driven by conservation objectives and organised by protected area managers.

A long-term solution to wetland conservation in Lesser Prespa Lake: regulated grazing contributes to the mosaic of habitats.

Baling of wet meadow vegetation in Ezerani Nature Park: direct benefits from vegetation removal provide stockbreeders with incentives to contribute to wetland conservation.

Regular monitoring of wetland habitat changes, in relation to the hydrological regime

In response to the dynamic changes noted across the littoral zone of the three countries and reacting to the perceived and projected effects of climate change, it is necessary to follow up closely any changes in wetland configuration and relate them to changes in important populations of waterbirds and other priority species of concern. Following the assessment and mapping of wetlands completed in recent years, changes in wetland ecosystems have been observed to be both abrupt (e.g. expansion of habitats in newly exposed littoral land) or more subtle and long-term (e.g. the expansion of riparian forests and vegetation succession on sand dunes). The nature and increased intensity of the described pressures on the lakes renders monitoring necessary over the coming years.

More specifically, additional efforts should be invested in monitoring the dynamic changes of wetlands along the receding waterline and the effects on important biodiversity, including assessments of the expansion of invasive species and the effects of agricultural activities on wetlands.

Regular monitoring of wetland vegetation is essential for assessing changes to the ecosystem and taking appropriate action.

Studies on grazing capacity and biomass nutritional value may prove useful in designing appropriate management interventions.

Transboundary coordination: collaboration schemes and joint action

Over the last two decades, several initiatives have been undertaken to coordinate the efforts by related stakeholders and authorities, across the littoral states and several transboundary projects have achieved a level of collaboration. Starting from the establishment of the Transboundary Prespa Park in 2000, a Strategic Action Plan for the Sustainable Development of the Prespa Park (SAP) was developed as a first joint project of the countries. Since these early efforts, local authorities, protected areas and NGOs have been collaborating in bilateral and trilateral projects at various levels; from targeted research, transboundary monitoring systems and creation of action plans to direct conservation action, the area's stakeholders and authorities are familiar with information exchange and joint projects.

Since 2018, there has been an effort to synchronize wetland monitoring and conservation activities and exchange knowledge among the protected area authorities, local governments, and the environmental organizations of PrespaNet. This effort has resulted in the implementation of joint monitoring activities, in sharing best practices in habitat management and in extensive exchange of information. The existing platform of the Transboundary Wetland Management Technical Group (TWMTG), a forum of local protected area authorities and the organizations of PrespaNet, has played a role in identifying potential synergies and in developing common goals in wetland monitoring and conservation. Such collaborative schemes among civil society, local governments and protected area authorities should be enhanced in the future to include the elaboration of current and arising issues relating to climate change and eutrophication. Additionally, these collaborative schemes should be streamlined with the interstate joint bodies operating under the Prespa Park Agreement to achieve maximum legitimization and hence results in the conservation of the transboundary area.

Discussing water level issues of Great Prespa Lake on site, December 2022

Annex I: *Classification of habitat and vegetation types into functional categories*

Habitat category	Habitat description	Surface area (ha) by country			Surface area/ habitat type (ha)	Surface area/habitat category (ha)	% Surface area
		Albania	Greece	North Macedonia			
Freshwater	3150. + Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation	277.20	208.49	531.86	1,017.55	1,018.22	20.2
	3260. + Water courses of plain to montane levels with Ranunculion fluitantis and Callitricho-Batrachion vegetation		0.06	0.61	0.67		
Reedbeds	C3.21 & C3.23 / D5.11 & D5.13 - Reedbeds	419.38	811.90	846.56	2,077.84	2,077.84	41.1
Wet meadows	C3.2 Flowering rush communities	0.02			0.02	769.59	15.2
	Calamagrostis epigeios comm.			383.50	383.50		
	3270.+ Rivers with muddy banks with *Chenopodion rubri* p.p and *Bidention* p.p vegetation	5.90	2.59		8.49		
	6420.+ Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion	2.60	60.78	0.04	63.42		
	D5.12 - Schoenoplectetum lacustris	6.70		7.80	14.50		
	D5.21 - Sedges community (Greek code: 7280)	16.80	5.25	37.58	59.63		
	E3.31 - Hay meadows (Hellenic-Moesian riverine and humid *Trifolium* meadows)	56.90	57.50	125.63	240.03		
Riparian forest	91E0. *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)	2.10	20.98	129.51	152.59	782.11	15.5
	92A0. + *Salix alba* and *Populus alba* galleries	0.31	138.02	491.91	629.52		
Sand dunes	6260. *Pannonic sand steppes		209.04	195.26	404.30	404.30	8.0

Sources and acknowledgements

The collation of information to produce this concise report on "Conservation of wetland habitats across the Transboundary Prespa basin" was based largely on the following reports, studies and articles and the corresponding maps that have been produced. This is the result of a long-term collaboration between the organizations of PrespaNet and the protected area authorities of the Transboundary Prespa basin, that has been active across the borders for more than a decade.

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PrespaNet

PrespaNet is network of environmental NGOs, the Society for the Protection of Prespa (SPP) in Greece, the Protection and Preservation of the Natural Environment in Albania (PPNEA) and the Macedonian Ecological Society (MES), working collaboratively to strengthen conservation efforts in the Prespa region. Since the establishment of PrespaNet in 2013, the three partners, have aimed to strengthen transboundary co-operation between NGOs, as well as with protected area management authorities, producing strategic plans for the conservation of the area and implementing joint research and conservation actions. The transboundary mapping of habitats in littoral and riparian areas is a result of increased cooperation among experts of the organizations.

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Transboundary Wetland Management Technical Group

A transboundary wetland management technical group (TWMTG) of related stakeholders/authorities of the Prespa basin was formed in early 2018 to promote cooperation and exchange information on wetland conservation management objectives and share progress on wetland management activities at the transboundary level across both Lesser Prespa and Great Prespa lakes. The TWMTG includes representatives of management bodies of protected areas related to the lake across the basin, i.e. the SPP and and the Management Unit of the Prespa National Park in Greece (MU-PNP/ NECCA), the Regional Agency for Protected Areas representing the National Park in Albania (RAPA) and PPNEA from Albania, the Municipality of Resen representing the Ezerani Nature Park/ (MoR), the Galičica National Park (GNP) and MES in North Macedonia. The TWMTG meets annually to discuss current conservation issues and exchange information on developments.

Contributors

Compiler: Koutseri Irene/ Society for the Protection of Prespa

Map Editing: Papanousi Foteini/ Society for the Protection of Prespa

Society for the Protection of Prespa: Catsadorakis Giorgos, Malakou Myrsini, Roumeliotou Vivi

Macedonian Ecological Society: Nikolov Lazar, Pejovikj Svetlana

Protection and Preservation of Natural Environment in Albania: Shyti Ilir, Nezaj Melitjan

Agricultural University of Athens: Fotiadis Georgios, Sakellarakis Fanourios-Nikolaos

Ss. Cyril and Methodius University, Skopje: Chobanova Marija, Hristovski Slavcho

Design Coordination: Solaki Eleni, Vlachou Hara / Society for the Protection of Prespa

Graphic Design: CReatures

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A view of the tri-national border and Golem Grad Island in Great Prespa Lake from the west

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Looking out over Lesser Prespa Lake and the basin from Mount Sfika in the south

Contributing local and regional authorities

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Ezerani Nature Park/ Municipality of Resen

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Municipality of Prespes, Greece

Municipality of Pustec, Albania

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