GLOBAL WETLAND OUTLOOK

Special Edition 2021

Ramsar Convention on Wetlands

50 YEARS

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The Convention on Wetlands

The Convention on Wetlands is a global inter-governmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

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FOREWORD

We all interact with and depend on wetlands for our livelihoods, sustenance and well-being.

In 2018, the Convention on Wetlands published the first ever *Global Wetland Outlook* – a unique report promoting increased understanding of the status and value of wetlands, and providing recommendations towards ensuring that wetlands are conserved, wisely used and their benefits recognized and valued by all. Its findings on widespread degradation and loss of wetlands globally, and the implications of this, constituted a wake-up call and was instrumental in raising awareness.

In the few years since it was published, the world has been dramatically changed by the COVID-19 pandemic. It has caused untold loss, and affected most aspects of our lives. It has also compelled us to put a higher value on nature, including wetlands, for their importance to human health and wellbeing.

The UN General Assembly, in its resolution of 30 August 2021, proclaimed World Wetlands Day, 2 February every year, a UN observance. It reaffirmed that wetlands are critical for people and nature and essential to achieving sustainable development – a worthy celebration of the 50th anniversary of the Convention on Wetlands. But as this *Global Wetland Outlook Special Edition 2021* clearly illustrates, while we can applaud many examples of progress in wetland protection and wise use, the global picture remains one of continued wetland loss.

This is happening at a time when we need wetlands and their biodiversity, water, livelihoods and climate services the most. Clearly, the Convention on Wetlands remains as relevant as when it was first crafted. Its implementation is more important than ever.

There is a silver lining in the palpable shift towards broader recognition that biodiversity loss and climate change are inextricably linked, and that sustainable development can only be achieved through stepped up action to reverse the unprecedented loss of nature. Responses to the pandemic, including economic stimulus, offer opportunities to build back better – and to build back wetter, using the full range of benefits provided by wetlands.

This may be the change that becomes a watershed moment. We hope that this *Global Wetland Outlook Special Edition 2021* can contribute to that.

Martha Rojas Urrego, Secretary General

Dr Lei Guangchun, Chair of the Scientific and Technical Review Panel (STRP)

EXECUTIVE SUMMARY

The *Global Wetland Outlook: Special Edition 2021* was prepared on the occasion of the Convention's 50th anniversary. Drawing on more than 30 major global and regional assessments and other recent scientific findings, it describes the pandemic and its implications; trends in wetlands since 2018; lessons for wetland wise use and protection; and how the Convention on Wetlands can be leveraged to address challenges facing wetlands.

The COVID-19 pandemic has changed the way we think about health and the environment, with more recognition of the importance of nature for health, including mental wellbeing. Ecosystem degradation and careless wildlife trade both increase the risks of pandemics, with up to three quarters of new diseases being zoonotic in origin. Meanwhile, water-borne diseases 'like infant diarrhoea' are increased by poor wetland management and cause millions of deaths every year.

People's health and livelihoods depend on well-managed wetlands. Control of emergent zoonotic diseases is increasingly seen as dependent on maintenance of well-managed, intact ecosystems and native biodiversity. Ecosystem approaches in wetlands can bring health benefits to all in line with One Health principles.

Deterioration of wetlands is widespread, but more wetlands are still reported as in 'good' rather than 'bad' ecological character. Biodiversity losses are linked to land-use change and still rising. Improvement in wetland ecological character is linked to extent of implementation of the Strategic Plan of the Convention.

Climate change is occurring faster than previously anticipated, with thresholds crossed and major changes inevitable. Wetlands are particularly impacted by sea-level rise, coral bleaching and changing hydrology, with Arctic and montane wetlands especially at risk. Changing weather increases risks of flooding and drought in many places.

Wetlands need to be part of delivering climate solutions. Recognition of the scale of benefits, and costs of their loss, is quite recent. Adequate water provision is fundamental, and wetlands are critical for water security. Undisturbed peatlands and coastal blue carbon ecosystems (salt marshes, mangroves, seagrass beds, etc.) are powerful carbon sinks, but can be significant sources of greenhouse gases if degraded. Wetland actions need to increasingly be included in Nationally Determined Contributions (NDCs), as well as in national adaptation and disaster risk reduction plans.

Impacts of agriculture on wetlands are becoming more apparent: Agriculture is a key driver of wetland degradation, but the future of sustainable food production is dependent on healthy wetlands and wise use. Over half of Wetlands of International Importance are damaged by agriculture. Transformation of agriculture is urgently needed to reverse these trends.

Enhanced integration and co-ordination are needed across the agriculture, urban development and wetland management sectors. Major changes are needed to reduce water use and pollution and to stop wetland conversion. Urban planning that incorporates wetlands delivers better health and well-being for city residents. The Convention on Wetlands has introduced a Wetland City Accreditation scheme to recognise cities taking exceptional steps to protect urban wetlands.

Broader stakeholder engagement brings diversified governance and management, and greater local ownership, but tensions remain. Protection of human rights, including gender rights, needs to be a prerequisite of wetland conservation. Recognition of the scale of the environmental crisis is, however, also bringing new partners into wetland conservation and management.

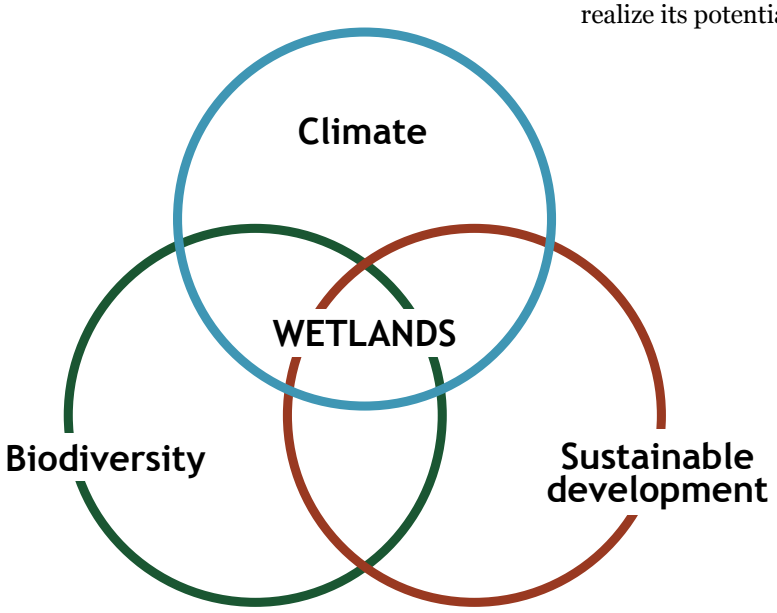
A confluence of international policy can drive positive change. Failure to meet the Aichi Targets and slow progress on the Sustainable Development Goals (SDGs), show that new approaches are needed. While some NDCs refer to wetlands, very few include specific actions or targets. The emerging Post-2020 Global Biodiversity Framework offers hope for confluence of actions towards sustainable development, biodiversity and climate change.

Wetlands are critical to delivering on global commitments relating to biodiversity, climate change and sustainable development. 'Nature-based solutions', including multiple roles for wetlands, can help move beyond a narrow focus on human-built infrastructure.

Half a century after the Convention on Wetlands was adopted, its mission is more urgent than ever. Continuing to benefit from the services wetlands provide while awarding them the protection they need requires global cooperation. The Convention plays a key role as a global forum for negotiation and consensus building on the management of wetlands. Wetlands of International Importance offer laboratories for achieving sustainable wetland management under different environmental conditions, pressures regimes and governance arrangements.

The Convention provides a means for catalysing wetland actions and tracking progress towards global targets relating to sustainable development, including as a co-custodian for SDG indicator 6.6.1, as well as relating to biodiversity and climate change. It provides a foundation for ambitious wetland restoration efforts during the UN Decade on Ecosystem Restoration.

There are many examples of success - good site management, improvement in species conservation status, progress with ecosystem restoration, and benefits in terms of water security, adaptation and mitigation outcomes. However, the world's wetlands are still being lost at alarming rates. Implementation of the Convention needs to be strengthened to fully realize its potential.



INTRODUCTION

The first *Global Wetlands Outlook* was published in 2018 (Ramsar Convention, 2018a). It reported that although wetlands still cover a global area of 1.2 billion hectares (ha) – larger than Canada – they are declining fast, with 35% losses of natural wetlands since 1970, where data are available. Quality of remaining wetlands is also suffering due to drainage, pollution, invasive species, unsustainable use, disrupted flow regimes and climate change. Yet wetland ecosystem services, ranging from food security to climate change mitigation, remain enormous, far outweighing those of terrestrial ecosystems.

At the 13th meeting of the Conference of the Contracting Parties, in late 2018, a number of important resolutions highlighted future priorities of the Convention on Wetlands, stimulated in part by the *Global Wetland Outlook*. These addressed, for example, peatland and blue carbon ecosystems, sustainable agriculture, cultural values and practices of Indigenous Peoples and rapid assessment of wetland ecosystem services.

Since then, the world has undergone fundamental changes, most dramatically a global pandemic.

This *Global Wetland Outlook: Special Edition 2021*, prepared on the occasion of the Convention's 50th anniversary, complements the 2018 Outlook. It draws on several important new studies published (see Box 1), ranging from analyses by the Intergovernmental Panel on Climate Change (IPCC) and Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) to economic studies like the Dasgupta report, and communiqués from the G7 (Group of Seven) and G20 (Group of Twenty). Sources were chosen to give as wide a perspective as possible. All agree on a nexus of three critical issues: (1) a climate emergency; (2) a global ecological crisis including catastrophic biodiversity loss; and (3) an imperative need for transformative societal change.

Wetlands have always provided services to humanity, yet recognition of the scale of these benefits and the consequences of their loss is quite recent. Unsustainable use and inappropriate management of wetlands not only results in loss of ecosystem services but can bring direct risks including disease. International processes, notably IPBES, have increased our understanding of wetland ecosystem services, and their role in wise use pathways. Both 'nature-based solutions' and ecosystem approaches in wetlands and their catchments are of fundamental importance, bringing ecosystem services, climate stabilisation and health benefits to all.

Part 1 of this Special Edition looks at the pandemic and its implications. Part 2 summarises what we have learned since 2018, drawing on the studies referred to above and focusing on the implications for wetlands. Part 3 discusses what this tells us about how wetlands and people might better interact in the future and Part 4 assesses how the Convention on Wetlands can be leveraged to respond to the challenges facing wetlands.

BOX 1

Publication	Assessment	Scale	Responsible organisation
2017/2019	Global Land Outlook	Global/regional	UNCCD
2018	Land Degradation and Restoration	Global /regional	IPBES
2018	Special Report: Global Warming of 1.5 oC	Global	IPCC
2018	*Global Wetland Outlook*	Global	Convention on Wetlands
2018	Mediterranean Wetlands Outlook 2	Regional	Med. Wetlands Obs. & MedWet
2018	Biodiversity and Ecosystem Services	Global/ regional	IPBES
2019	Special Report on the ocean and cryosphere	Global	IPCC
2019	Global Environment Outlook 6	Global	UNEP
2020	State of World Fisheries and Aquaculture	Global	FAO
2020	State of Food and Agriculture	Global	FAO
2020	World Water Development Report	Global	UNESCO
2020	Living Planet Report	Global	WWF
2020	State of Nature in the EU	Regional	EEA
2020	State of the World's Forests	Global	FAO
2020	World Heritage Outlook	Global	IUCN
2020	State of the World's Fisheries	Global	FAO
2020	The Economics of Biodiversity: The Dasgupta Review	Global	UK Government
2020	Report on Human Rights and the Environment	Global	UN
2020	Mapping and Assessment of Ecosystems and their Services	Regional	EU
2020	Global Biodiversity Outlook 5	Global	CBD
2020	World Disasters Report	Global	IFRC
2021	Sustainable Development Report	Global	UN
2021	Global Risks Report	Global	WEF
2021	Local Biodiversity Outlooks 2	Global	FPP and others
2021	Nature, Biodiversity and Health	Global	WHO
2021	Climate Change 2021: The Physical Basis	Global	IPCC WG1
2021	G7 Climate ministers' communiqué	Global	G7
2021	Atlas of Rangelands	Global	ILRI
2021	G20 Environmental communiqué	Global	G20
2021	The Economic Case for Nature	Global	The World Bank
2021	Unearthing Investor Action on Biodiversity	Global	Credit Suisse

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1. A YEAR THAT CHANGED EVERYTHING

Eighteen months after the first *Global Wetland Outlook* (Ramsar Convention, 2018a) was published, the COVID-19 pandemic swept across the world, affecting every aspect of society. There are significant implications for the Convention on Wetlands, including on economies, working practices and management of Wetlands of International Importance (Waithaka *et al.* 2021). COVID-19 has also, perhaps most significantly, affected the way that decision-makers and civil society view links between environment and health. This Special Edition starts by looking at wetlands and health.

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1.1 The pandemic has fundamentally altered the way we think about health and the environment

Key messages

1. There is increasing recognition of the importance of nature for health. This includes mental well-being, highlighted by the lockdowns associated with the pandemic.
2. Ecosystem degradation and careless wildlife trade both increase the risks of devastating pandemics, with up to three quarters of new diseases being zoonotic in origin.
3. Water-borne diseases like infant diarrhoea, carried in insanitary water, are also increased by poor wetland management and kill millions of people every year.

In 2020, IPBES addressed the issue of biodiversity and pandemics. The general conclusions are highly relevant to wetland managers and policy-makers:

- Pandemics emerge from the microbial diversity found in nature;
- Human ecological disruption and unsustainable consumption both increase pandemic risk;
- Reducing anthropogenic global environmental change may reduce pandemic risk;
- Land-use change causes more than 30% of emerging disease events;
- The trade and consumption of wildlife is a globally important risk for future pandemics;
- Current pandemic strategies usually aim to control diseases after they emerge and often damage biodiversity in the process; and
- Escape from the pandemic era requires policy options that foster transformative change.

They concluded that the evidence "demonstrates that pandemics are becoming more frequent … Without preventative strategies, pandemics will emerge more often, spread more rapidly, kill more people, and affect the global economy with more devastating impact than ever before."

Three quarters of emerging diseases are zoonotic, passing from animals to humans (Taylor *et al.* 2001). Risks are increased by the wildlife trade (Shivaprakash *et al.* 2021), agricultural intensification (White & Razgour, 2020) and ecosystem degradation, including of wetlands, where biodiversity loss can increase the risks of disease emergence and transmission (Van Langevelde *et al.* 2020; Lugassy *et al.* 2021). This makes strategic wetland conservation an important prevention strategy (Wu *et al.* 2020). At present, in contrast to the above, many health strategies, such as wetland drainage to control the spread of malaria (Martinou *et al.* 2020), damage wetlands and impact wetland dependent species.

Simple solutions will not work. Emerging management responses to this and future pandemics need to include integrated water management (Kotze, 2021), for health as well as general wellbeing. Benefits and risks need to be carefully balanced to maintain important ecosystems services while minimising the opportunities for emergence of disease.

Health benefits are not only physical. An additional lesson from the pandemic is that wetlands, particularly in urban areas, provide important resources as psychological safety valves for people who are feeling stressed, frightened and confined (Fagerholm *et al.* 2021; Reeves *et al.* 2021a).

BOX 2

RELEVANT RESOURCES AND RESOLUTIONS OF THE CONVENTION

Ramsar Technical Report No. 7: *Ramsar Wetland Disease Manual: guidelines for assessment, monitoring and management of animal disease in wetlands*

Ramsar Handbook No. 4: *Avian Influenza and Wetlands*

Meanwhile, wetlands are linked with human health in many other ways. Hundreds of thousands of deaths each year are linked to insanitary water, including over half a million children who die of diarrheal disease (Dadonaite, 2019), again often as a result of poor wetland management. Well-managed watersheds release purer water (Liu & Bergen, 2018), making integrated wetland management an important factor in health policies. While the pandemic has focused attention on one particular aspect of health, improved wetland management will have positive impacts on many other diseases as well.

See also section 3.2, which addresses how sustainable wetland management can help support human health.

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2. NEW FINDINGS SINCE THE PUBLICATION OF THE 2018 *GLOBAL WETLAND OUTLOOK*

The 2018 *Global Wetland Outlook* showed the extent of wetland loss. Research since then has looked further at the implications for the ecological character of wetlands and at what humanity stands to lose if these trends are not halted and reversed.

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2.1 Wetland extent and condition continues to deteriorate globally

Key messages

1. Deterioration of wetlands is increasingly widespread although more wetlands are reported as currently being in good rather than bad ecological character.
2. Biodiversity losses are continuing to rise, but are also better understood than previously.
3. Multiple sources of pollution, particularly from agriculture, continue to degrade wetland ecosystems.
4. Improvement in wetland ecological character is found to be linked to implementation of the Convention on Wetlands Strategic Plan commitments.

A recent estimate of the global total wetland area is a minimum of 1.5-1.6 billion hectares (updated since the first *Global Wetland Outlook* by Davidson & Finlayson, 2019). The 2018 Outlook reported that wetland area continues to decline, with conversion and loss continuing in all parts of the world. Since 1970, inland wetland-dependent species have declined far more than species dependent on other biomes and an increasing number are facing extinction.

Contracting Parties to the Convention on Wetlands report on extent of wetlands through their National Reports to the Convention, derived from their National Wetlands Inventories. This forms the basis for tracking SDG Indicator 6.6.1 on change in the extent of water-related ecosystems over time, for which the Convention is co-custodian with UNEP (UN DESA, 2021; see e.g., box 13 Resolution XIII.7). Contracting Parties started reporting national data in 2018, followed by reports in 2021 to the 14th Meeting of the Conference of the Contracting Parties (COP14), providing nationally validated data on SDG 6.6.1 that will be updated every 3 years (see e.g., UN ECOSOC, 2021). Although data on wetland extent, distribution and trends are still incomplete, accuracy is increasing as Contracting Parties scale up efforts to complete and update wetland inventories, which will also support future wetland assessments and outlooks.

The 2018 *Global Wetland Outlook* did not report on the ecological character state of remaining wetlands. Ecological character is the combination of the ecosystem components, processes and benefits/ services that characterise the wetland at a given point in time (Ramsar Convention, 2005). Three studies published since 2018 help address this. The first, analyses qualitative reports from Contracting Parties to the Convention in National Reports to COP11, COP12 and COP13 (Davidson *et al.* 2020a) and the other two report on qualitative "citizen-science" state of wetlands surveys, carried out in 2017 and 2020 (McInnes *et al.* 2020; Simpson *et al.* 2021). It should be noted that for 2021 Contracting Parties have submitted National Reports, and drawing on these the Convention Secretariat will present a Global Implementation Report to COP14 in 2022.

Analyses reinforce a picture of continuing global wetland decline. In 2011 and 2014, more Contracting Parties reported more improvement than deterioration in the ecological character state of their Wetlands of International Importance (Davidson *et al.* 2020a). In 2017, equal numbers of Parties reported improvement and deterioration (Figure 1) and the overall trend was negative. Furthermore, more Contracting Parties reported more deterioration than improvement in the ecological character state of their wetlands generally (Davidson *et al.*

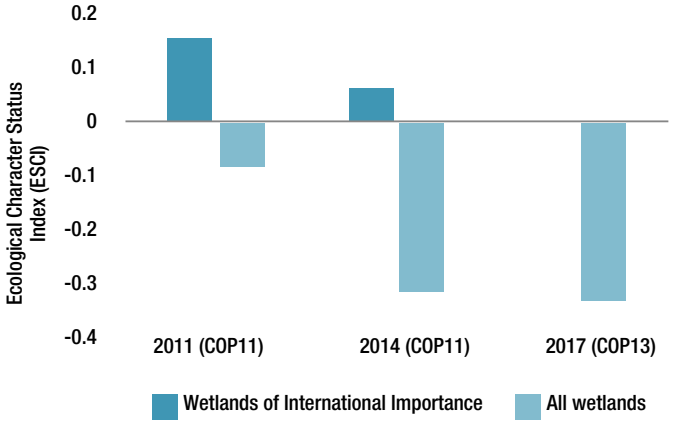

Figure 1
The ecological character state of Wetlands of International Importance and of all wetlands, reported by Contracting Parties in their National Reports to COP11, COP12 and COP13. The Ecological Character Status Index (ECSI) for Wetlands of International Importance in 2017 was 0.

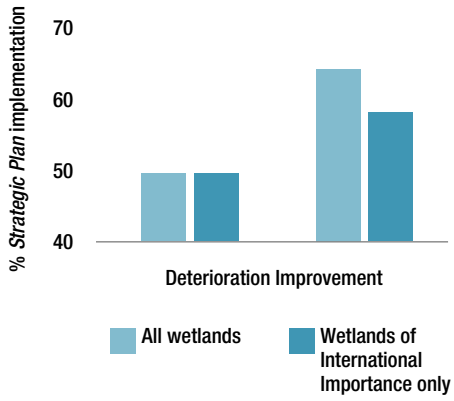

Figure 2
The relationship between the average extent of national Strategic Plan implementation by Contracting Parties reporting either deterioration or improvement in the ecological character state of all their wetlands and of their Wetlands of International Importance. Figures are derived from data in COP13 National Reports and Davidson *et al*. (2020a).

2020a) (Figure 1). However, as information on the state of a large proportion of Wetlands of International Importance is out of date or in the process of being updated, it is not possible to provide a comprehensive, current assessment of their condition (Convention on Wetlands, 2021a; Davidson *et al*. 2020b).

In both 2017 and in 2020, citizen scientists reported more wetlands as being in 'good' ecological character state than in a 'poor' state (McInnes *et al*. 2020; Simpson *et al*. 2021). The two citizen science surveys also reported more wetlands as deteriorating in state (2017: 36% of responses; 2020: 52%) than improving (2017: 21%; 2020: 29%), a trend apparent across most Regions under the Convention. This trend has continued over the three recent years (2018-2020; Simpson *et al*. 2021). The most widespread deterioration reported for both the state of all wetlands and of Wetlands of International Importance was in Africa and Latin America and the Caribbean (McInnes *et al*. 2020). Citizen-scientists perceived that deterioration in wetland state is more widespread within Wetlands of International Importance than outside them (McInnes *et al*. 2020; Simpson *et al*. 2021).

Contracting Parties that report an improving state of all wetlands, and of Wetlands of International Importance, also report implementing a larger than average number of Strategic Plan actions (see Box 3). Therefore, implementation of the Convention seems to be linked to an improving state of wetlands. On average, Parties report (Ramsar Convention,

BOX 3

RELEVANT RESOURCES AND RESOLUTIONS OF THE CONVENTION

Resolution XII.2: *The Ramsar Strategic Plan 2016-2024*

Resolution XIII.5: *Review of the fourth Strategic Plan of the Ramsar Convention*

2018) implementing only half (50.5%) of the Strategic Plan actions to which they have committed – so more implementation is urgently needed in many countries (see Figure 2).

Biodiversity losses are most strongly linked to land-use change and losses are projected to continue to increase. Recent research has focused on drivers of change in wetlands, identifying both land-use changes and the side effects of pollution, with the impacts of climate change becoming steadily more apparent. A major report from IPBES (see box 4) provides key data on biodiversity and trends in the provision of wetland ecosystem services.

Water quality also continues to decrease as a result of pollution from multiple sources. Nearly half the world is still using sanitation that leaves wastewater untreated (UNICEF & WHO, 2020), and there are high levels of nutrient loading, especially nitrogen and phosphorus from agriculture (Xie & Ringler, 2017). Wetlands in many parts of the world continue to face water quality challenges, with significant human health impacts from water-associated diseases (UNESCO & UN-Water, 2020). Eutrophication damages many freshwater and coastal wetlands; for example, over 700 coastal areas are impacted by dead zones. These impacts will be intensified by climate change and increases in sea surface temperature, acidification and rainfall (Malone & Newton, 2020). The global ocean oxygen density decreased by around 2% between 1960 and 2010, affecting ocean nutrient cycles (Laffoley & Baxter, 2020). Pesticide runoff is damaging wetlands throughout the world, including iconic sites like the Great Barrier Reef in Australia (Vandergragt *et al.* 2020).

Plastic debris is building up in freshwater (Wagner *et al.* 2014) and marine (Paduani, 2020) ecosystems, killing birds (Costa *et al.* 2020) and turtles (Yaghmour, 2020). Given well-documented impacts on biodiversity and human-health (European Commission, 2019), addressing plastic pollution is critically important (WHO, 2019; Campanele *et al.* 2020). Increasing concentrations of pharmaceutical residues are also a major concern, impacting wetland-dependent species, and reducing the natural capacity of wetlands to treat and transform nutrients and chemicals.

BOX 4

LAND-USE CHANGE IS THE DOMINANT FACTOR AFFECTING FRESHWATER HABITATS

"**For terrestrial and freshwater ecosystems, land-use change has had the largest relative negative impact on nature since 1970**, followed by the direct exploitation, in particular overexploitation, of animals, plants and other organisms, mainly via harvesting, logging, hunting and fishing. In marine ecosystems, direct exploitation of organisms (mainly fishing) has had the largest relative impact, followed by land-/sea-use change. Agricultural expansion is the most widespread form of land-use change, with over one third of the terrestrial land surface being used for cropping or animal husbandry ... In freshwater ecosystems, a series of combined threats that include land-use change, including water extraction, exploitation, pollution, climate change and invasive species, are prevalent."

"**The negative trends in biodiversity and ecosystem functions are projected to continue or worsen in many future scenarios** in response to indirect drivers such as rapid human population growth, unsustainable production and consumption and associated technological development."

IPBES Global Assessment Report on Biodiversity and Ecosystem Services (2019)

2.2 Climate change is occurring faster than expected with thresholds crossed and major changes inevitable for wetlands and people

Key messages

1. Wetlands are particularly impacted by climate change, especially sea-level rise, coral bleaching as a result of increased sea surface temperatures, and changing hydrology in inland waters.
2. Arctic and montane wetlands are especially at risk.
3. Changing weather patterns also increase risks of water stress – both flooding and drought – in many parts of the world.
4. New information on the rate of climate change emphasises the urgency of wetland management and restoration for both mitigation and adaptation.

A string of extreme weather events, fires, storms, droughts, floods and the continuous breaking of climate records has provided abundant evidence of the consequences of climate change. There are for instance huge economic and human threats associated with the loss of coastal wetlands from projected sea level rise over the next 80 years. Coastal populations and Small Island developing states are disproportionately at risk; a slower rate of sea level rise would provide more opportunities for adaptation in small islands, low-lying coastal areas and deltas.

Reports from the Intergovernmental Panel on Climate Change (IPCC) suggest climate change is moving even faster than expected. In August 2021, Working Group 1 of the IPCC concluded that: "The scale of recent changes across the climate system as a whole and the present state of many aspects of the climate system are unprecedented over many centuries to many thousands of years" (IPCC, 2021).

Climate change is directly impacting Wetlands of International Importance, both through a net loss of wetland area within sites as a result of drying (Xi *et al.* 2021), desertification and coastal erosion, and due to multiple impacts on associated biodiversity and ecosystem services (Harrison *et al.* 2018). Management to minimise the impacts through adaptation is becoming essential. The need for adequate protection and wise use of wetlands is recognised as a central plank of any climate strategy, with restoration needed in places where degradation has already taken place (Taillardat *et al.* 2020).

BOX 5

WETLANDS ARE AT HIGH RISK FROM CLIMATE CHANGE, SEVERELY IMPACTING MANY ECONOMICALLY MARGINALISED PEOPLE, ESPECIALLY IN COASTAL COMMUNITIES AND SMALL ISLAND DEVELOPING STATES

"By 2100, global mean sea level rise is projected to be around 0.1 metre lower with global warming of 1.5°C compared to 2°C (*medium confidence*). Sea level will continue to rise well beyond 2100 (*high confidence*), and the magnitude and rate of this rise depend on future emission pathways. A slower rate of sea level rise enables greater opportunities for adaptation in the human and ecological systems of small islands, low-lying coastal areas and deltas (*medium confidence*).

"Coral reefs … are projected to decline by a further 70–90% at 1.5°C (*high confidence*) with larger losses (>99%) at 2°C (*very high confidence*). The risk of irreversible loss of many marine and coastal ecosystems increases with global warming, especially at 2°C or more (*high confidence*). "Regions at disproportionately higher risk include Arctic ecosystems, dryland regions, small island developing states, and Least Developed Countries (*high confidence*)."

IPCC Special Report on global warming of 1.5oC (2018)

BOX 6

ARCTIC AND MONTANE WETLANDS ARE AT PARTICULAR RISK FROM CLIMATE CHANGE WITH PROFOUND CONSEQUENCES FOR WETLAND ECOSYSTEM SERVICES

"Cryospheric and associated hydrological changes have impacted terrestrial and freshwater species and ecosystems in high mountain and polar regions through the appearance of land previously covered by ice, changes in snow cover, and thawing permafrost. These changes have contributed to changing the seasonal activities, abundance and distribution of ecologically, culturally, and economically important plant and animal species, ecological disturbances, and ecosystem functioning (*high confidence*)."

"Since the mid-20th century, the shrinking cryosphere in the Arctic and high mountain areas has led to predominantly negative impacts on food security, water resources, water quality, livelihoods, health and well-being, infrastructure, transportation, tourism and recreation, as well as culture of human societies, particularly for Indigenous peoples (*high confidence*)."

"Global-scale glacier mass loss, permafrost thaw, and decline in snow cover and Arctic sea ice extent are projected to continue in the near-term (2031–2050) due to surface air temperature increases (*high confidence*), with unavoidable consequences for river runoff and local hazards (*high confidence*)."

IPCC Special Report on the ocean and cryosphere in a changing climate (2019)

2.3 Impacts of agriculture on wetlands, and consequences for food production are becoming more apparent

Key messages

1. The prospects of both wetlands and agriculture are closely linked: the future of sustainable food production is dependent on wetland wise use.
2. Over half of all Wetlands of International Importance are negatively impacted by agriculture.
3. Transformation of agriculture is needed to reverse trends in wetland loss and degradation.
4. Dialogue to strengthen policies and undertake coordinated action by the agriculture, water and wetlands sectors is essential.

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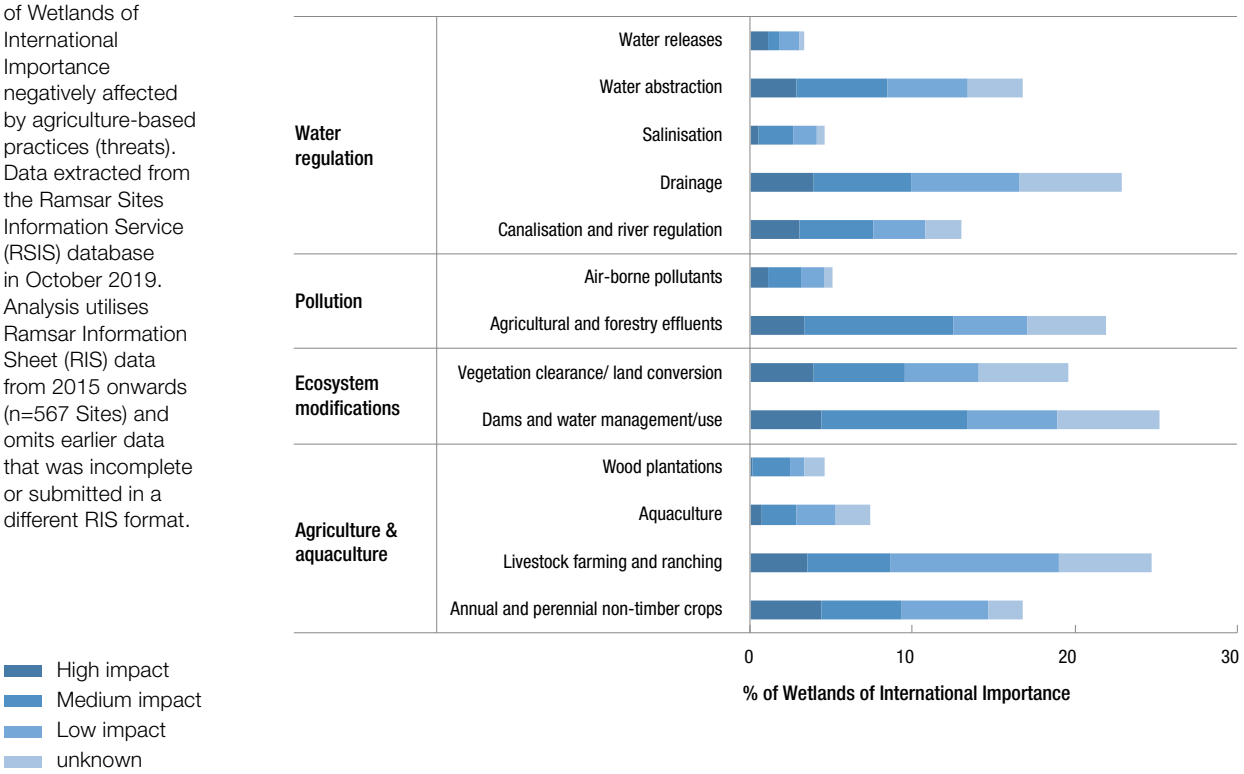
Expansion and intensification of agriculture is occurring in many regions to meet the growing need for food. Demand is expected to increase, as the human population of 7.7 billion people in 2019 is projected to grow to 9.7 billion by 2050 (United Nations, 2019). The growth pattern of developing economies, and changing diets, has broad implications for food demand and in turn agriculture production (Food Security Information Network, 2019; FAO, 2020b), and wetlands.

Wetlands, including many Wetlands of International Importance, are under pressure from agriculture. Due to land conversion, the extent of natural wetlands declined by 35% between 1970-2015, while human-made wetlands, including rice paddy fields and reservoirs, increased by 233% (WET index), where data are available. The rate of decline of natural wetlands during the same period (-0.78% per year) was higher than natural forests (-0.24% per year), and by 2015, global rates of wetland loss increased to 1.6% (Darrah *et al.* 2019). The proportion of wetland loss attributable to agriculture has not been calculated globally, however, regional studies indicate that agricultural development is often the primary cause (e.g., Patino & Estupinan-Suarez, 2016, Zou *et al* 2018, Mao *et al.* 2018, Robertson *et al.* 2019).

The massive impact that land-use change has had on wetlands is projected to continue or worsen in many future scenarios in response to drivers such as rapid human population growth, unsustainable production and consumption, dietary changes and associated technological development. The degradation, fragmentation, and loss of wetland connectivity across landscapes contributes to the further loss of biodiversity as dispersal mechanisms are removed.

Analysis of Ramsar Sites Information Service (RSIS) data reporting on the pressures negatively affecting Wetlands of International Importance indicates that over 50% of them are affected by pressures related to agriculture. For example, more than 20% are being damaged by

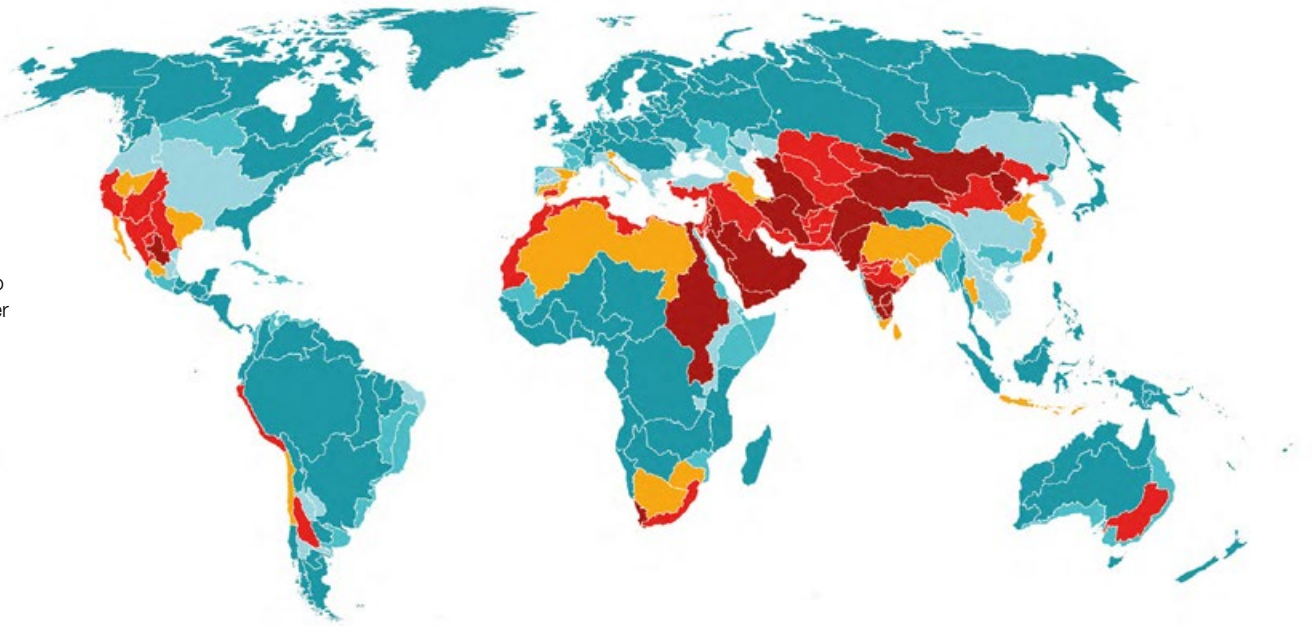
Figure 3
The percentage of Wetlands of International Importance negatively affected by agriculture-based practices (threats). Data extracted from the Ramsar Sites Information Service (RSIS) database in October 2019. Analysis utilises Ramsar Information Sheet (RIS) data from 2015 onwards (n=567 Sites) and omits earlier data that was incomplete or submitted in a different RIS format.



livestock farming, agricultural/ forestry effluents and/or land clearing (Figure 3), with agricultural intensification disproportionally driving high water stress in parts of Asia, northern Africa, Australia, and the Americas. The application of fertilisers and pesticides is growing, particularly in Asia and Latin America (FAOSTAT), with a nine-fold increase in nitrogen-based fertilizers since the 1960s. Around 70% of all global freshwater water extraction and diversion is for agriculture (AQUASTAT; Figure 4).

The costs to wetland health and integrity have, in turn, direct impacts on food security. Agriculture ultimately depends on healthy wetlands and adequate water resources. The damage unsustainable agricultural practices are having on wetlands will in time rebound negatively on agriculture itself. A transformation to more sustainable agricultural practices is urgently needed (Seifollahi-Aghmuini *et al.* 2010).

Figure 4
Contribution of the agricultural sector to the level of water stress, by basin, 2015. From FAO 2020b. Note: The contribution of agriculture to water stress is defined as the ratio between freshwater consumed by agriculture and total renewable freshwater resources, after considering environmental flow requirements.



2.4 Wetland ecosystem services and values are increasingly used as nature-based solutions

Key messages

1. Wetlands have long provided ecosystem services to humanity, but recognition of the scale of these benefits, and the costs of their loss or degradation, is relatively recent.
2. The most fundamental of these ecosystem services is the provision of adequate quantities and quality of water, with major health and well-being impacts where this is lacking.
3. Wetlands also provide services related to climate change mitigation and adaptation, disaster risk reduction, energy, food security and the supply of many materials.
4. The ability to integrate wetland ecosystem services into policy-making has been aided by the IPBES assessment of biodiversity and ecosystem services and the first *Global Wetland Outlook*.

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The earliest city-based civilisations were located in the great floodplains of North Africa, Eurasia, the Andes and Meso-America, testament to the importance of wetlands for humankind. The role of wetland ecosystem services has long been recognised by communities dependent on them and wetland sustainable use deeply embedded within local cultures and norms.

However, if wetlands degrade, their ability to provide for people is reduced. Climate change is altering rainfall patterns and jeopardizing agriculture (Balasubramanya & Stifel, 2020). Water related disasters constitute a significant proportion of natural disasters (74% of all events during 2001-2018, floods and droughts alone affecting over a billion people), with Asia being a hot spot (UNESCO & UN-Water, 2020).

Perhaps as a result of this, over the last three years the importance of ecosystem services, including their economic importance, has been receiving increasing attention. The 2019 IPBES report outlined the links between biodiversity and ecosystem services. In 2021, the G20 acknowledged "the many synergies in financial flows for climate, biodiversity and ecosystems" in their communiqué (2021). The World Bank is more precise: "Economies, particularly in low-income countries, cannot afford the risk of collapse in the services provided by nature … by a conservative estimate a collapse in select services such as wild pollination, provision of food from marine fisheries and timber from native forests, could result in a significant decline in global GDP: $2.7 trillion in 2030 …" (Johnson *et al.* 2021).

Critical wetland ecosystem services include carbon sequestration and storage, particularly in peatlands and marine ecosystems; ensuring safe and reliable supplies of drinking and irrigation water; many goods and services connected with food security; and management against water-related disasters such as droughts and floods. Factoring these often-unacknowledged services more centrally into wider land management strategies is increasingly seen as essential.

BOX 7

RELEVANT RESOURCES AND RESOLUTIONS OF THE CONVENTION

Resolution XIII.17: *Rapidly assessing wetland ecosystem services*

Ramsar Policy Brief No. 2: *Integrating multiple wetland values into decision-making*

2.5 Broader stakeholder engagement brings diversified governance and management, and greater local ownership, but tensions remain

Key messages

1. Protection of human rights, including gender rights, needs to be a prerequisite of wetland conservation activities.
2. Recognition of the scale of the environmental crisis is bringing new partners into wetland conservation and management, opening up new opportunities for taking action.

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Calls for human rights to feature more prominently in conservation strategies have increased. Concerns have been raised by allegations of human rights abuses in connection with protected area establishment and management (UNGA, 2017), by increasing militarization of conservation in response to wildlife poaching (Duffy *et al.* 2019), by violence against and forced disappearance of environmental defenders (Scheidel *et al.* 2020), and by threats to protected area rangers, over a thousand of whom have been killed on duty in the last decade (Woodside and Vasselu, 2021).

Political tensions are increasing in respect to water issues. Growing urban water needs clash with land use aspirations of rural communities, and management of wetland and mountain ecosystems has huge implications for downstream flooding. The Global Risks Report (World Economic Forum, 2021) lists water crises among the top-five risks in terms of impacts. Water insecurity has caused tensions between countries. Dams built by one country that reduce water supply for downstream neighbours are a particular source of stress, although the impacts of flood control, agricultural irrigation and forest management are all important. Sustainable development depends on just, peaceful and inclusive societies. Integration of human rights issues into conservation requires, for instance, application of Free, Prior and Informed Consent in any work involving territories or interests of Indigenous peoples and protection of the rights of women, youth and minorities.

At the same time, recognition of the scale of the environmental crisis is persuading many stakeholders to take sustainability issues much more seriously. In October 2021, the UN Human Rights Council recognised that having a clean, healthy and sustainable environment is a human right (OHCHR, 2021). Institutions like the World Bank and the World Economic Forum have issued strong analyses in support of sustainability policies. Many corporations are quietly changing their attitudes towards biodiversity loss, climate change, plastic pollution, and land and water degradation, recognising that environmental concern is good business. New policies from institutions like the European Union also help persuade companies to take issues more seriously, while in other places, conversely, corporations are leading governments into more sustainable policies. The Convention's wise use concept has the potential to play an important role here.

BOX 8

RELEVANT RESOURCES AND RESOLUTIONS OF THE CONVENTION

The Relationship of indigenous peoples and local communities with wetlands. Gonzalo Oviedo and Mariam Kenza Ali, A report from the Secretariat of the Convention on Wetlands, August 2018

Guidelines on Mainstreaming Gender under the Ramsar Convention on Wetlands. Lorena Aguilar, A report from the Secretariat of the Convention on Wetlands, 2021

2.6 A confluence of international policy can provide a powerful framework for change

Key messages

1. Lessons from the failure to meet the Aichi Biodiversity Targets — on wetland protection, invasive species, corals and restoration — and slow progress on the Sustainable Development Goals, show that new approaches are needed.
2. Progress to address climate change is too slow; even if the latest NDCs are fully implemented they will not meet the Paris Agreement targets.
3. While some NDCs refer to wetlands in the context of the land use, land-use change and forestry (LULUCF) sector, very few include specific actions or targets for wetlands.
4. The new Post-2020 Global Biodiversity Framework offers hope, along with an emerging confluence of urgent actions towards sustainable development, biodiversity and climate change.

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BOX 9

THE AICHI TARGETS RELATED TO WETLANDS WERE NOT ACHIEVED

Assessment of Aichi Target 5:
"… Wilderness areas and global wetlands continue to decline. Fragmentation of rivers remains a critical threat to freshwater biodiversity. **The target has not been achieved** (*high confidence*)".

Assessment of Aichi Target 9:
"… There is no evidence of a slowing down in the number of new introductions of alien species. **The target has partially been achieved** (*medium confidence*)."

Assessment of Aichi Target 10:
"…. Overfishing, nutrient pollution and coastal development compound the effects of coral bleaching. Corals have shown the most rapid increase in extinction risk of all assessed groups. .... **The target was missed by the stated date of 2015, and it has not been achieved by 2020** (*high confidence*)."

Assessment of Aichi Target 11:
"…The proportion of the planet's land and oceans designated as protected areas is likely to reach the targets for 2020 ... However, progress has been more modest in ensuring that protected areas safeguard the most important areas for biodiversity, are ecologically representative, connected to one another … and are equitably and effectively managed. **The target has been partially achieved** (*high confidence*)."

Assessment of Aichi Target 15:
"… Progress towards the target of restoring 15% of degraded ecosystems by 2020 is limited… **The target has not been achieved** (*medium confidence*)."

CBD Global Biodiversity Outlook 5 (2020)

In 2010, the Convention on Biological Diversity set a series of global, ten-year targets, the so-called Aichi Targets. Assessment shows that none of the targets were achieved completely, and most fell far short of the aspirations of the original proponents. Box 9 shows some implications for wetlands. The failure of the Aichi Targets to protect wetlands has implications for the SDGs and other current and future targets.

This failure should serve as a reminder that statements and agreements need to be backed by action, financial commitments and comprehensive monitoring. So far, this is not happening. Most of the SDGs are not on track to meet their deadline. The latest assessment of NDCs found them falling short of what is needed to meet the Paris Agreement targets. The UN Framework Convention on Climate Change (UNFCCC) notes "an urgent need for either a significant increase in the level of ambition of NDCs between now and 2030 or a significant overachievement of the latest NDCs, or a combination of both, in order to attain cost-optimal emission levels suggested in many of the scenarios considered by the IPCC for keeping warming well below 2°C or limiting it to 1.5°C." (UNFCCC, 2021). Major changes are needed in the next few years if the projected consequences of inaction are to be avoided. Part 3 looks at some of the ways that the role of well-managed wetlands can be leveraged in delivering on globally agreed goals and targets.

BOX 10

MEDITERRANEAN WETLANDS ARE SIGNIFICANTLY MORE AT RISK

Located at the crossroad of three continents, the Mediterranean Basin has a long, common history and culture, but diverse economic, demographic and political situations. The region is a global biodiversity hotspot, with wetlands supporting more than a third of species. Wetlands also offer water, food, health and economic opportunities. However, the region experienced a loss of 52% and 28% of its marine and freshwater biodiversity respectively since 1992, and 36% of its wetland-dependent species are globally threatened.

The region is already impacted 20% more by climate warming than the rest of the world, with increasing frequency of heat waves, storms, droughts. By 2040, projections indicate that 250 million people might live under freshwater-stressed conditions and sea level in the region will increase over 1 metre by 2100, threatening a third of Mediterranean people. Water flow decreased by 25% to 70% in many rivers between 1960 and 2000, affecting seasonal wetlands. Furthermore:

- **Intensive agriculture** consumes two thirds of freshwater resources in the Mediterranean. The demand for irrigation water and for productive land continues to increase at the expense of natural wetlands and traditional agricultural landscapes.
- **With over 42% of Mediterranean people living along the coastline**, settlements, industry and tourism consume coastal wetlands and increase water demand.

  The result is that the loss of Mediterranean wetlands since 1970 (48%) is higher than in all three surrounding continents.

However, measures to reverse the trends can be taken. Some recommended steps include:

1. **Ensure the effective application of international agreements, including the Convention on Wetlands and the EU Nature Directives, for the protection of wetlands.** These frameworks enable biodiversity adaptation to climate change, e.g., waterbird population recoveries in several countries. Governments and international funding agencies should commit to their implementation.
2. **Implement nature-based solutions such as ecosystem restoration and integrated management mechanisms:** including Integrated River Basin Management, Integrated Water Resources Management and Integrated Coastal Zone Management.
3. **Involve the private sector** – tourism, industry, agriculture, urban – in the conservation of wetlands by adopting sustainable practices.
4. **Promote the development of agroecological practices** (sustainable farming that works with nature) to ensure conservation of wetlands, cultural landscapes and to guarantee good quality food and health.
5. **Support science-policy interface organisations.** The Medwet Ramsar Regional Initiative (27 states), the Mediterranean Alliance for Wetlands, and the Mediterranean Wetlands Observatory (a scientific monitoring tool), all foster better dialogue between scientists, policy-makers and civil society, to find common solutions for Mediterranean wetlands.

Further information: Lefebvre *et al*. 2019; MedECC, 2020; Mediterranean Wetlands Observatory, 2018; Galewski *et al*. 2021.

3. WISE USE OF WETLANDS IS CRITICAL TO GLOBAL SUSTAINABILITY

Water, the bloodstream of the biosphere, which sustains ecosystems and people, is made available by wetlands. Human societies have an essential and fundamental relationship to wetlands (Pascual *et al.* 2017).

3.1 Wetlands are critical to delivering the Sustainable Development Goals and other global sustainability commitments

Key messages

1. Wetlands play a crucial role in maintaining the quality and regulating the quantity of water, thereby fundamentally underpinning economic development and human well-being.
2. Wise use of wetlands is an essential component in meeting international targets relating to biodiversity, climate change and sustainable development.
3. 'Nature-based solutions', including the role that healthy wetlands play in buffering water-related risks, can help society move beyond a narrow focus on human-built infrastructure.
4. The Convention on Wetlands provides a framework for national and international cooperation that is essential to safeguard wetlands and acts as a voice for wetland conservation and restoration.

The 2030 Agenda for Sustainable Development, adopted in 2015, provides a blueprint for peace and prosperity for people and the planet. Conservation and wise use of wetlands is an important pathway to meeting many of the 17 goals and 169 targets of the SDGs, with benefits also for global targets related to climate change, biodiversity conservation and disaster risk reduction. The Convention on Wetlands is, together with the UN Environment Programme, are co-custodian of SDG Indicator 6.6.1, and data submitted by Contracting Parties based on National Wetland Inventories is used to track change in extent of water-related ecosystems over time.

The linkages between wetlands and sustainable development outcomes are expressed in several ways, and actions for wetlands have an implication for delivery on SDGs much beyond SDG 6 Target 6. For example, maintaining healthy inland wetlands contribute to protecting the coastal environment from eutrophication, thereby contributing to delivering on SDG 14 Life Below Water, and also helps sustain fishery productivity, contributing to SDG 2 Zero Hunger. In 2017, fish consumption accounted for 17% of global population's intake of animal proteins (FAO, 2020a) and at least two-thirds of all the fish consumed worldwide are dependent on coastal wetlands.

Having access to quality blue environments, such as wetlands, can significantly benefit human health. Feeling psychologically connected to, living near, or undertaking recreation in the natural world such as wetlands is associated with better mental health (SDG 3, Good Health and Well-being, White *et al.* 2021).

Water and wetlands are 'climate connectors' requiring collaboration and coordination across actions needed for sustainable development, climate change and disaster risk reduction, while wetlands are also critically important carbon stores (SDG 13, Climate Action). Healthy wetlands and equitable sharing of benefits can also contribute to peace making (SDG 16 Peace, Justice and Strong Institutions) (Griffin & Ali, 2014), though wetland conservation still does not figure prominently in peace-building efforts.

Nature-based solutions for water, which incorporate the role that healthy and sustainably

BOX 11

INTERNATIONAL CO-OPERATION IS CRITICAL

"**The global environment can be safeguarded through enhanced international cooperation and linked, locally relevant measures. The review and renewal of internationally agreed environment related goals and targets, based on the best available scientific knowledge and the widespread adoption and funding of action on conservation, ecological restoration and sustainable use by all actors, including individuals, are key to this safeguarding.** Such widespread adoption implies advancing and aligning local, national and international sustainability efforts and mainstreaming biodiversity and sustainability across all extractive and productive sectors, including mining, fisheries, forestry and agriculture, so that together, individual and collective actions result in a reversal of the deterioration of ecosystem services at the global level. Yet these bold changes to the direct drivers of the deterioration of nature cannot be achieved without transformative change that simultaneously addresses the indirect drivers."

"Nature can be conserved, restored and used sustainably while other global societal goals are simultaneously met through urgent and concerted efforts fostering transformative change."

IPBES Global Assessment Report on Biodiversity and Ecosystem Services (2019)

BOX 12

TRANSITIONS TO SUSTAINABLE USE OF FRESHWATERS WILL NEED CONCERTED AND MULTIPLE EFFORTS

Safeguarding freshwater ecosystems and the services they provide for nature and humanity is an urgent challenge. The Global Biodiversity Outlook 5 identifies a number of 'Transitions' to aid the delivery of the 2050 Vision for Biodiversity. The Sustainable Freshwater Transitions comprise the following elements:

- Integrate environmental flows into water management policy and practice;
- Combat pollution and improve water quality;
- Prevent overexploitation of freshwater species;
- Prevent and control invasive alien species in freshwater ecosystems; and
- Protect and restore critical habitats.

Global Biodiversity Outlook 5 (2020)

BOX 13

RELEVANT RESOURCES AND RESOLUTIONS OF THE CONVENTION

Resolution XIII.7: *Enhancing the Convention's visibility and synergies with other multilateral environmental agreements and other international institutions.*

managed wetlands play in buffering water-related risks, are an important pathway for moving beyond a 'business as usual' focus on human-built infrastructure. This is particularly true for coastal areas, which carry a disproportionately high concentration of population and economic assets, higher rates of population growth, sediment deprived deltas and human-induced land subsidence. These together lead to the phenomenon of sinking, making the impacts of sea-level rise even more extreme (Syvitski, 2009). Though the uptake of nature-based solutions has increased recently, critical challenges remain in terms of upscaling investment and knowledge (Chausson *et al.* 2020).

Considerable progress has been made towards targets designating portions of the planet's land and oceans as protected areas. However, further work is needed to ensure that these are ecologically representative and safeguard the most important areas for biodiversity. Protected and conserved areas need to be connected to one another as well as to wider land- and seascapes and to be equitably and effectively managed. Existing multilateral environmental agreements provide a platform of unprecedented scope and ambition for action, but greater national commitment and effective cooperation in using and implementing these established mechanisms are vital to enable such international instruments to effectively safeguard ecosystems.

Finally, wetlands play critical spiritual, aesthetic and cultural roles. Ecosystem services encompass far more than strictly utilitarian purposes. For example, thousands of pilgrims each year brave harsh weather to visit the high altitude, Himalayan wetland Mansarovar for spiritual atonement (Verschuuren, 2016), one of innumerable sacred lakes, wells, springs and rivers. An important dimension of justice, for humans and the planet, is the recognition of 'rights of nature' within legal frameworks, including proposals for a universal 'Rights of Wetlands' statement. This puts the human species in a more respectful relationship with nonhuman nature for effective, sustainable and ethical 'stewardship of the Earth and the life on it' (Davies *et al.* 2020).

The changes needed to stabilize the environment over the next few years are profound and reach far beyond conventional ideas of conservation. Current development trajectories are insufficient to conserve and sustainably use nature and ensure the SDGs (IPBES, 2019). Key leverage points for transformation towards sustainability identified in the IPBES process include directing efforts towards: (1) visions of a good life; (2) total consumption and waste; (3) values and action; (4) inequalities; (5) justice and inclusion in conservation; (6) externalities and linkages at a distance (so called 'telecouplings'); (7) technology, innovation and investment; and (8) education and knowledge generation and sharing (Chan *et al.* 2020).

Wetland wise use supports the delivery of these leverage points and, when placed at the centre of decision making, helps to ensure sustainable development.

To reach these ambitious goals in wetlands, the Convention on Wetlands needs better implementation and more effective leveraging of the synergies that exist with other Multilateral Environmental Agreements (MEAs) and institutions. Wetlands of International Importance themselves are important not just as a means of increasing the chances of wise use in critically important wetlands, but also as laboratories for sustainable wetland management. Working with Contracting Parties, including capacity building to support national implementation, is a critical element of success.

3.2 People's health and livelihoods depend on well-managed wetlands

Key messages

1. Wetlands provide many health-supporting resources and functions, including contributions to food and water security, disaster risk reduction and well-being.
2. When inappropriately managed, wetlands can also be a source of disease.
3. Control of emergent zoonotic diseases is increasingly seen as being dependent on maintenance of well-managed, intact ecosystems and native biodiversity.
4. Ecosystem approaches in wetlands can bring health benefits to all and ensure that disease prevention and control is addressed within wise use, and One Health, principles.

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BOX 14

RELEVANT RESOURCES AND RESOLUTIONS OF THE CONVENTION

Resolution XI.12: *Wetlands and health: taking an ecosystem approach*

Ramsar Technical Report No. 6: *Healthy Wetlands, Healthy People*

Ramsar Technical Report No. 7: *Ramsar Wetland Disease Manual: guidelines for assessment, monitoring and management of animal disease in wetlands*

Wetlands are places that can determine human health and well-being through provision of clean water and nutrition, as sites supplying medicinal products, or as places for mental health and psychosocial well-being (Horwitz *et al.* 2012; Romanelli *et al.* 2015; Maund *et al.* 2019).

Historically, the recognition of some wetlands as a source of water-borne parasitic diseases was the cause of their drainage and destruction, for example, the case of mosquito control in North America, undertaken at industrial scales. Ironically, such measures, along with pollution and the disruption of natural flow regimes following activities such as damming and abstraction, have all been causes of disease emergence (Cromie *et al.* 2012). Ecosystem degradation can convert beneficial ecosystem services into *disservices*, including increased risks of zoonotic disease transfer (Everard *et al.* 2020), which analysis shows is very closely correlated with ecosystem change (Wilson *et al.* 2021).

Simplistic responses to complex disease emergence are unlikely to be successful. Policy makers need to incorporate ecological understanding of zoonotic disease into health and environmental planning, to evaluate disease-risk trade-offs, prioritise interventions, and build wider health resilience to climate change (Gibb *et al.* 2020). Concepts of 'landscape immunity' are developing; maintaining native biodiversity, removing alien invasive species and reducing human exposure to wildlife-transmitted pathogens (Reaser *et al.* 2021). Preventative strategies need to include good management of wetlands resources, including formal protection, which, for example, has been associated with reduced risk of highly pathogenic avian influenza outbreaks (Wu *et al.* 2020).

Well-managed wetlands, including those in protected areas, can also provide uncontaminated drinking water, reducing municipal budgets and dramatically reducing ill health and infant mortality. The role of wetland ecosystem services is increasingly recognised in disaster risk reduction and maintenance of aquatic food resources for impoverished communities, both with important human health implications. Estimates of the global value of wetland ecosystem services have been revised upwards to Int$47.4 trillion a year, 43.5% of the value of all natural biomes (Davidson *et al.* 2019).

Wetlands also provide important places for recreation, relaxation and aesthetic and spiritual renewal; the importance of urban green space (Ugolini *et al.* 2020), including wetlands (Reeves *et al.* 2021b), has become increasingly apparent during the pandemic.

Proper recognition of the health and societal benefits of wetlands implies new approaches to their management, integrating wetland ecosystem services centrally into sectoral policies and strategies and disseminating values into public and private spheres. Given that many national and local governments and many corporate interests still regard water services as 'free goods' this will require profound changes of attitude and practice.

Resolution XI.12, *Wetlands and health: taking an ecosystem approach*, addressed wetland and health issues, strongly urging Parties to adopt an ecosystem approach to health in wetlands and their catchments with integrated methodologies and actions across relevant sectors (e.g., human health, wildlife management and agriculture). This can bring health benefits to all and ensure that disease prevention and control actions are undertaken within Wise Use, and One Health, principles. The Convention's *Healthy Wetlands, Healthy People* report (Horwitz *et al.* 2012) and *Wetland Disease Manual* (Cromie *et al.* 2012) provide practical guidance to wetland managers on how to reduce and respond to wetland disease risk, including ensuring that spatial planning policy includes wetlands so as to prevent hazards, improve health and adapt to climate change.

3.3 Meeting the climate challenge requires ambitious wetland conservation and restoration across society

Key messages

1. The management and restoration of wetland ecosystems are essential strategies to mitigate climate change, whilst also protecting the many other ecosystem services that they provide.
2. Undisturbed peatlands as well as coastal blue carbon ecosystems (mangroves, seagrass beds, salt marshes) are exceptionally powerful carbon sinks, but can also be significant sources of greenhouse gases if degraded or converted.
3. Wetland ecosystem actions can be included in NDCs, accounting for their carbon uptake and storage often requires further mapping of extent and location.

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Wetlands have multiple roles to play in mitigating and adapting to climate change, by contributing to the ecosystem services needed to help humanity adapt to the changes that are now inevitable, and to sequester and store carbon to reduce rate of change. The mitigation potential of large-scale restoration of degraded peatlands and blue carbon ecosystems is of particular relevance to the Convention on Wetlands.

The 2015 Paris Climate Agreement of the UNFCCC establishes NDCs as a means for countries to reduce and mitigate carbon emissions, towards meeting the overall goal of the agreement. However, whilst wetlands can provide good nature-based solutions, this needs to go together with a dramatic reduction in emissions.

BOX 15

RELEVANT RESOURCES AND RESOLUTIONS OF THE CONVENTION

Resolution XIII.14: *Promoting conservation, restoration and sustainable management of coastal blue-carbon ecosystems*

Ramsar Briefing Note No. 10: *Wetland Restoration for Climate Change Resilience*

Ramsar Briefing Note No. 12: *The Contribution of Blue Carbon Ecosystems to Climate Change Mitigation*

Blue carbon ecosystems

'Blue carbon' is defined under the Convention on Wetlands as the "carbon captured by living organisms in coastal (e.g., mangrove forests, salt marshes and seagrass meadows) and marine ecosystems and stored in biomass and sediments" (Convention on Wetlands, 2021b). The IPCC (2014) recognizes that blue carbon has a dual role in providing both climate mitigation and adaptation.

Undisturbed coastal wetlands are a powerful carbon sink, with long-term carbon sequestration rates up to 55-times faster than tropical rainforests (McLeod *et al*. 2011). Coastal wetlands store significant amounts of atmospheric carbon – on average 512 tonnes carbon per hectare for seagrass, 917 tonnes carbon per hectare for salt marshes and 1,028

Figure 5
Distribution of Wetlands of International Importance containing blue carbon ecosystems (BCEs) (see Beer *et al*. 2020 for data).

tonnes carbon per hectare for mangroves (Pendleton *et al.* 2012). This blue carbon is stable and can remain for hundreds or thousands of years. Conversely, once disturbed and drained, not only is the stored carbon released, the potential for on-going carbon sequestration is also lost (Pendelton *et al.* 2012).

While blue carbon ecosystems are 'hot-spots' of carbon storage, they also deliver other important ecosystem services that contribute to human well-being, such as protection from storms and floods, protection of coastal water quality, biodiversity, food and as nursery grounds for many species of marine life.

Mangroves may be included in a country's REDD+ programme (Reducing Emissions from Deforestation and Forest Degradation) if they are included in its national definition of 'forest'. All blue carbon ecosystems can be included in the national accounting section of the NDC (Windham-Meyers *et al.* 2019). Having information on wetland area is the minimum step required to include blue carbon in NDCs and allow accurate carbon accounting. The lack of accurate mapping of blue carbon ecosystem is a significant gap in our understanding and was identified by Contracting Parties as the most common barrier in work to protect, restore and sustainably manage blue carbon ecosystems.

Globally, there are at least 780 Wetlands of International Importance that contain a minimum of one blue carbon ecosystems, with many of the sites containing multiple blue carbon ecosystems (Figure 5). Tidal marshes are the most common, occurring in nearly 75% of Wetlands of International Importance that include blue carbon ecosystems. Nearly half contain tidal forested wetlands, mostly mangroves.

This is a significant carbon reservoir, with Wetlands of International Importance that include mangroves for which data are available holding an estimated total 1.61 gigaton (i.e., x1015g) of carbon.

Peatlands

Peatlands are wetland ecosystems with a peat soil. Peat is dead, partly decomposed plant material stored long-term under waterlogged conditions. Occurring from the high mountains to the sea, and from high to low latitudes, peatlands can be found in all biomes, particularly in the sub-polar, boreal, temperate and tropical areas of the planet. They cover about 400 million hectares (3%) of the earth's land surface. Peatland inventories are incomplete, with new, sometimes large, areas still being discovered (e.g., Lähteenoja *et al.* 2011; Dargie *et al.* 2017).

Peatlands are important for biodiversity, water regulation, livelihoods, and especially for climate change mitigation through long-term storage of organic carbon. They are by far the most effective terrestrial carbon stock holding a minimum of about ~600 Gt (Convention on Wetlands, 2021c).

Although the majority of the world's peatlands are still relatively intact, including those of the extensive boreal and tropical biomes, around 65 million ha or 15% of total known peatland has been drained, mostly for agriculture and forestry (Joosten *et al.* 2016). This drained peatland is responsible for about 4% of anthropogenic greenhouse emissions (Joosten *et al.* 2016; Leifeld *et al.* 2019, Günther *et al.* 2020). Under 'business as usual' scenarios without significant protection and restoration, by 2100 emissions from drained peatlands are projected to comprise 12–41% of the remaining greenhouse gas emission budget necessary to keep global warming less than 1.5°C (Leifeld *et al.* 2019; Humpenöder *et al.* 2020; Convention on Wetlands, 2021c, 2021d).

If a net-zero carbon future is to be achieved, conservation of intact peatlands and restoration of those that have been degraded, are both essential. As much as 50 million hectares of drained peatland (half currently in agricultural use) will need to be rewetted and restored (Humpenöder *et al.* 2020), almost two million hectares per year. This will also conserve biodiversity and other ecosystem services (Convention on Wetlands, 2021c, 2021d).

The basic approach to peatland restoration is simple: restore natural hydrology and a high water-table at drained sites and thus facilitate peatland vegetation growth (Purre *et al.* 2020). Rewetting does not reduce emissions to zero: emissions depend on the extent to which the peatland water-table can be raised and kept high (Evans *et al.* 2021). In addition, rewetted peatlands often emit methane, a more potent greenhouse gas than carbon dioxide, although the amount is likely to decrease over time as peat accumulation restarts (Nugent *et al.* 2018, 2019). Günther *et al.* (2020) have shown that, despite methane peaks, rewetted peatlands contribute less to global warming than keeping them drained.

Restoration efforts have started but need enormous upscaling and will involve significant expense, effort and social endeavour, not least due to the reorganisation of the economic functions delivered by drained or exploited peatlands. This will in many places include a transition to paludiculture, wet agriculture and forestry on peatlands (*see* Resolution XIII.19, *Sustainable agriculture in wetlands*, in 2018). In some areas where large human populations coexist in the vicinity of peatlands, restoration may also be a challenge because it requires re-establishment of peat-forming vegetation that in the tropics consists mostly of rain forest trees. Their re-establishment on rewetted tropical peat is difficult to achieve for a variety of reasons (Page *et al.* 2009).

BOX 16

RELEVANT RESOURCES AND RESOLUTIONS OF THE CONVENTION

Resolution XIII.12: *Guidance on identifying peatlands as Wetlands of International Importance (Ramsar Sites) for global climate change regulation as an additional argument to existing Ramsar criteria*

Resolution XIII.13: *Restoration of degraded peatlands to mitigate and adapt to climate change and enhance biodiversity and disaster risk reduction*

Ramsar Policy Brief No. 5: *Restoring Drained Peatlands: A necessary step to achieve global climate goals*

3.4 Enhanced integration and co-ordination is needed across the agriculture, urban development and wetland management sectors

Key messages

1. Agriculture is both a key driver of wetland degradation and fundamentally dependent on healthy wetlands. While impacts have long been recognised, non-sustainable agricultural practices continue to damage and destroy wetlands.
2. Major changes to global agricultural systems will be needed to stop wetland conversion, and reduce water use of water and pollutants, including adapting for dietary change.
3. A growing proportion of the world's population live in cities for which wetlands provide important services, especially clean water.
4. Urban and water resource planning that incorporates wetlands and their benefits delivers improved health and well-being for city residents. Evidence of these benefits for urban and peri-urban communities can encourage other city administrations to follow similar planning models.
5. The Convention on Wetlands has introduced a Wetland City Accreditation scheme to recognise cities that have taken exceptional steps to protect their urban wetlands.

Agriculture

Transformation of agriculture is needed to reverse the trend of wetland loss and degradation, while simultaneously providing food for the increasing human population. While modern agriculture addresses the growing food demand, it has been a major cause of environmental degradation, including on wetlands, and is not sustainable. The need for global change has been recognised for some time (FAO, 2011, 2018), but few regions are taking sufficient action to ensure the wise use of wetlands.

Knowledge of the interactions between different types of agriculture (intensive, extensive, integrated) and inland, coastal and human-made wetlands is needed to improve environmental policies and guide on-ground initiatives. Critical issues include the amount of water required for irrigation and the implications of diverting this water from other purposes, and the impacts of agricultural pollution on freshwater and coastal ecosystems. Climate changes mean that some hitherto productive agricultural areas may become less productive or fall out of production, other areas may see greater potential for food production than before.

Enhanced dialogue between agriculture, water and wetland/environmental sectors is needed to strengthen policies and undertake coordinated action to achieve the SDGs and ensure wise use of wetlands. Changes to land and water use practices (e.g., more efficient use of water), improved institutional and financial frameworks, and strengthened environmental policies and laws, are all important here.

Sustainable cities

Over half of humanity now lives in cities (3.5 billion people) (United Nations, 2020). It is projected that over five billion people will live in cities by 2030 and over 70% of the population will live in urban areas by 2050 (United Nations, 2018). Of future urban growth, 90% is expected in Asia and Africa.

Cities occupy around 3% of the Earth's land but account for 60-80% of energy consumption and produce 75% of carbon emissions (United Nations, 2018). This rapid urbanization has resulted in inadequate and overwhelmed infrastructure and services particularly in terms of transport, housing, waste collection, water provision and sanitation. This puts pressure on freshwater supplies, sewage, the living environment, and public health. For example, 828 million people now live in urban slums where environmental and health issues are widespread (United Nations, 2020).

Human settlements have, in many cases, historically developed alongside wetlands due to the supply of freshwater and other resources such as food and shelter (Ramsar Convention, 2013). Wetlands provide important benefits for urban dwellers (WWT Consulting, 2018). Of particular significance are wetland's role in flood regulation, water treatment, water supply, recreation and leisure, education and human well-being. Urban wetlands provide significant value, for instance the Boeng Cheung Aek wetland in Phnom Penh, Cambodia provides US$30.12 million wastewater treatment, food, and water provisioning services per year (Ro *et al.* 2020).

BOX 17

RELEVANT RESOURCES AND RESOLUTIONS OF THE CONVENTION

Resolution XIII.19: *Sustainable agriculture in wetlands*

Ramsar Policy Brief No. 6: *Transforming agriculture to sustain people and wetlands*

Ramsar Briefing Note No. 13: *Wetlands and agriculture: impacts of farming practices and pathways to sustainability*

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However, increased urbanisation often leads to wetland destruction as they are drained, infilled, built on, polluted, and encroached by invasive species. Wetlands continue to be lost and degraded in urban areas due to a combination of political factors: urban wetland benefits being under-valued, not included in planning and subject to uncoordinated and poor governance.

Sustainable Development Goal 11 calls for cities to be made inclusive, safe, resilient and sustainable (United Nations, 2015) but how can this be achieved? A key aspect is the recognition of the benefits, including the importance of conservation and restoration of urban wetlands. The Convention on Wetlands Resolution XI.11, *Principles for the planning and management of urban and peri-urban wetlands* (Ramsar Convention, 2012), encourages urban planners and decision makers to adopt practical principles:

- Avoid destroying existing wetlands;
- Restore and create wetlands as part of nature-based solutions to urban infrastructure;
- Understand the value and benefits of urban wetlands;
- Engage with all stakeholders in urban wetland decision making including Indigenous peoples and local communities; and
- Integrate wetlands fully into urban planning recognising wider elements to spatial planning such as water resource management, transport, and agriculture.

Resolution XIII.16, *Sustainable urbanization, climate change and wetlands*, also encourages the prevention of activities that may have an adverse impact on urban and peri-urban wetlands (Ramsar Convention, 2018c).

City initiatives such as Garden City, City and Biodiversity, and Sponge Cities have adopted these principles practically, by recognising the importance of wetlands in delivering integrated urban water management, well-being benefits and biodiversity conservation. Resolution XII.10: *Wetland City Accreditation of the Ramsar Convention* (Ramsar Convention, 2015), encourages cities to apply for Wetland City accreditation celebrating the important role wetlands in making urban areas liveable and sustainable. So far, 18 cities have been accredited in China, France, Hungary, Republic of Korea, Madagascar, Sri Lanka and Tunisia.

RELEVANT RESOURCES AND RESOLUTIONS OF THE CONVENTION

Resolution XI.11: *Principles for the planning and management of urban and peri-urban wetlands*

Resolution XII.10: *Wetland City Accreditation of the Ramsar Convention*

Resolution XIII.16: *Sustainable urbanization, climate change and wetlands*

BOX 18

4. THE CONVENTION ON WETLANDS – INTO THE FUTURE

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4.1 The Convention on Wetlands reaches 50 years

Key messages

1. The Convention on Wetlands plays a key role as a global forum for negotiation and consensus building on the management of wetlands.
2. Wetlands of International Importance offer laboratories for achieving sustainable wetland management under different environmental conditions, pressures regimes, and governance arrangements.
3. The Convention provides a means for implementing and tracking progress towards global targets relating to wetlands including the Sustainable Development Goals and global biodiversity and climate targets.
4. The Convention also provides a foundation for ambitious wetland restoration efforts during the UN Decade on Ecosystem Restoration.

On 30 August 2021, the 75th session of the United Nations General Assembly (UNGA) adopted a resolution co-sponsored by 75 Member States proclaiming 2 February of each year, the date of adoption of the Convention on Wetlands, as World Wetlands Day observed by the UN. This marks an important acknowledgment of the Convention on Wetland's unique role in wetland protection for half a century.

The recognition of needs for statutory wetland protection came first in North America. The profile of global wetlands was then raised both by Project Mar ('mar' is the root of many words for wetland – marsh, marismas, marais, marécages), run in 1962 by the International Waterbird and Wetland Bureau (IWRB) and IUCN, and by the IWRB's 1964 publication of Liquid Assets: "... their value for recreation, science and education were explained; the economics and dangers of drainage discussed; the constructive use, conservation and management of wetlands outlined. The whole thrust of the message was summarized in the words of Count Leon Lippens of Belgium in the preface: "it is as stupid to drain the last of our great marshes, with their wealth of wildlife, as it would be to demolish the Cathedral of Chartres to plant potatoes" (Matthews, 1993).

Yet, whilst the immediate driver for the genesis of the Convention on Wetlands was concern over waterbird declines, the address to the 1971 final negotiating conference at Ramsar, Iran, gives a wider vision of the importance of wetlands, not just for all of biodiversity but also for people:

"... the conservation of wetlands and waterfowl is by no means a discreet project. It is an integral part of the conservation of our natural environment, its fauna and fauna. ... in this age of spiralling deterioration of our biosphere I suggest we no longer have the time to defer and delay the application of broader concepts [of wetland conservation]." (Firouz, 1972).

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4.2 The Convention on Wetlands is an inclusive partnership for wise use of wetlands, integrating conservation and social benefits

Wetlands occur around the globe. They are highly interconnected, linking mountains to oceans and spanning national borders. They are some of the most valuable ecosystem on earth, providing a wide range of ecosystem services that sustain human life and well-being.

There is a growing recognition that wetland ecosystems also have a critical part to play in meeting the defining challenges of our time – the biodiversity and climate crises – and achieving sustainable development. Ultimately, these challenges are interlinked, with often-mutual solutions. Without halting loss of wetlands, and rapidly scaling up restoration, we will not be able to meet global biodiversity, climate or sustainable development goals.

Fifty years ago, the need for a global agreement on wetlands was becoming increasingly apparent to visionaries within the hunting and science communities, and to governments. Half a century later, the fundamental mission of the Convention is more urgent – and apparent – than ever: Continuing to benefit from the services wetlands provide while awarding them the protection they need requires global cooperation.

The network of nearly 2,500 Wetlands of International Importance includes some of the world's most critically important wetlands, managed to ensure these areas remain in good condition. They provide a set of living laboratories to test and refine ideas of conservation and wise use, often with multiple ownership and governance models within a single site. Tools and capacity building catalysed by the Convention support site management, as well as development and implementation of policies for wise use of all wetlands. Reporting to the Convention provides data on progress made, including towards broader societal goals such as SDG 6 Target 6, providing a model that may be applied also in relation to other indicator frameworks.

There are many examples of success - good site management, improvement in species conservation status, progress with ecosystem

BOX 19

TEN YEARS TO TURN THE TIDE - THE UN DECADE ON ECOSYSTEM RESTORATION

The UN Decade on Ecosystem Restoration was launched in June 2021. A set of principles were launched at the 2021 World Conservation Congress (FAO *et al*. 2021). The Decade seeks to reverse environmental narratives of loss and despair and to scale up the rate, ambition and expertise for restoring the planet's ecosystems. The Convention on Wetlands has a critical part to play through its role in bringing together technical leaders to provide advice and best practice on restoration issues relating to blue carbon ecosystems (mangrove, seagrass and kelp beds and coastal marshes) and peatlands.

The decade also highlights the need for urgency: the cost and difficulty of restoration increases with increasing levels of degradation and with delays in responding. While ambitious restoration programmes are under way or proposed in many regions, with the potential to deliver significant gains in ecosystem resilience and the preservation of carbon stocks and biodiversity, global targets for restoration have so far not been achieved. An urgent increase in effort is thus called for, and the Decade aims to kick-start this process.

BOX 20

"**Existing multilateral environmental agreements provide a platform of unprecedented scope and ambition for action to avoid and reduce land degradation and promote restoration …** However, greater commitment and effective cooperation in using and implementing these established mechanisms at the national and local levels are vital to enable these major international agreements to create a world with no net land degradation, no loss of biodiversity and improved human well-being."

IPBES Assessment Report on Land Degradation and Restoration (2018)

"Treating wetlands as natural infrastructure can help meet a wide range of policy objectives, such as water and food security, as well as climate change mitigation and adaptation … Restored wetlands recover most of their ecosystem services and functions within 50 to 100 years, providing a wide range of benefits for both biodiversity and human well-being … Considering the role of wetlands in freshwater catchments, river basins and coastal zones, future wetland restoration efforts could be greatly enhanced by the development of indicators and restoration targets aimed at evaluating and recovering the range of interactions between organisms and their abiotic environment."

"The implementation of known, proven actions to combat land degradation and thereby transform the lives of millions of people across the planet will become more difficult and costly over time. An urgent step change in effort is needed to prevent irreversible land degradation and accelerate the implementation of restoration measures… **The benefits of taking action (restoring degraded land) are higher than the costs of inaction (continuing degradation)**."

IPBES Assessment Report on Land Degradation and Restoration (2018)

restoration, and benefits in terms of water security or mitigation outcomes. Yet the world's wetlands are still being lost at alarming rates. Fifty years since visionaries met in Ramsar, Iran, to finalise a global wetlands treaty, the need to fully implement all aspects of the Convention is even more urgent (Kingsford *et al*. 2021). The opportunity to leverage full implementation of the Convention for biodiversity conservation, climate change and sustainable development outcomes has never been greater.

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ACRONYMS

BCE: Blue carbon ecosystem

CBD: Convention on Biological Diversity

COP: Conference of the Contracting Parties

EEA: European Environment Agency

EU: European Union

FAO: Food and Agriculture Organization of the United Nations

FPP: Forest Peoples Programme

G7: Group of Seven, an intergovernmental forum consisting of Canada, France, Germany, Italy, Japan, the United Kingdom and the United States.

G20: Group of 20, intergovernmental forum of 19 countries and the European Union

IFRC: International Federation of the Red Cross

ILRI: International Livestock Research Institute

IPBES: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

IPCC: Intergovernmental Panel on Climate Change

NDC: Nationally Determined Contributions to the UNFCCC

OHCHR: Office of the High Commissioner for Human Rights

REDD+: Reducing Emissions from Deforestation and Forest Degradation programme

SDG: United Nations Sustainable Development Goals

UN: United Nations

UNCCD: United Nations Convention to Combat Desertification

UNEP: United Nations Environment Programme

UNESCO: United Nations Educational, Scientific and Cultural Organization

UNFCCC: United Nations Framework Convention on Climate Change

UNGA: United Nations General Assembly

WEF: World Economic Forum

WHO: World Health Organization

WWF: Worldwide Fund for Nature (World Wildlife Fund in North America)

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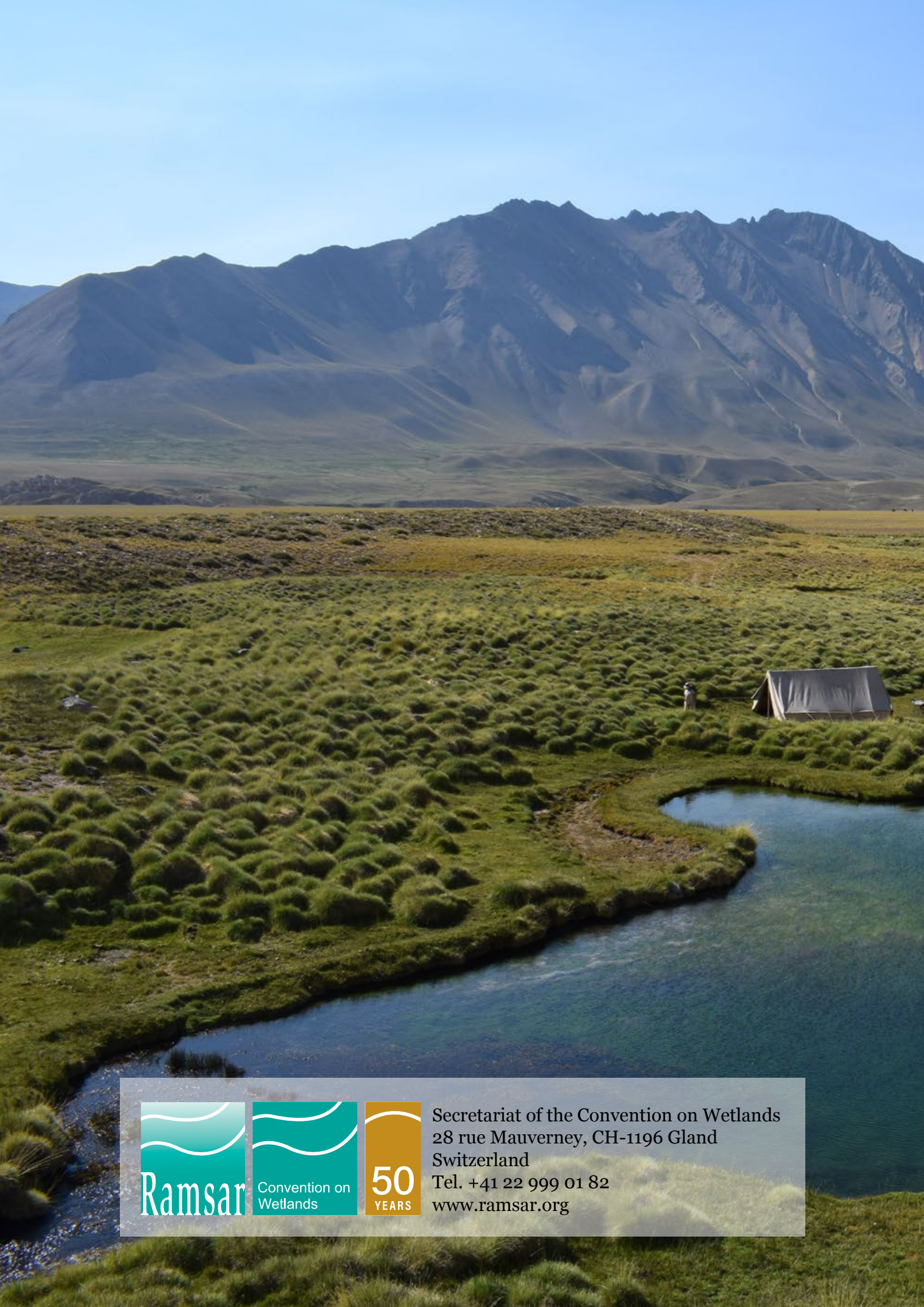

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