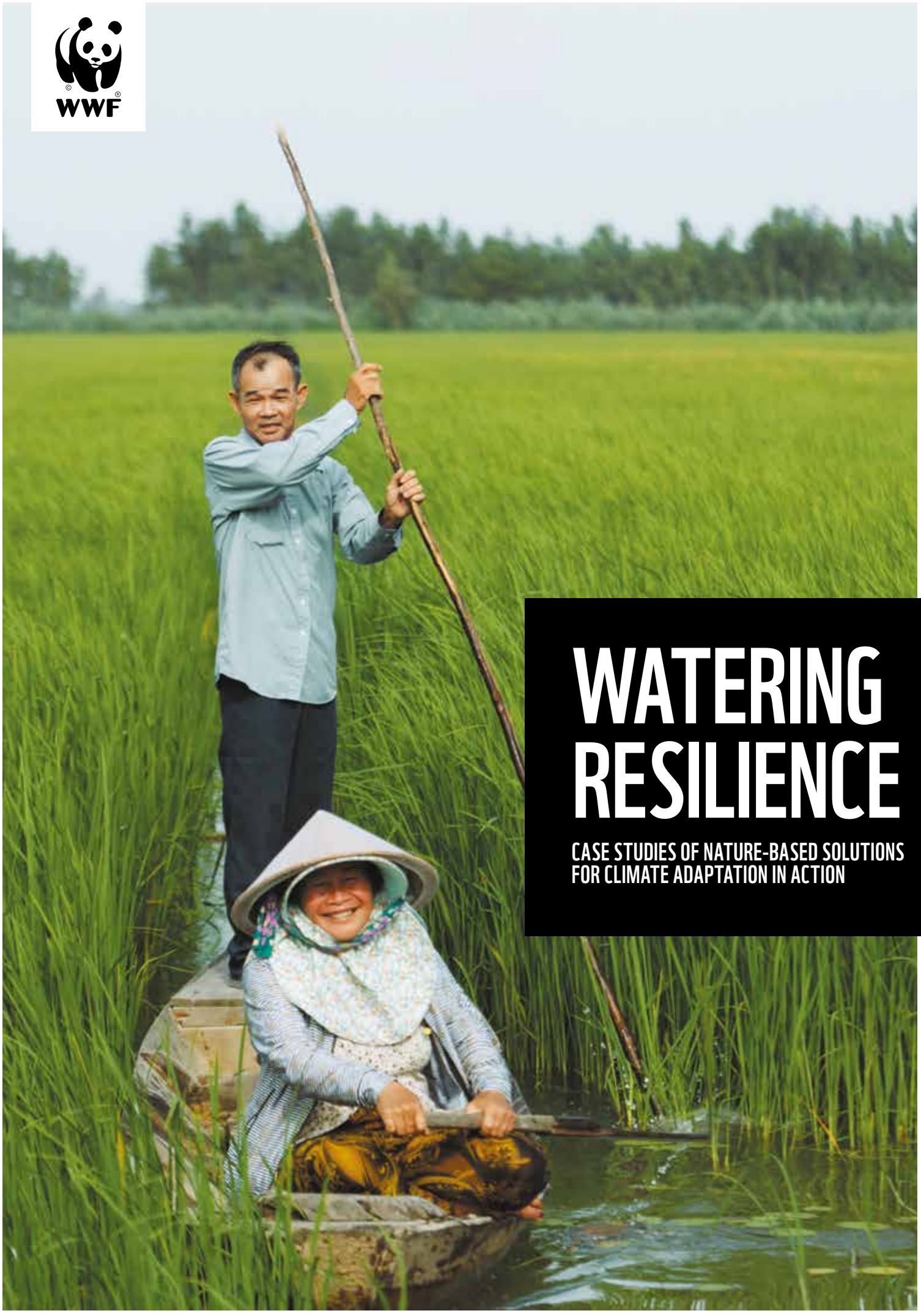


WATERING RESILIENCE

CASE STUDIES OF NATURE-BASED SOLUTIONS FOR CLIMATE ADAPTATION IN ACTION

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INTRODUCTION

This is the world's watershed moment. The climate crisis is intensifying at terrifying speed, impacting societies, economies and ecosystems across the globe – mostly through water. Every day, the news is full of reports about yet another catastrophic flood, devastating drought, or record-breaking storm.

Lives and livelihoods are being lost, communities devastated, and food production, economies and development goals undermined. Global heating is also accelerating the loss of nature – and vice versa. Deeply intertwined, the worsening climate and biodiversity crises threaten everyone's future.

Climate and weather-related disasters have increased by 40 per cent over the last twenty years,[1] with the planet's most vulnerable communities being hit hardest of all. Of more than 400,000 people killed in climate-related disasters over the last decade,[2] nine out of ten victims have been from the developing world.[3] But nowhere is immune. And everywhere, climate change impacts will worsen. Overall, between 2030 and 2050, climate change is expected to cause around 250,000 additional deaths per year.[4] Countries on every continent are grappling with increasingly frequent and increasingly extreme weather events. In 2024 alone – likely to be the hottest year on record[5] – the world has witnessed historic droughts from the Amazon to southern Africa along with catastrophic floods from the southeastern US to Europe and the Mekong.

On top of all this are the less visible, longer-term impacts from melting glaciers, changing rainfall patterns and river flows, decreasing groundwater levels and rising seas, which threaten ever greater disruption. And the International Panel on Climate Change (IPCC) is clear that the situation is only going to deteriorate as temperatures continue to rise. What is just as clear is that the world needs to rapidly and drastically scale up financial investment and implementation measures to tackle climate change – prioritising both mitigation and adaptation.

Despite the worsening impacts and all the dire predictions, we are not doing nearly enough to rein in runaway climate change. Even if all countries live up to their existing pledges to cut greenhouse gas emissions, we'll still be heading for a cataclysmic global temperature rise of 2.6°C above pre-industrial levels.[6] Indeed, current policies are projected to lead to the planet heating by 3.1°C on average by 2100, which implies temperatures well above this in some continents, such as Europe.[7] Needless to say that would result in unimaginable devastation across the globe.

But we can still avoid that fate. Countries must commit to ambitious plans to deliver a net-zero world by 2050 – and do everything in their power to achieve them. Because every additional fraction of a degree of heating will make things worse. For example, the number of people living in water-stressed regions is projected to be 50 per cent higher under a rise of 2°C compared to 1.5°C.[8] So every fraction of a degree we manage to avoid will make our planet more liveable, especially for the most vulnerable.

There's no great mystery about how to do it, either. We need to first limit emissions: reduce our energy consumption through rapidly increasing energy efficiency, changing our diets, etc. and also decarbonise our energy mix through phasing out fossil fuels as quickly as possible and tripling renewable energy capacity by 2030. We also need to stop the destruction of carbon-rich ecosystems from rainforests to peatlands, mangroves to seagrass beds. Indeed, investing in protecting and restoring healthy ecosystems is critical to mitigating climate change.

But we also have to urgently accelerate climate adaptation to enable us to cope with our rapidly changing world. Even under the most optimistic scenarios, climate impacts will continue to multiply for years, with decades of warmer temperatures, rising seas and an intensification of extreme weather events. Yet adaptation has not received the attention - let alone the funding - it deserves and requires.

Overlooked to date, a massive increase in investment in ecosystem-based adaptation is needed – not in competition with mitigation, but in addition to it. That's what this report is all about. In particular, it demonstrates how Nature-based Solutions (NbS) in freshwater and coastal ecosystems can – and indeed must – play a central role in accelerating climate adaptation. And how they already are in many countries and in many different ways. The beauty of the NbS case studies featured in this report is that they help tackle societal challenges by enhancing the health of our rivers, lakes and wetlands, while delivering a host of co-benefits to people, nature and climate in the process. They offer real win-win-win solutions.

So why does this report focus on freshwater and coastal ecosystems? Because water is the primary way we will be – and already are being – impacted by climate change. From extreme floods and droughts to decreasing river flows, groundwater levels and rising sea levels, the climate crisis is a water crisis. And healthy freshwater and coastal ecosystems – rivers, lakes, floodplains, wetlands, mangroves and so on – are the best natural defences against these impacts, providing a critical buffer for our communities, companies and cities.

Naturally flowing rivers and connected floodplains slow and spread floodwaters, minimizing flooding downstream. Wetlands absorb water in wetter seasons and release it in drier periods, smoothing out flood peaks and alleviating droughts. Free-flowing rivers from source to sea supply sediment to densely populated and agriculturally rich deltas, preventing them from sinking and shrinking, and keeping them above the rising seas. Thriving mangroves protect coastal communities from storm surges. Urban wetlands cool our cities and make them healthier places to live.

But we have long undervalued these ecosystems. Over the last 50 years, we have lost a third of the world's wetlands and we continue to lose them faster than forests. We have viewed rivers as little more than pipes for water, lakes as stores to be pumped and polluted, and wetlands as 'wastelands' to be converted. In the process, we have sacrificed many of the diverse benefits of healthy freshwater and coastal ecosystems, including their central role in climate adaptation and resilience. The answer is to invest in protecting and restoring them – to turbocharge our use of NbS.

So what exactly are Nature-based Solutions? At the United Nations Environment Assembly (UNEA) in March 2022, governments formally agreed a definition of NbS as "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits."[9] Specifically, we are talking about protecting, restoring and sustainably managing healthy freshwater and coastal ecosystems to help tackle the water-related impacts of climate change. But, critically, well-designed NbS can also provide multiple social, economic and environmental benefits on top of accelerating climate adaptation.

With over half of the world's population already facing water shortages for at least one month per year, healthier freshwater ecosystems – the rivers, lakes, wetlands and aquifers that store and supply water – are key to enhancing water security. Meanwhile, one third of global food production is directly linked to rivers,[10] underlining how critical it is to invest in their protection and restoration. Thriving mangroves are also a vital nursery for fish and other aquatic species that feed hundreds of millions and sustain countless livelihoods as well as a diversity of other species.

Indeed, one of the most important co-benefits of effective NbS is that they can help to restore biodiversity. The world is in the midst of a nature crisis, which threatens the fabric of life on Earth and our very survival. WWF's Living Planet Report 2024 found that monitored wildlife species populations have fallen by 73 per cent on average since 1970, with freshwater species populations crashing by an even more catastrophic 85 per cent. By enhancing and sustaining the health of rivers and reefs, marshes and mangroves, streams and seagrass beds, NbS for climate adaptation can simultaneously help to reverse the loss of nature.

In many cases, measures to adapt to climate change through restoring or protecting nature will also help to mitigate climate change by naturally storing more carbon; climate resilient development that will support sustainable development for all. Rewetting degraded peatlands, for example, enables them to filter and absorb water and recharge groundwater, which helps buffer droughts and floods, while also helping to preserve the most important terrestrial carbon store – as peatlands store an estimated 470-1,200 gigatons of carbon globally while covering only around 3 per cent of the world's land area. Restoring seagrass beds can help protect coasts from damaging storms and erosion through dampening the force of waves, while capturing carbon up to 35 times faster than tropical rainforests – and acting as nurseries for biodiversity, including commercially important fish stocks.

This all contrasts with many traditional approaches to tackling these challenges, including engineered, concrete solutions that often provide only a single benefit of physical protection from hazard impacts. As well as the multiple benefits they bring for people and the planet, there's a strong financial argument for prioritising well-managed NbS. Because of their lower maintenance costs and higher co-benefits, they're usually cheaper to implement and manage than traditional 'grey' infrastructure and more resilient, while addressing the same level of risk – so funding them is a smart move.[11] In Europe, studies found out that reducing flood peaks using floodplain restoration is economically the most attractive option.[12]

It's worth stressing too that doing nothing is not a neutral option: business as usual comes with an enormous cost. Without action, by 2050 water problems will shave about 8 per cent off global GDP, with developing countries facing a 15 per cent loss.[13]

In Europe – the fastest-warming of all the continents – annual economic losses from coastal flooding alone could be more than €1 trillion by the end of the century.[14] By 2030, the annual cost of losses and damages from climate change is projected to reach between US$402–805 billion in developing countries[15] – a figure that is expected to rise to US$1.5–$2.4 trillion annually by 2050.[16]

Implementing NbS could save developing countries at least US$104 billion in 2030 and US$393 billion in 2050 by reducing the intensity of climate change and weather-related hazards by at least 26 per cent.[17] But one of the reasons that we haven't seen more investment in NbS to date is that decision-makers around the world know little about them or aren't convinced that they work on a large scale, and instead come under pressure to resort to quick, familiar 'concrete' solutions that in an era of climate disruption can end up doing more harm than good. Indeed, the last thing the world needs right now is increasing investment in maladaptation - measures that actually result in



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BY INVESTING IN NBS, WE CAN GET NATURE ON OUR SIDE, HELPING US TO ADAPT TO THE WORLD'S WATER-RELATED CLIMATE CHALLENGES.

gas emissions and increased vulnerability to climate change. And it is happening. A 2024 report by the European Court of Auditors showed that 40 per cent of EU-funded adaptation projects in Europe had little or no impact - or had even resulted in maladaptation.

As a result, the gains that NbS could offer if they were effectively integrated into national adaptation strategies and plans remain largely unrealized. In the dry but telling words of the European Commission, "Nature-based solutions are included only to a limited extent at strategic level and in policy documents, especially sectoral strategies and plans. This may hamper their more systemic use and deployment for climate adaptation."[18]

That's why we've put together this report. With a focus on freshwater and coastal ecosystems, it brings together a wide variety of NbS case studies that WWF is developing and implementing around the world. From Brazil to the Baltic, Madagascar to the Mekong, these are real-life examples of initiatives that can accelerate climate adaptation. And while each of them deals with a specific solution in a specific place, the thinking behind them and the techniques they demonstrate are ripe for replication according to local contexts and scaling up. In particular, they highlight the importance of collaboration, of working with communities, partners and governments to deliver resilient solutions.

While these initiatives are all water-related, what's particularly striking is the sheer range of work that's taking place, in terms of actions, timescales, magnitudes and locations. Such as the transformative Recharge Pakistan initiative, which is set to drastically strengthen adaptation at the landscape level by restoring wetlands across the Indus River basin to mitigate extreme flooding and replenish aquifers – and benefit millions. Or how restoring mangroves in Madagascar is helping to buffer vulnerable communities against storms. In the Netherlands and Germany, giving more room to rivers - or actually handing more of their original floodplains back to rivers - reduces flood risk. NbS can help tackle water scarcity in rural grasslands of South Africa as well as acting as a protective natural sponge for the megacity of Hong Kong.

The case studies show that NbS works. They also show that there are a host of innovative approaches that can help to scale these solutions up. But none of this will be possible without a massive influx of finance. So at the end of this report, we set out some practical recommendations for decision makers around the world: the most important of which is the urgent need to scale up funding for adaptation to US$300 billion per year, and ensure that a significant proportion of the extra funds are earmarked for NbS - given all the co-benefits for people and nature and the reduced risk of maladaptation.

This is a huge sum but it pales into comparison compared to the damage that runaway climate impacts could cause if we don't strengthen climate adaptation and resilience. And there is real momentum at last. The international community is finally paying more attention to adaptation. The framework for the Global Goal on Adaptation was finally established at COP28 in Dubai, incorporating targets on water, ecosystems and biodiversity and highlighting ecosystem-based adaptation. This was echoed in the Global Stocktake at the end of COP28, which mentioned the importance of water and healthy ecosystems to adaptation for the first time. Meanwhile, a Ministerial meeting hosted by the COP28 Presidency saw 38 new countries join the Freshwater Challenge – the largest freshwater restoration and protection initiative in history – primarily because of the role of healthy ecosystems in adapting to the worsening water-related impacts of climate change.

Given the scale of the climate crisis, there will need to be some trade-offs in the rush to accelerate climate adaptation. The world must invest in the best mix of solutions, including 'grey' and 'green' infrastructure. But countries and companies should prioritise NbS for large-scale investment since it offers so many co-benefits, including simultaneously contributing to tackling the biodiversity crisis. The key to designing adaptation measures and deciding what to invest in comes down to five principles[19], which will help accelerate action and avoid maladaptation:

- Harness the power of nature first to help people adapt, in order to maximise all the co-benefits that come with Nature-based Solutions;
- Avoid harming nature when planning and implementing adaptation measures;
- Help nature adapt to climate change by enhancing ecosystem connectivity and natural dynamics for strengthened resilience;
- Support the most vulnerable groups first by providing support to communities that are most exposed to climate risks and with the least resources to adapt; and
- Work at system scale, based on science, to build resilience to climate change.

The world is playing catch-up on adaptation. Our understandable focus on mitigation has contributed to the slow pace of adaptation. But it's time to transform our approach. The daily news is filled with reports of water-related disasters that scientists are increasingly able to link to climate change. Collectively, it seems as if water – too much or too little of it – is never out of the headlines. Indeed, against this constant backdrop of bad news, water can look like the most malign of enemies: increasingly unpredictable and uncontrollable.

But we can work with nature to help build resilience and defend ourselves against these risks. By investing in NbS, we can get nature on our side, helping us to adapt to the world's water-related climate challenges.

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ADAPTATION IN ACTION

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RECHARGE PAKISTAN: REDUCING FLOOD RISK, REPLENISHING NATURAL WATER RESOURCES

Across the world, the climate crisis is fuelling more extreme floods. Relying solely on 20th Century concrete solutions can no longer keep societies and economies safe. Nowhere knows this more than Pakistan.

The superflood of 2010 was one of the country's worst natural disasters. Nearly 2,000 people lost their lives, while two million homes were damaged or destroyed, and 1.6 million acres of farmland were submerged. The long-term impacts on livelihoods and development were immense.

And, devastatingly, 1-in-1000 year superfloods are now becoming far more regular. Slightly over a decade later, Pakistan was hit by another catastrophic flood, which swamped a third of the country, affected over 33 million people, caused widespread damage and cost the country more than US$30 billion. Climate scientists say that global heating made the flood 50 per cent worse, and predict increased flooding in future as temperatures rise. Constructing more concrete defences is not the answer. New solutions are needed, including scaling up investment in transformative ecosystem-based approaches.

Like Recharge Pakistan. This seven-year project - run by the Ministry of Climate Change and Environmental Coordination and the Ministry of Water Resources through the Federal Flood Commission, and supported by the Green Climate Fund, USAID, The Coca-Cola Foundation and WWF-Pakistan - has a budget of nearly US$80 million, and is the largest investment to date in an ecosystem-based approach to flood and water resources management at the national level. And the largest across WWF's global network.

Focusing on sites in the Khyber Pakhtunkhwa, Sindh and Balochistan provinces, Recharge Pakistan is primarily designed to mitigate extreme flooding by slowing run-off and enhancing the capacity of wetlands to spread excess water and absorb it, safeguarding critical agricultural lands and communities downstream.

At the heart of this large-scale initiative is the restoration of wetlands, flow paths and channels, as well as 14,000 hectares of forests and woodlands. Together, these ecosystem-based approaches will enhance soil health and groundwater recharge, increase base water flows in the dry season and reduce flood risk. In addition, 127 green infrastructure projects, including recharge basins and flood protection embankments, will be developed to build greater resilience to extreme floods. These efforts will be strategically planned to ensure that ecosystem-based approaches under Recharge Pakistan complement existing grey infrastructure, maximizing benefits for both people and nature.

The benefits are expected to be game changing with tens of thousands of hectares protected from extreme flood damage and 20 million cubic metres of water safely stored in nature. All told, around 700,000 people will directly benefit from this initiative and a whopping 7 million indirectly.

But the project will only reach these goals through a collaborative approach. So it will work with local farmers in key watershed areas to expand climate-friendly agriculture and irrigation practices to increase community resilience. Local businesses will also be part of the overall picture, with a drive to co-develop sustainable, alternative livelihoods that reduce the pressure on natural resources.

Recharge Pakistan is a highly ambitious scheme, and it needs to be, given the magnitude of the water-related climate threats that the country is facing. Even so, it only targets a few parts of the country, so action on an even bigger scale is still required. But Recharge Pakistan is pointing the way. Investing in large-scale ecosystem-based approaches is central to a more resilient future. As this pioneering project starts to show real results, it will spur further investments in ecosystem-based climate adaptation in Pakistan - and beyond.



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INVESTING IN MANGROVES TO BUFFER COASTAL COMMUNITIES

Mangroves may not be the most visually spectacular of ecosystems, but for the benefits they offer nature and people alike they take some beating.

Thriving mangroves support local fisheries, tourism, traditional medicine, and crafts, and provide vital nurseries for fish, crabs, and other marine species, along with shelter for birds, bees, and other terrestrial animals. By filtering excess sediments from the water, they protect coral reefs, while they act as a natural shield for lives and property too, protecting coastal communities and cities from increasing storm surges and sea level rise under climate change. They also prevent erosion and stabilise coastlines. Finally, they're one of the most effective carbon sinks on Earth, able to sequester up to four times as much as tropical forests by area. It's thought that, worldwide, they hold some 21 gigatonnes of carbon, most of which is held in the soil beneath their roots.

And yet, over the past 50 years, half of the world's remaining mangroves have been lost, largely due to human activities. Rampant coastal development and unsustainable resource use have taken a heavy toll, and without urgent action we could lose what's left of the planet's mangroves over the next century.

WWF is working to turn the tide. The Mangroves for Community and Climate (MCC) Project is a five-year effort with communities, governments and other partners to protect, restore, and strengthen the management of large areas of mangroves, including in Madagascar. The project operates in the Manambolo Tsiribihina and Diana regions, improving the sustainable management of mangroves in these areas. The actions carried out by the MCC project ensure the security and resilience of communities impacted by climate change by supporting sustainable mangrove management practices. This work will secure an estimated 2 billion tonnes of carbon and help protect 300,000 people from tropical storms and coastal erosion, while supporting sources of income for families that live along these saltwater forests and depend on mangrove ecosystems for their livelihoods.

In Madagascar, WWF has been working with communities around Ambaro Bay since 2016 to restore and sustainably manage their mangroves. WWF is now supporting 55 community-based natural resource management groups, covering approximately 86,000 hectares, to reinforce their work with mangrove ecosystems. The project also aims to restore 7,500 hectares of degraded mangroves by 2025**.** The goal is to reduce – or even completely stop – the threats mangroves face and to promote climate-smart restoration. This is a critical Nature-based Solution for the people of the area: harnessing the power of healthy mangroves to buffer them against worsening climate impacts and provide economic and environmental benefits. And also boost biodiversity.

The benefits extend directly to the local communities, increasing fishermen's incomes, creating additional revenue sources through artisanal crafts and ecotourism, and strengthening the communities' resilience during climate crises.

The same results are being seen further south in Ampanihy district, where four communities are also restoring mangroves. Indeed, the concept of working with mangroves is spreading as more and more coastal communities lead efforts to protect and restore them: trusting in thriving ecosystems to improve their livelihoods and their resilience to climate change – showing yet again that nature has solutions to many of our most pressing problems.

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RESTORING FLOODPLAINS, REBUILDING NATURAL FLOOD DEFENCES & DROUGHT RESILIENCE

With Germany experiencing a series of extreme floods in recent years, momentum is building for action to accelerate adaptation and build more resilient societies, economies and ecosystems.



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In particular, there is growing interest in restoring and reconnecting floodplains. Not only do they slow and spread floodwaters, but healthy, functioning floodplains are also one of the most productive ecosystems on Earth thanks to the sediments and nutrients deposited during natural flooding, and the regular changes in water levels that create a host of ecological niches.

But 80 per cent of Germany's floodplains have been lost: blocked, channelled, straightened or disconnected by dikes to meet the demands of agriculture, navigation, and industrial and residential development. In the process, some of the diverse benefits of healthy, connected floodplains have been lost - from minimising the impacts of floods to alleviating droughts, and sustaining rich biodiversity.

Restoring these ecosystems will strengthen adaptation - a fact underscored by WWF Germany's successful floodplain restoration project on the Middle Elbe river. The largest dike relocation in Germany to date, the Nature-based Solution reconnected 600 hectares of floodplains to the river system in the Lödderitzer Forest by constructing a new dike up to 2.5km farther away from the river than the old structure, which was 'slit' in 10 places to let the water through. Theoretically, this would help to spread floodwaters, reducing the peak flow and nourishing nature.

And so it has proved. During the heavy winter floods of 2023-24, the extended area of reconnected floodplain allowed water from the rising Elbe river to spread naturally over an area of 900 hectares (three times more than before) - reducing the local flood peak by up to 28 cm, and protecting housing and infrastructure. It also linked a section of valuable floodplain forest to the natural flood dynamics of the Elbe once again.

While the Elbe river flows through one of the last largely connected floodplain forest complexes in central Europe, restoring disconnected stretches is critical to boosting biodiversity. The river's alluvial woods and meadows, dune sites, flood channels and backwaters support a uniquely rich mix of species. This includes some 180 regularly nesting bird species along with 130 migratory species that rest, feed and winter in the region; a vast array of insects including more than 700 species of butterfly, 200 species of bee and 50 species of dragonfly, and more than 1,000 different plant species. More than 50 mammals also live within the Elbe river basin, including the European beaver, which found its very last refuge here in the 19th century when it had been hunted almost to extinction in the rest of Europe.

WWF Germany's project in the Middle Elbe shows that reconnecting rivers to their floodplains is an effective NbS. Now a German Federal programme, Blue Belt Germany,[20] is aiming to expand on this by returning the country's large rivers and floodplains to a more near-natural state, while keeping them compatible with shipping where relevant. WWF Germany is involved, and is currently running another NBS pilot project to restore some 2,300 hectares of floodplain on the Middle Elbe, showcasing adaptation to climate change for the benefits of nature, people, and transportation.

The Blue Belt project focuses on measures to improve natural water retention in the floodplains to enhance drought resilience, thereby helping to maintain stable water levels in the river even during dry periods. Along with reconnecting the floodplains, the project also involves the "adaptation" of existing drainage system structures to stop floodplains from drying out, the creation of small wetlands that also provide valuable new habitats for wetland species, planting a richly structured mosaic of native tree and plants species, and the conversion of fields used for intensive arable farming into new areas of floodplain grassland rich with wildflowers, managed through controlled grazing by sheep and cows.

In parallel with the environmental engineering work, WWF Germany is working with local authorities to showcase how a near-natural river floodplain landscape can be restored and sustainably managed to meet the needs of all stakeholders. The campaign is also ensuring that local people actively participate in and enjoy the changing landscape - because community support and buy-in is essential to the success of these Nature-based Solutions.

VIET NAM

WORKING WITH THE MEKONG TO BRING GOOD FLOODS BACK AND REVIVE THE DELTA

The Mekong River delta in Viet Nam is an incredibly productive ecosystem and vital for the country's agricultural production.

The upper section of the delta used to benefit from natural flooding in the wet season - and the water, sediments and nutrients it would bring. But over recent decades, the operation of hydropower reservoirs upstream has significantly reduced the size and frequency of the seasonal flood pulse, while the simultaneous development of an extensive flood control system, involving the construction of 20,000 km of dikes, and sand mining has further transformed the natural dynamics in the delta.

These decisions were taken with the best of intentions. But while they have produced renewable energy, enabled farmers to grow a third rice crop each year and reduced extreme flood risks, they have also resulted in a rapid decline in the ecological and agricultural conditions in the delta - and undermined long term resilience just as the impacts of the climate crisis are worsening.

Unsurprisingly, Mekong floodplains need seasonal flooding to stay healthy, or the ecosystem services they provide to people and nature quickly deteriorate. Reducing natural flooding prevents the dynamic flows of water, sediment and nutrients, which are essential to recharge groundwater, counteract subsidence, and replenish soil fertility. Overall, natural water storage has been reduced, fields have become less productive, and communities have been made more vulnerable. Indeed, the delta itself is now sinking and shrinking even faster than the level of the sea is rising.

Urgent efforts are needed to restore natural processes in the delta as they are central to rebuilding resilience, sustaining productivity and keeping the delta above the rising seas. Step forward WWF Viet Nam, which is implementing Nature-based Solutions around three key wetland sites - Lang Sen and Tra Su Wetland Reserves, and Tram Chim National Park - to demonstrate how working with nature rather than against it can pave the way towards a sustainable future for the people of the upper delta, and boost biodiversity in the process.

The NbS involves measures to resume flood-based agriculture and in the process enhance the health and resilience of communities and ecosystems - measures such as installing culverts and sluice gates in dikes to allow water into the fields during the flooding season, and protecting and restoring channels that connect the river to its floodplains. Not only will seasonal flooding replenish groundwater, fertilise fields with natural nutrients and build up the land with deposits of sediments, it will also flush out pollutants and pests, restore the ebb and flow that benefits biodiversity, and allow fish to once again move in and out of inundated areas. In short, it will bring life back to the floodplain ecosystem.

But this approach creates a challenge: it prevents a third rice crop, which can provide valuable income, at least in the short term, for families that need it. However, restoring the natural flood pulse also opens up a host of more sustainable alternative income-streams for farmers. Along with aquaculture (raising giant freshwater prawns or stocking flooded fields with fish) and floating vegetables (lotus is particularly suitable), farmers can also cultivate ancient varieties of so-called 'floating rice', which are adapted to seasonal flooding and once covered hundreds of thousands of hectares in the upper delta.

This highlights a critical aspect of this NbS - and indeed all successful NbS. They must involve consultation and cooperation with local communities. Without their buy-in, no solution will have the necessary support to ensure it results in long term benefits and resilience. In this case, the project team is working closely with farmers in the area, including helping them to capitalise on the potential of these new activities.

And finally, this innovative NbS incorporates a monitoring and evaluation component to capture the hard data to prove that it's viable to replicate it across the delta and floodplains in Viet Nam and Cambodia. This will help to tackle one of the greatest challenges for scaling up NbS - the lack of examples that it really works.



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BOLIVIA

PROTECTING THE PANTANAL BY HARNESSING THE POWER OF NATURE – AND COMMUNITIES

The Pantanal is a truly extraordinary place. The world's largest tropical wetland, it covers around 170,000km² across Bolivia, Brazil and Paraguay and is home to more than 4,700 species, including at least 1,650 species of superior plants, 1,030 butterflies, 650 birds and 325 fishes.

It boasts the world's greatest aquatic plant diversity, highest density of jaguars and largest concentration of caimans as well as key populations of hyacinth macaw and giant river otter. Many of the fish species are important for small-scale, recreational and commercial fisheries.

Speaking of which, more than 270 communities – from Indigenous Peoples to farmers and fishers – call the Pantanal home. Overall, at least 1.2 million people depend on it directly for their water, food and livelihoods, while millions more benefit from its water supplies and flood control downstream.

But the Pantanal is in peril. Human activities and climate change are threatening the health of the wetland, degrading water sources and altering water and river flows – leading to record numbers of fires in recent years.

WWF has launched an ambitious new strategy – PantaNow! – to drive conservation action across the landscape in collaboration with governments, the private sector, partners and communities. At the heart of this will be Nature-based Solutions to restore natural freshwater functions within the Pantanal to help people and nature adapt to the changing climate – and build long term resilience.

But the strategy is not starting from scratch. WWF has been working in the region for years, helping to restore springs and water sources that flow into the Pantanal. And to protect them by supporting community-led initiatives.

Take Motacusito in Bolivia: springs that rise here feed the Cáceres Lagoon, which connects with the Paraguay River, helping to sustain the Pantanal with life-giving water. Recognising the growing threats and the critical importance of their ecosystems to their lives and the Pantanal, women from the Motacusito community led a campaign to protect their natural resources. Working with the municipal government of Puerto Suárez, the Bolivian Society of Environmental Law and WWF Bolivia, the group secured a new law decreeing that half of the municipality would be used for the conservation and protection of the ecological functions of its water sources, and the development of community ecotourism.

The new law has been such a success that women from Motacusito have begun visiting women in other communities to tell them what they've done and what they've achieved, and encouraging them to follow suit. The best NbS have the support of all stakeholders and are replicable and scalable, and this is one that emphatically ticks those boxes. What's more it highlights an important point: where healthy ecosystems still exist, the most effective nature-based approach to climate adaptation and resilience is to invest in protecting and sustainably managing those systems.

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INVESTING IN WETLANDS IS A WATER-WISE APPROACH TO ADAPTATION

Winter rains are on the rise in Finland thanks to climate change, and floods increasingly follow as fast-flowing water rushes down rivers that can no longer contain it, eroding the banks and inundating farmers' fields.



© Vivi Kaasone

All the while, nutrients leach from agricultural land and are swept downstream, driving the eutrophication of the Baltic Sea, manifesting in toxic algal blooms and deoxygenated dead zones.

Healthy ecosystems are one of the very best lines of defence and WWF has been working in Finland for nearly 20 years to demonstrate the benefits of investing in healthy wetlands and watersheds for climate adaptation and biodiversity. In recent years, the focus has been on areas of Western Uusimaa with Nature-based Solutions in the upper, middle and lower parts of four river catchments.

Forests cover more than 75 percent of Finland's surface area, and they have a huge, largely untapped potential for improving water conservation. That's the basis for Metsälähde, which is taking place in the forests of the headwater areas of the upper catchments. The goal of the project is to restore and construct a mosaic of ecologically healthy wetlands and waterways, absorbing nutrients and sediments, retaining more water in the forest itself and smoothing out flood peaks in arable areas downstream. The project also aims to raise awareness of the benefits of these measures, so that water protection becomes an integral part of Finnish forestry.

Farther down the catchments in the Valuta project, WWF Finland is working with local landowners on NbS to retain water and level out flow patterns, combating erosion, flooded fields, and eutrophication. A series of small, multi-functional wetlands have been created to tackle the impact of human activities and make the area more climate resilient. These wetlands slow down flows and retain silt and nutrients, improving the condition of other water bodies. WWF Finland has also been returning rivers to their natural meanders, and restoring floodplains so excess water is diverted away from important agricultural land. Vegetation in newly planted buffer zones around agricultural and forestry areas retains water and nutrients.

Finally, similar NbS are part and parcel of the Rankku project, which targets coastal catchment areas to reduce nutrient load in the Baltic Sea and boost biodiversity. Along with multi-effect wetlands inland, including one in the iconic shape of a panda's head to mark WWF Finland's 50th anniversary in 2022, the project is also restoring seagrass meadows in coastal waters. These meadows provide a critical habitat for small invertebrates and juvenile fish, including commercial species; and they bind carbon and recycle nutrients. Healthy coastal wetlands also provide additional protection from climate change-related sea level rise and storm surges.

Critical to all these NbS is collaboration with communities, landowners and the authorities. But WWF Finland's success is also based on years of showing real results. People need to be convinced that working with nature actually works. The fact that the current projects are oversubscribed, with more landowners wanting to get involved than current funding allows for, tells its own story - the same story that this report is seeking to tell: investing in Nature-based Solutions is central to adapting to climate change and reversing nature loss.

SLOWING THE FLOW BY GIVING MORE ROOM TO THE RIVER

The Geul river hasn't changed much in the last 100 years. It meanders through the hilly landscape of South Limburg in the Netherlands, flowing through a protected Natura 2000 site and providing a home to iconic wildlife, including beavers and migratory fishes, such as the critically endangered European eel and Atlantic salmon.

But while the river itself still runs relatively naturally, it's a different story in much of the surrounding land, which has been heavily modified by intensive agriculture and urbanization. Farming on the riverbanks, construction on the floodplain and a proliferation of hard surfaces in urban areas have all impacted the river's connectivity to riparian landscapes, lessening the ecosystem's ability to absorb water and minimize flooding.

The Geul is prone to flash flooding after heavy rainfall, impacting people and nature, sometimes severely. During the extreme floods in Europe in 2021, the Geul burst its banks and inundated nearby urban areas, including the city of Valkenburg aan de Geul, where floodwaters reached a depth of 1.25m. The event is estimated to have caused €600 million of economic damage – and showed once again that dikes and other conventional 'grey' flood defences can't always be relied on.

The key is to slow the flow of excess water and allow it to infiltrate into the ground – reducing extreme floods and replenishing groundwater for the future. So that's what WWF, together with several other nature organisations, have been working on in the region, investing in Nature-based Solutions to strengthen its frontline defences against future floods. Overall, around 250 hectares has been restored along and around the Geul River, reconnecting it to its floodplain and enhancing the riverine landscape's natural ability to act as a sponge.

This has involved a range of activities, from removing old agricultural drainage systems in order to keep water in the ground, to planting 'graften' (horizontal rows of native shrubs) on hilly agricultural land to slow down surface flows. WWF and partners have also been working with local farmers, collaborating with them to shift away from crops like maize that result in hard, compacted soils and into agroforestry, which allows far more water to infiltrate into the soil. Planting shrubs and forests on the floodplain has the same de-compacting effect, while (re)creating small ponds and marshes has further boosted the landscape's natural capacity to store water. Many of these activities have been carried out together with local residents, including explaining how NbS can help reduce flooding and improve the quality of the landscape at the same time.

And the results? As well as reducing flooding, the recreation of natural floodplains around the Geul is boosting the ecological status of the river and benefiting biodiversity. For example, more natural sediment dynamics are greatly improving the condition of the river's valuable fish spawning grounds. Meanwhile, restoring full connectivity along its 53km length contributes directly to the EU's objective of restoring 25,000km of free-flowing rivers by 2030. Because of the community based approach, now all municipalities the Geul flows through have signed a petition addressing the regional and national governments stating that they are in favour of NbS being included in climate adaptation plans.

The Geul river project is another example of the shift in the Netherlands away from a 1000-year reliance on dikes and other hard infrastructure to manage floods towards a hybrid approach that involves working with nature rather than against it. After significant floods in the 1990s and the realisation that the worsening impacts of climate change were only going to increase flood risks and threaten to overwhelm hard infrastructure, the country began exploring new measures that would result in more resilience, including providing more "Room for the River".

Begun in 2007, this huge project involving the government and numerous partners, including WWF, took steps to increase the area available for floodwaters by relocating dikes further from the river, reconnecting rivers to parts of their floodplains, and creating side channels to divert high water flows. While these interventions were designed primarily to reduce flood risk, the programme has also resulted in a range of co-benefits for fish and other species as well as greatly enhancing recreation and human well-being.

Giving room back to the river works – whether it's the Geul or the Rhine. This approach should be replicated and scaled up worldwide. It should also serve as guidance for countries considering fragmenting their free flowing rivers: maintaining connectivity along naturally flowing rivers and with healthy floodplains can be the best and most cost-effective form of adaptation.

© Joshua Harris / WWF-UK

PUTTING NATURE AT THE HEART OF ADAPTATION IN HONG KONG

You might be surprised to learn that Nature-based Solutions are at work in one of the world's most densely populated regions, but that's what you'll find if you take a trip to Hong Kong's Mai Po marshes on the eastern bank of the Pearl River estuary in China.

The high-rise urban skyline is an incongruous backdrop for this remarkable wetland, where WWF Hong Kong has been managing a 380-ha nature reserve since 1983. Comprising a mix of shallow and deep open water areas, mangroves, reedbeds, marshes, ponds, and traditional *gei wai* ponds for rearing shrimp, Mai Po offers a haven for biodiversity, protection against floods and storm surges, and a rare place where local people can go to escape the pressures of the city and reconnect with the natural world.

Around 100,000 birds of over 400 species use the reserve and the adjoining mudflats each year; it's an important staging post for migratory waterbirds on the East Asian-Australasian Flyway and also provides a vital habitat for mammals, including the Eurasian otter and Hong Kong's only wild felid, the Leopard cat. Resident water buffalo act as ecosystem engineers, through grazing and wallowing in mud to create microhabitats, thus helping restore rain-fed marsh areas.

As climate change intensifies the environmental threats Hong Kong faces from rising sea levels and severe typhoons to stronger waves, higher tides, and heavy rainfall, the Mai Po marshes act as a natural buffer. Investing in protecting and restoring the area's mangroves, *gei wai*, ponds and marshes enhances resilience to flooding, slowing down surges and soaking up the surplus water. And healthier wetlands sustain richer biodiversity, while thriving mangroves sequester more carbon.

These natural defences, though, need looking after. The Mai Po Management Committee, which includes representatives from WWF Hong Kong, the government as well as other local stakeholders, sets five-year management plans that take into account climate impacts and adaptation, as well as including quantifiable targets for species recovery. Constant scrutiny of science-based research and monitoring data informs adaptive decision-making.

Just as important, WWF Hong Kong works to raise awareness of why wetlands matter, and the fully accessible facilities are extensively used for educational and recreational purposes through guided eco-tours and various events. Its over 30-year Wetland Management Training Programme serves as a regional hub for capacity building. It also plays a central part in WWF Hong Kong's 'One Planet' education programme to inspire and mobilize young people to be part of the global conservation movement. As other case studies highlight, ensuring local communities are involved and understand the benefits of working with nature are critical to the long-term success - and long-term benefits - of NbS.



© Anthony Sun

PROTECTING GRASSLANDS FOR PEOPLE AND NATURE

The remote rangelands of South Africa's mountainous Eastern Cape Drakensberg are a strategic water-source area for the country, with their many rivers, wetlands and springs providing freshwater for millions of people downstream.

Healthy grasslands absorb rainwater, releasing it slowly throughout the year. They reduce runoff and erosion, ensure groundwater is replenished and help reduce the impact of flooding events. As the climate crisis disrupts weather patterns and alters rainfall and river flows, the health of these high-altitude grasslands and the services they provide are becoming ever more important, even as they face threats from poor management such as overgrazing, uncontrolled burning and invasive plant infestation.

While these rangelands are not ideal for crop production, they are well suited for stock farming. If sheep flocks are managed well, farmers can ultimately improve their wool quality – and income. However, poor management can result in overgrazing, which can lead to severe erosion as well as impact water supplies downstream as the overall health of the ecosystem deteriorates along with its ability to regulate the flow of water from this key catchment area. But managing the grazing in a sustainable way can be challenging, particularly for farmers in smaller operations or on communal land.

This is the context for two regenerative agriculture projects implemented by WWF South Africa, one that is still underway in collaboration with global fashion brand H&M Group and one with Kering (owner of labels including Alexander McQueen, Gucci and Yves Saint Laurent) that was successfully completed. While each project is slightly different, their focus is on working with nature to support sustainable wool production in these remote, biodiverse rangelands and simultaneously help communities to adapt to the changing climate, build a more water-secure future and reverse nature loss.

As with any community-based projects, outreach work to find out the farmers' needs was the first step. Based on this needs assessment, project teams began building relationships and signing conservation agreements with sheep farmers, as well as providing training and mentorship within the pilot project areas. These agreements encourage farmers to implement conservation actions in exchange for benefits that improve their livelihoods such as access to sheep shearing services, livestock vaccines, invasive plant clearing, training and improved market access. Commitments include planned rotational grazing to allow areas of rangeland to rest during the summer growing season as well as restoration of natural plants and biodiversity. The closer the grasslands are to their natural state, the better they can continue to bind the soils, and absorb and slowly release water.

A team of local people have also been trained in invasive plant clearing and provided with equipment and contracts to clear riparian areas that are overrun with invasive plants. This is another example of how restoring the natural ecosystem benefits climate resilience by reducing flooding risks, and benefits farmers by removing plants that can entrap lambs and reduce wool quality.

For all those downstream of these critical water source areas, scaling up these projects along with other Nature-based Solutions promises to accelerate climate adaptation and build resilience. As for H&M Group and Kering, these regenerative projects mean they can support efforts in critical landscapes to reduce the impact of the materials they source while contributing to climate resilience and biodiversity protection in a world where fashion can come at a terrible cost. Water, grass and wool are perhaps an unlikely combination, but in this instance they go together remarkably well.

Images © Angus Burns

HEALTHY WETLANDS ARE LIFE SUPPORT SYSTEMS FOR PEOPLE AND NATURE

Bengaluru is India's answer to Silicon Valley and one of the fastest-growing cities in the world.

But while the rapid development in recent decades has brought prosperity to many, it has also impacted critical freshwater ecosystems, threatening their diverse benefits to people, businesses and nature - just when they are most needed to help the city cope with the worsening impacts of climate change.

Nowhere is the crisis more apparent than in the Arkavathy River. A tributary of the Kaveri River, the Arkavathy rises in the Nandi hills to the north of Bengaluru, and about a third of the city sits within its basin. Twenty years ago, when only 20 per cent of the basin was built up, the river cascaded through a connected network of lakes and tanks, which collected and stored some of its water. Despite large-scale agricultural activities in the region, farmers could rely on sufficient surface water for irrigation, while domestic and industrial users had enough water too.

But over the last two decades, this dynamic system has been disrupted by unsustainable human activities and climate change - transforming the connected network of waterways and water bodies into a series of scattered freshwater fragments. And it's not just the water stores that have been damaged. Rapid urbanization has degraded the river basin, while the cultivation of exotic, water-intensive crops has depleted water levels. At the same time, climate change has made the monsoons more irregular, so they can no longer be relied upon to recharge the vanishing water bodies. Two reservoirs – Hesaraghatta and Thippagondanahalli (TG Halli) – built to answer Bengaluru's growing demand for water have remained dry for years. This has created a concerning circle. As surface water has begun to run out, the dependence on groundwater has increased, and people have been forced to rely on borewells, drilling deeper and deeper to reach the diminishing amounts that remain.

And that's not all. Many stretches of the Arkavathy river have been severely polluted by sewage and industrial effluents while waterweed infestations have blocked channels, silted up lake beds and suffocated aquatic life. Urgent action is needed to restore the health of these vital ecosystems to underpin water and food security now and in the future, and to help rural communities and cities adapt to the changing climate.

As a response, multiple stakeholders led by the District Administration of Doddabellapura, a peri-urban area in the outskirts of Bengaluru, and WWF India engaged local government departments, communities, businesses, experts and NGOs. They developed a programme, supported by HSBC Climate Solutions Partnership, that aims to reduce climate risks by restoring river connectivity, enhancing the health of wetlands, and rejuvenating catchment areas in the upper region of the Arkavathy basin by leveraging Nature-based Solutions to address socio-environmental challenges caused by climate change. As a first step, the initiative set out to deepen understanding of the system by conducting various assessments and preparing health scorecards for lakes, wetlands and tanks to identify threats and possible solutions. It then set out to develop a shared vision and design an ecosystem based implementation plan to restore ecological health with multiple stakeholder inputs and building on local traditional wisdom.

Ensuring community participation and buy-in is critical to the success of NbS - and this has been at the heart of the project. Impressively, more than 1,000 volunteers registered to join the 'mitra' programme: Wetland Mitras, or friends of the wetland, are trained to conduct wetland health assessments, organise clean-ups and monitor borewells.

The invaluable work of the Mitras is complemented by concentrated efforts to reconnect waterways and water bodies, de-weed channels and regulate water storage. In addition, rafts of aquatic plants are being deployed to improve wetland health. As well as cleaning pollutants from the water, these so-called 'floating islands' are a boon for biodiversity, becoming home to a variety of aquatic and bird life.

NbS like these are effective, sustainable and can be incredibly powerful. This project aims to restore around 350 hectares of wetlands and 35km of the Arkavathy in Karnataka through collective action. They are also critical to a brighter and more resilient future for the Arkavathy basin. No one is saying that these measures alone are a silver bullet but this project is showing that working with nature is a critical part of efforts to foster a path to resilience. The human pressures - exacerbated by climate change - are immense but using the power of nature to restore rivers and wetlands can help to tackle them, enhancing adaptation and driving sustainable development, while also bringing biodiversity back to big cities like Bengaluru and small growing ones like Doddabellapura.



© WWF-India

DAM GOOD WAY OF BOOSTING WATER SUPPLIES, RESILIENCE AND BIODIVERSITY

Water has always been a precious resource for people living on small islands, and in the Mediterranean - one of the world's most popular tourist destinations - they face particular sustainability challenges, both in terms of scarcity of supplies and salinization in the remaining aquifers.

With the region warming 20 per cent faster than the global average under climate change, water stress is only going to increase in the coming years as temperatures rise and weather patterns are disrupted. So it's never been more important to steward water wisely and to enhance natural water storage.

One way of doing this is by constructing traditional check-dams. These are small stone weirs built with natural materials on ephemeral and seasonal streams. The barriers slow the flow of water after heavy rains and so reduce flood risk, while increasing infiltration and replenishing aquifers, which helps mitigate against drought. Over time, small ponds form behind the check-dams, which can help with small-scale irrigation in nearby areas and create oases for biodiversity in the arid surroundings.

WWF Greece and other partners, such as MedINA and HISR, have been working on a project that aims to utilise this traditional solution to help tackle the worsening water crisis on the country's islands. The goal is to demonstrate the contribution that this nature-positive approach can make to climate adaptation by enhancing natural water retention and mitigating floods, and then spread this knowledge so that this solution is scaled up across the Mediterranean.

After spending several months searching for a suitable test site, the team launched a two-year pilot on the Greek island of Paros. They chose a stream called Kavouropotamos as the focus for their efforts, eventually building 34 stone weirs at carefully chosen spots along a 1.3 km stretch. The team worked very closely to raise awareness of what they were doing with local stakeholders, and many community members were involved with the construction work.

With the weirs in place, the focus has shifted to scientific monitoring (through the Horizon "Spongescapes" project) which aims to prove - qualitatively and quantitatively - that they are making a difference on Paros, and that the same concept can be scaled up and replicated in other Mediterranean islands. In fact, the implementation of the check dams in the small stream of Kavouropotamos has raised the attention of the relevant authorities in the islands of Ios, Sifnos, and Evia and similar actions have already been launched, while the Municipality of Paros has expressed interest to replicate the construction of check-dams in other streams of the island.

Of course, nobody's trying to claim that the weirs can solve the water crisis on their own, but results so far suggest that combining this traditional low-impact practice with modern approaches can nevertheless make an important contribution to water security and climate adaptation.

© Thanos Giannakakis / WWF Greece

COMMUNITY-LED SOLUTIONS TO ENHANCE COASTAL RESILIENCE

Tanzania has an extensive coastline, which is home to some of the most important mangrove ecosystems in East Africa, including a 53,000 hectare forest in the Rufiji River delta.



© Egno Gerald Nkunguru / WWF Tanzania

As is the case across the globe, these mangrove ecosystems are critical for people and nature, serving as nurseries for fish and other marine species that support both small-scale and commercial fisheries. They also protect many of Tanzania's coastal communities from the rising sea levels and increasingly violent storm surges we're seeing under climate change. And they are a valuable ally in global efforts to rein in runaway climate change, absorbing and storing significant volumes of carbon.

But only when they are thriving and functioning properly, which is an increasing concern in Tanzania. Deforestation, illegal logging and unsustainable agricultural practices are all taking a toll on the country's mangrove resources, so WWF Tanzania has made restoration a priority.

With support from two key projects that are underway in the region – 'Sustainable Use of Mangroves in the Western Indian Ocean Region', funded by BMZ-Germany, and 'Mangrove Management for Climate Risk Resilience and Improved Livelihoods,' funded by Norad – WWF is focusing on grassroots restoration in an area stretching across Rufiji, Mafia, Kilwa and Mkoani-Pemba.

Local communities are at the forefront of this work, supported by training and capacity-building programmes that enable them to monitor and manage their mangrove areas sustainably. WWF has established five community-based organisation (CBO) networks to coordinate the efforts, comprising more than 75 individual CBOs engaged in mangrove restoration. These networks foster collaboration and communication, sharing expertise and best practices, and they work together to raise wider social awareness of why mangroves are so important.

Many CBOs, with strong participation from youth and women, have been planting mangrove seedlings in degraded areas to restore forest cover – and revive nature's capacity to buffer their coastal communities from the worsening impacts of climate change. Meanwhile, they are helping species to thrive by restoring biodiversity hotspots.

But as is often the case, Nature-based Solutions are not a silver bullet. Restoring mangroves is not enough on its own. Restored ecosystems need to be maintained so other CBOs, drawn from 23 villages from the project sites, are working to establish community enterprises to reduce reliance on mangroves for firewood and other unsustainable uses. Alternative incomes are now being generated along the Tanzanian coast through seaweed farming and beekeeping activities, with newly created Community Microfinance Groups (CMGs)/Village Savings and Loans Association (VSLAs) in 23 mangrove communities, giving community members the means to start new small businesses.

So far, WWF has given grants totally over US$73,000 to around 20 CBOs, benefiting over 50,000 community members, and has trained 170 community members (made up of over 80% women) on how to add value to and market their products. Seaweed soap, body oil and skin jelly are proving particularly popular. With community members leading the restoration process and building new livelihoods, the projects are proving to be a real win-win: the very essence of an effective NbS.

RECONVERTING FARMLAND TO RESILIENT WETLANDS IN THE DANUBE DELTA

The Danube Delta is Europe's greatest wetland but much of it is no longer 'wet', having been converted into farmland.

This has disrupted the dynamic functioning of the delta, threatening biodiversity, undermining sustainable livelihoods and leaving its communities more vulnerable to the worsening impacts of climate change - without even boosting food production significantly.

So in 2012, WWF partnered with the Mahmudia community and the Biosphere Reserve Administration in the Delta to pioneer a new approach after decades of unsustainable agricultural development across the region - an approach that worked with nature rather than against it. Under the EU-funded project, over 900 hectares of artificially-created agricultural land were reconnected to the delta's natural water flow and reconverted back into wetlands.

The results? Clear proof that Nature-based Solutions can benefit societies, economies and ecosystems in a variety of ways, including building climate resilience. The project created diverse wetland ecosystems, which have boosted fish stocks, increased biodiversity, enhanced carbon sequestration in the soil, sparked a surge in eco-tourism and reduced the risk of extreme flooding and drought.

The community was so convinced about the benefits of this NbS that they welcomed a subsequent naturally-created NbS. In 2023, a dike in Mahmudia failed, flooding another swathe of agricultural land and recreating a bigger thriving wetland. The leaseholders launched legal efforts to drain it, despite 97 per cent of the local community wanting to go with the flow and keep the restored wetland - and their new-found prosperity and enhanced resilience to the impacts of the climate crisis.

Clearly, this kind of NbS needs to be scaled up across the region to strengthen climate adaptation and reverse nature loss, as 900 hectares is just a drop - or just 2.35% of agricultural land - in the Danube Delta. But a healthy, dynamic delta also depends on a healthy, functioning river and therefore on other NbS upstream, especially in the Danube basin, which has been severely degraded over the past 150 years, losing 80 per cent of its wetlands due to dikes, dams, canalisation and, increasingly, climate change.

WWF has been involved in numerous restoration projects throughout the Danube basin to enhance climate adaptation - many of them under the innovative Living Danube Partnership with The Coca-Cola Foundation and the International Commission for the Protection of the Danube River. In the first phase alone, over 5,460 hectares of wetlands, rivers and floodplains were restored, including the Gârla Mare wetlands in the Danube floodplain in western Romania, which were finally reborn in 2022 after years of negotiations, obstacles and adjustments to the technical solutions. This highlights one of the challenges with NbS - they can take a long time. Which is why we need to accelerate action now.

Which is why the extension of the Living Danube Partnership in 2024 was so widely welcomed. The partnership will continue to focus on restoring essential wetlands, floodplains and tributaries along the Danube River, building on the success and impact delivered in the initial phase. It will continue to build resilience for communities vulnerable to water-related climate risks in urban and rural areas, while improving watershed health in the Danube basin and delivering benefits for communities, agriculture and nature. Including the health of the Danube Delta.

© Tudor Ionescu / WWF-Romania

TACKLING THE CHALLENGE OF SCALING UP ADAPTATION

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The preceding case studies show that Nature-based Solutions for climate adaptation can make a real difference to people and nature, helping on a local level to accelerate adaptation and underpin resilience. They show that they are worth replicating and scaling up. And that is what is required to deliver the impact at river basin and landscape level that is necessary to tackle the climate and nature crises. But showcasing successful NbS is not enough. And that is why WWF has been working with partners to develop other transformational NbS, innovative tools and financial mechanisms to accelerate action. Here are just a few that WWF is driving:

BECAUSE IT'S WORTH IT: COST-BENEFIT ANALYSES OF POTENTIAL LARGE SCALE NBS IN THE MEKONG

It's a common refrain: there is no pipeline of NbS projects with detailed-enough financial and technical information to win over decision makers and investors. This is holding back the adoption of transformational NbS and slowing investment in projects that will deliver a more resilient and sustainable future. And this is what an innovative project in the Mekong is seeking to overcome - by providing the numbers that decision makers need to opt for NbS and showcasing how this can be replicated across the Mekong and elsewhere.

It's part of the Climate Resilient by Nature (CRxN) initiative, which the Australian government and WWF Australia are running across the Indo-Pacific region. Launched in 2021, it supports projects that work with communities to restore and protect critical ecosystems, build sustainable livelihoods and increase resilience to climate shocks.

The CRxN Mekong Project focuses on the Upper Mekong River and floodplain ecosystem across Thailand, Laos, Cambodia and Viet Nam. It's impossible to exaggerate the importance of the diverse benefits provided by the river and freshwater ecosystems across the basin from food production to buffering against extreme floods, nutrient cycling to water purification. They not only support the lives, food security and livelihoods of tens of millions of people, but they also sustain an astonishing wealth of wildlife, including the third greatest diversity of freshwater fishes on Earth, migratory birds, river dolphins, four species of otter and the Siamese crocodile.

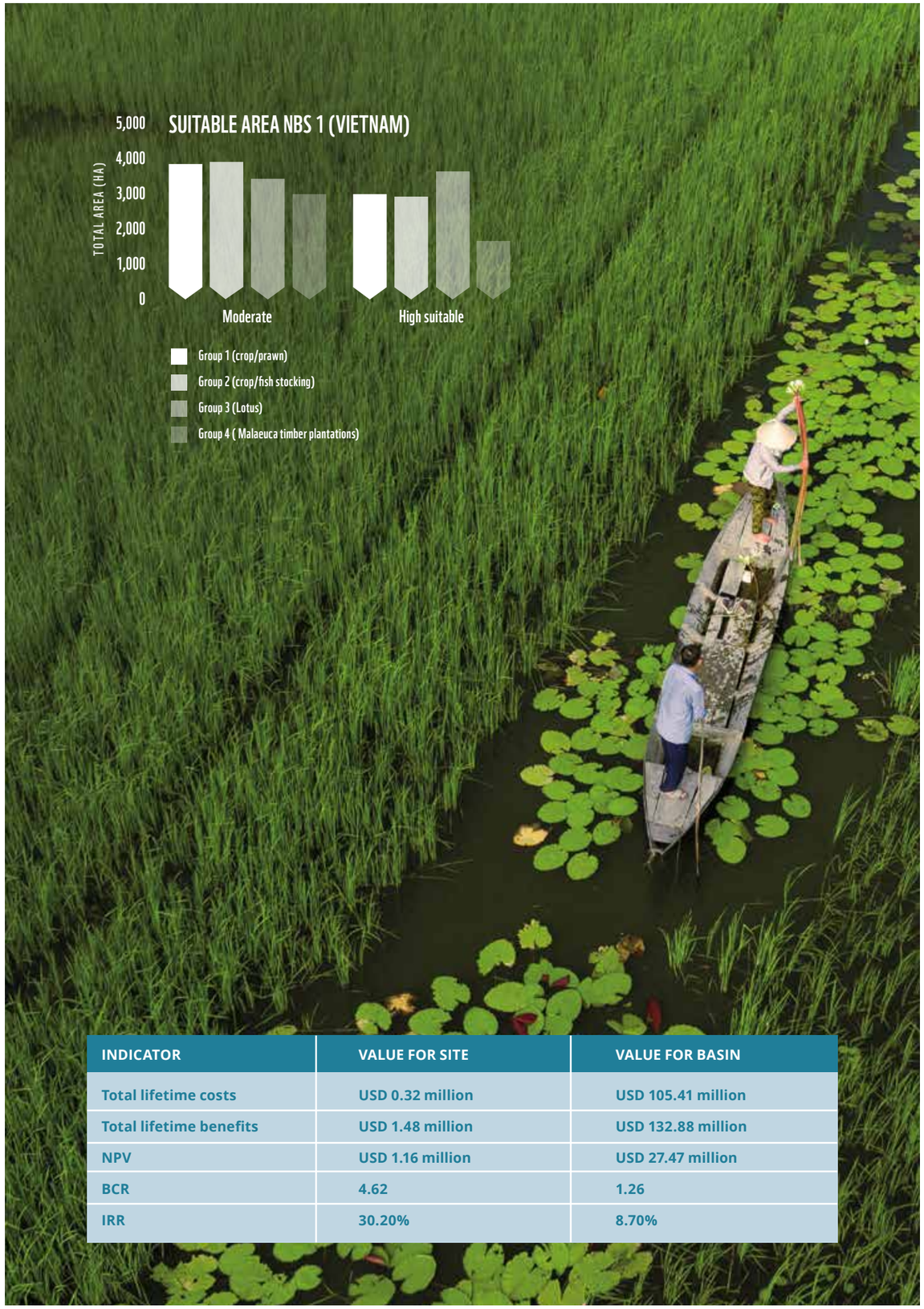
But all of this is at risk – from hydropower dams, sand mining, land-use change and unsustainable livelihood practices as well as climate change, which is disrupting the Asian monsoon's historic patterns and driving more extreme floods and droughts. Crops and aquatic ecosystems are increasingly suffering, and rural lives are being turned upside down across the Mekong basin. Indeed, the densely populated, agriculturally productive and biodiverse Delta is sinking and shrinking.

NbS have a critical role to play in the national and regional response to these challenges - and this project aims to provide the necessary data and projections to accelerate investment and implementation. There are four key aspects to this work: demonstrating the viability and cost-effectiveness of specific large scale NbS, quantifying the potential returns they offer on investment, highlighting their co-benefits, and investigating barriers to scaling them up.

The project - involving three real-world case studies, a literature review, and a series of workshops - is supplying the necessary information to answer the question '*How can Nature-based Solutions be scaled up in the Greater Mekong to benefit freshwater habitats and rural communities that rely on them?*'

The case studies cover improving natural floodplain dynamics, riverine wetland ecosystems and flooded forest ecosystems, providing technical and financial feasibility data for each one, including the total lifetime costs and benefits to the site and the entire basin, and detailing how it could be scaled up across the region with estimates of the amount of moderate and highly suitable areas for replication.

Along with detailed maps and analysis, this component of the CRxN Mekong project provides what so many people are asking for - a clear, numbers-based rationale for working with nature across the Mekong. And it's an approach that could be replicated in river basins across the globe. Find out more on its fantastic website: Scaling freshwater Nature-based Solutions in the Mekong sub-region.



INDICATOR	VALUE FOR SITE	VALUE FOR BASIN
Total lifetime costs	USD 0.32 million	USD 105.41 million
Total lifetime benefits	USD 1.48 million	USD 132.88 million
NPV	USD 1.16 million	USD 27.47 million
BCR	4.62	1.26
IRR	30.20%	8.70%

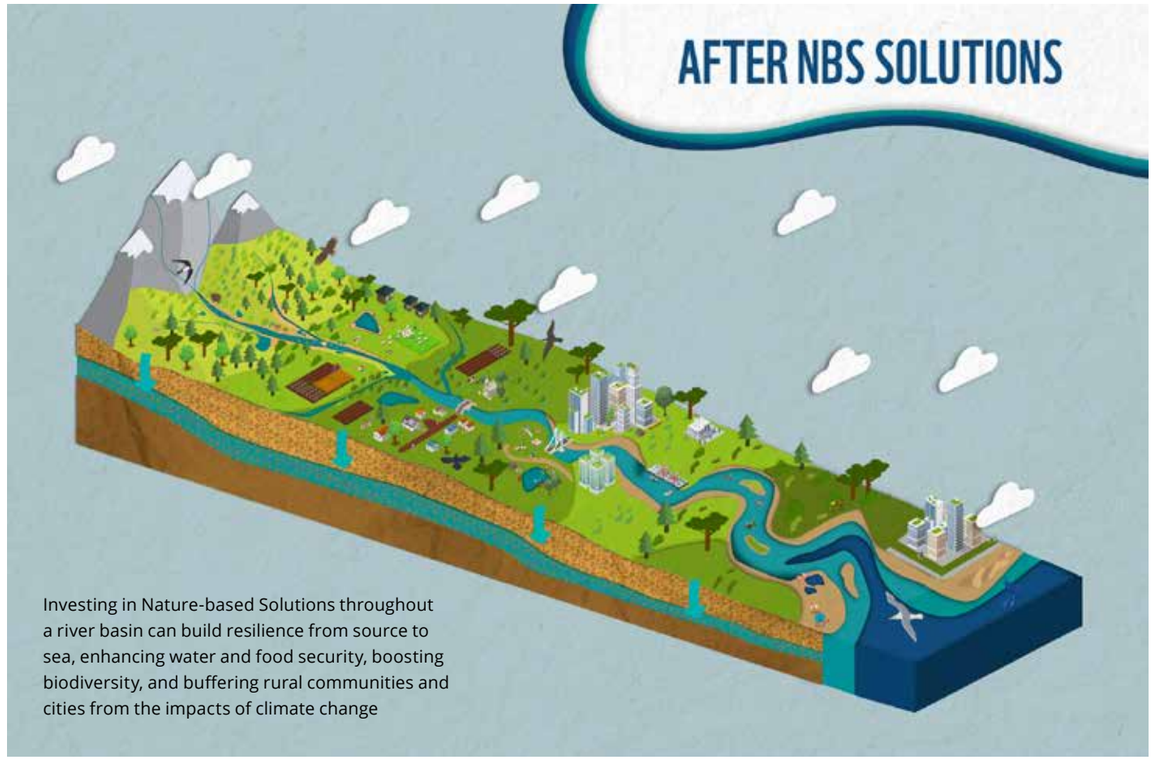
© WWF-Viet Nam / Cham Team

STUDY AREA LOWER MEKONG BASIN



WWF. Freshwater Nature-based solutions in the Sub-Mekong region. Source Google Earth

NATUREWISE: AN NBS INCUBATOR FOR EUROPE



Investing in Nature-based Solutions throughout a river basin can build resilience from source to sea, enhancing water and food security, boosting biodiversity, and buffering rural communities and cities from the impacts of climate change

Nowhere is safe from the worsening impacts of the climate crisis. While vulnerable communities and cities in the developing world are being hit the hardest despite contributing the least to global warming, the developed world is also facing increasingly deadly and destructive weather events. Just take Europe: the world's fastest warming continent has suffered a series of extreme floods and droughts in recent years, wrecking lives and livelihoods and costing EU Member States €650 billion in economic losses between 1980 and 2022.

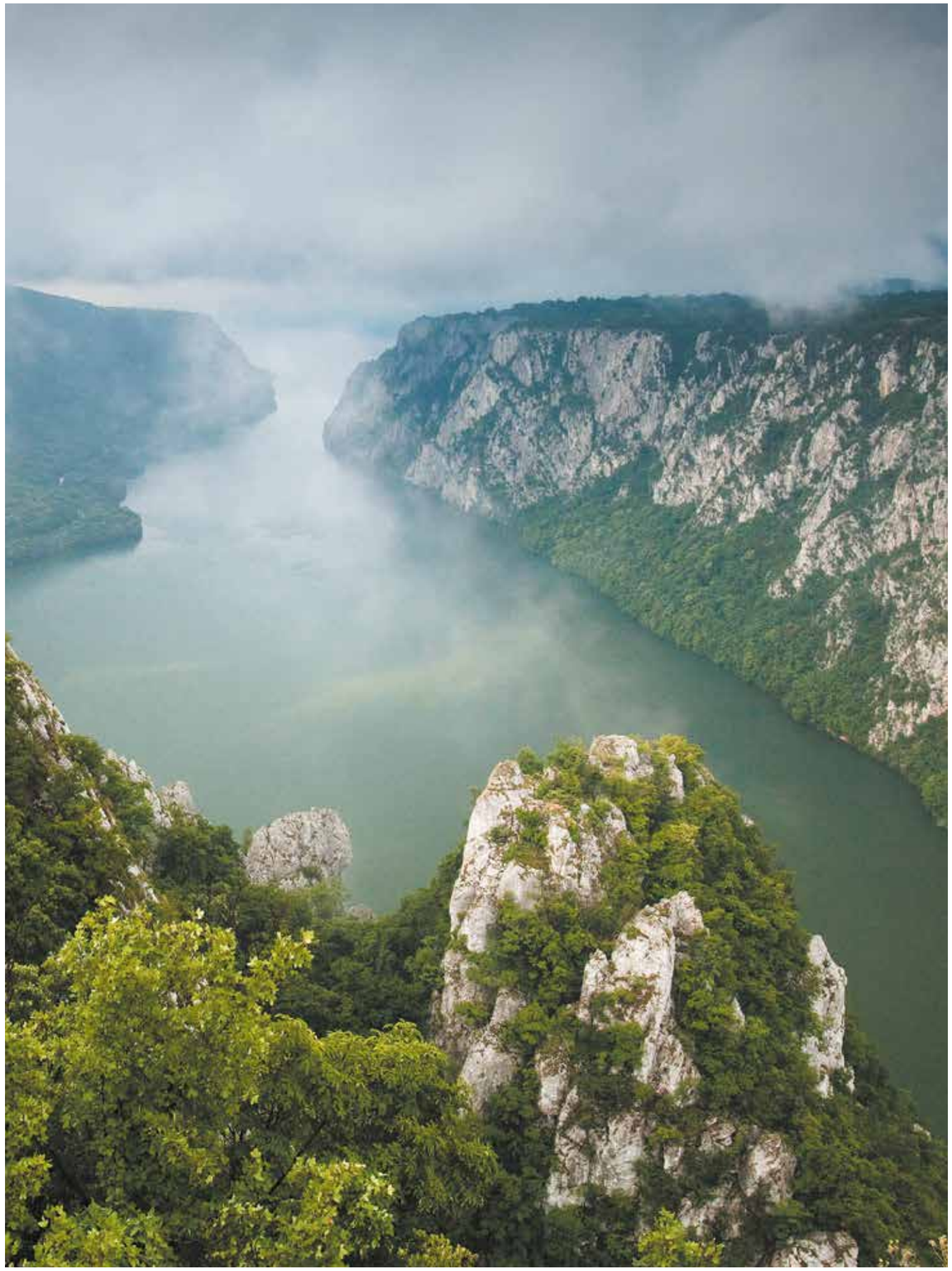
According to the last European Climate Risk assessment, the continent is unprepared for ever-intensifying climate impacts. A key reason for this is that Europe's ecosystems are so degraded: our best natural buffers against natural disasters are too unhealthy to help us. Let's just take Europe's rivers. They are the most fragmented on Earth, while only 40 per cent of the EU's water bodies are in good ecological condition. And the continent's biodiversity is in crisis. WWF's Living Planet Report 2024 found that there had been a 35 per cent decline in monitored wildlife species populations in Europe and Central Asia on average since 1970.

Clearly, there's a need for large-scale funding for NbS for climate adaptation across Europe, but investments to date have been few and far between, and there's a significant gap in financing for early-stage project development. Although there has been some progress, Europe is still mostly wedded to 20th Century solutions based on trying to control nature with concrete and hard infrastructure.

So WWF is developing NatureWise - an Incubation Facility for NbS for climate adaptation in Europe - with the prime purpose of developing transformational NbS propositions and maturing them to a level that financial institutions can take-over and bring them to financial close.

Led by WWF's Living European Rivers initiative and WWF Netherlands, this incubation facility will help to bridge the current gap on early-stage development of NbS in Europe - something that no one is focusing on at the moment - and so develop a pipeline of viable NbS for investment.

Central to this will be WWF's new four-year partnership with the European Investment Bank to collaborate in mainstreaming NbS. The EIB will provide guidance on mobilizing public and private funding for the projects designed at NatureWise - ecosystem restoration projects linked to sectors such as agriculture, energy, and urban resilience. This facility will not just be a WWF facility. It will be open to other organisations to originate projects as well because we can only deliver effective large scale change by working together. And NatureWise will



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definitely need more partners, including corporates, public bodies, academic institutions and NGOs as well from the financial sector to help kickstart the facility's work in the first three landscapes - and, of course, to fund projects in the future.

The aim is to get the facility up-and-running within a year because the climate and nature crises can't wait. And because there is an unprecedented opportunity. The EU Nature Restoration Law came into force in 2024 obliging Member States to restore 20 per cent of the continent's land and waters by 2030, including a specific objective to restore 25,000 km of rivers. Meanwhile, the new European Commission committed to launching a European Climate Adaptation Plan and a European Water Resilience Strategy.

By 2030, the aim is to create a pipeline of 10 large scale NbS programmes to accelerate climate adaptation and reverse nature loss in Europe - mobilising €0.5 billion in new green investments.

Developing a pipeline of transformational NbS and leveraging new funding for them through NatureWise will help Europe meet its targets under the Paris Agreement and Global Biodiversity Framework, as well as its own targets in the Nature Restoration Law and Climate Adaptation Strategy. Critically, it will strengthen adaptation and reduce the impact of climate change on societies and economies. And it will serve as an example for other regions - since every continent needs to incubate more NbS in the coming years.



PARTNERING TO PROTECT PEOPLE

WWF and IFRC working with nature to reduce disaster risk

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In recognition of the role that nature can play in protecting people from escalating climate change impacts, particularly weather-related disasters, WWF and the International Federation of Red Cross and Red Crescent (IFRC) joined forces to leverage Nature-based Solutions to address the climate emergency and reduce disaster risk. Along with promoting NbS and encouraging decision makers to incorporate nature into their climate adaptation and disaster risk reduction strategies, the partnership is already driving change in specific countries - collaborating on opportunities to accelerate NbS for resilience.

One example is in Zambia, where WWF Zambia and the Zambian Red Cross are working together, supported by their Dutch counterparts, to explore NbS for mitigating flood and drought risk in the Kafue Flats (a critical region for Zambia's people, economy and nature - see case study below). Combining their complimentary skills, the organisations researched various options, learned from communities and stakeholders, assessed the social, economic and environmental benefits of potential NbS and their sustainability, and developed a long list of projects, out of which between three and five will be selected for implementation.

"The project partners bring diverse expertise, experiences, best practices and lessons learnt to the table," said Wina Wina, Disaster Risk Management Lead at the Zambia Red Cross Society. "Generating evidence and insights on Nature-based Solutions, while involving communities and stakeholders at all levels, helps to approach solutions from different angles."

Meanwhile, another project is underway in the Philippines, where WWF Philippines and the Philippine Red Cross, also supported by their Dutch counterparts, are collaborating on NbS in three pilot sites to help reduce risk in a country that is increasingly vulnerable to extreme weather events, particularly typhoons. The pilots will be co-developed with local communities and other stakeholders, and will be designed to be 'bankable' to ensure continuity and long term resilience. Critically, these NbS approaches are being linked to national efforts, such as to the Philippine Government's NbS Roadmap, to ensure that NbS can be scaled up for maximum impact.

And that is a central part of all the work being done in the global partnership betweenWWF and IFRC on NbS for climate adaptation and disaster risk reduction: the projects will provide lessons for other communities and regions in each country but also for other countries struggling to adapt to the worsening impacts of climate change. The aim is to ensure that effective NbS can be replicated and scaled - benefiting societies, economies and nature across the globe. The lessons will also benefit work under WWF's global partnership with Save the Children, which includes a core pillar on NbS for climate adaptation.

But 160 years ago, that's exactly what he applied to fight the water crises that were ravaging his capital. Dom Pedro's regenerative forestry rejuvenated local watercourses, and to this day the streams and rivers of the Tijuca National Park supply part of the city.

But now it's the wider Atlantic Forest region - recognized as a global biodiversity hotspot for its incredible species richness and high rates of endemism - that urgently needs help to recover. While it's home to seven of every ten Brazilians and is responsible for generating 80 per cent of the nation's wealth, only 12 per cent of its original forest cover remains, and essential ecosystem services are breaking down.

Extreme weather events are becoming increasingly frequent and intense in the Atlantic Forest under climate change, with both prolonged droughts and torrential rains causing recurring crises in recent years. Water shortages are hitting domestic consumers, agriculture, and industry; while floods and landslides damage infrastructure and are now Brazil's main cause of disaster-related deaths. Meanwhile, waterways are being degraded by mining effluents, raw sewage, deforestation, and urban and agricultural pollution.

NbS at a landscape scale are needed to strengthen adaptation, by making the hydrological cycle more regular and improving water quality. But where do you start in such a vast area, and what do you do? A recent WWF project set out to answer that question. It divided the Atlantic Forest into 680 river basins, which were then analysed using a range of prioritization scenarios. This revealed 87 basins that were particularly suited to NbS interventions: 29 stood out for their drought risk profiles, 26 for their high flood and landslide risks, 34 for their unfavourable water balance, and 16 for their low compliance with the Forest Code.

WWF then worked to identify tried-and-tested NbS interventions suited to each priority river basin. As with all NbS, the key is to let nature do what it does best. Restoring original vegetation in watershed areas improves water quality by reducing sediment and turbidity, significantly lowering treatment costs; and it increases the soil's capacity for water storage, slowing down peak flows.

Removing artificial barriers from rivers to restore floodplain connectivity also lessens flood risks, while digging small infiltration basins increases water supplies in times of drought. Ecological restoration with native species that have lower water requirements provides important green cover while keeping more water in the soil.

All of these water-focused techniques are on the table as WWF works with communities, the Brazilian authorities and many other stakeholders to restore the health of the Atlantic Forest. Although applying NBS on this scale will require serious levels of investment, if we do it right the returns will be even greater. The consequences of doing nothing, by contrast, are unaffordable.

RIVER BASINS READY FOR RESTORATION ACROSS THE ATLANTIC FOREST

When Brazil's Emperor Dom Pedro II declared that the forests surrounding Rio de Janeiro should be protected and that native vegetation should be restored, he did so long before anyone had heard of the term 'Nature-based Solution'.

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FUNDING KAFUE FLATS WILL BE REPAID IN WATER, FOOD, ELECTRICITY AND BIODIVERSITY

Zambia's Kafue Flats form a spectacular mosaic of wetlands, grasslands and woodlands that provide critical habitat for a diverse array of plants and animals, including several endangered and endemic species.

But the health of this Ramsar site, which incorporates two National Parks, is not just vital for biodiversity, it is also absolutely critical for the people of Zambia. But its health is declining due to human activities and the increasing impacts of the climate crisis.

Currently, the Kafue Flats support the livelihoods of a million people, provide nearly half the water supply for the capital city, Lusaka, and hydropower from the Kafue Dam supplies 50 per cent of Zambia's electricity - most of which powers copper mining, the country's most important industry. Those are more than enough reasons to be concerned about the degradation of this ecosystem but it also happens to irrigate 90 per cent of Zambia's sugar crop, supports the country's highest density of livestock and produces 7 per cent of its total fisheries output.

The functioning of the ecosystem is largely dependent on the natural, seasonal flooding of the Kafue River, which brings not only water but also sediments and nutrients to nourish the Flats. However, as is the case in so many vital ecosystems worldwide, the Kafue Flats are being pushed to the limit. Rising temperatures, changing rainfall patterns, and more frequent and severe droughts and floods coupled with human modifications, including land-use changes, dams and other infrastructure, have had significant impacts on the water flow and overall health of the ecosystem.

This has been exacerbated by the deterioration of the Lukanga Swamps upstream - another Ramsar site - where unsustainable activities, including deforestation for charcoal, is impacting the natural flow of water and sediments to the Kafue Flats. Meanwhile, riverbank cultivation, illegal sand mining, indiscriminate tree-felling and unsustainable extraction of water for domestic and commercial use have reduced the flow of the Magoye river, which flows into the Kafue Flats - except it no longer does during the dry season. Add in the intensifying impacts of climate change and it's clear that the health of the Kafue Flats will continue to worsen, threatening its irreplaceable benefits for people and nature - if urgent, transformative action is not taken.

Restoring the natural balance of the Kafue Flats is the only way to ensure they'll continue to provide their wide array of critical ecosystem services. In consultation with the Zambian government, WWF has begun a 1.5 year 'proof of concept' project to restore riparian zones in an effort to combat soil erosion and improve water quality. As well as interventions to regenerate selected wetland areas, the project entails collaborating closely with local communities, directly involving them in efforts to curb unsustainable practices, develop alternative livelihoods and restore ecosystems.

If the first stage of the project unfolds as anticipated, work will then be expanded to four or five other landscapes and riverscapes, where these approaches can be replicated and scaled up. It's essentially a blueprint for national restoration and regeneration, showing how NbS for rivers and wetlands can play a central role in accelerating climate adaptation and delivering a more sustainable future for Zambia.



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CONCLUSION

WORK WITH NATURE RATHER THAN AGAINST IT TO ACCELERATE ADAPTATION

At a time when most of the news about the climate crisis and nature loss seems unremittingly bleak, the inspiring stories in this report remind us that there is hope and that solutions exist. Each case study highlights the diverse benefits for people, nature and climate if we work with nature rather than against it. They demonstrate that we can help societies, economies and ecosystems adapt to the worsening - primarily water-related - impacts of climate change.

Covering a variety of WWF projects from source to sea - from restoring watersheds to reconnecting floodplains, resuscitating mangroves to rebuilding resilience in deltas, this report shows that Nature-based Solutions are critical to ensuring a liveable and sustainable future. They prove that by collaborating with partners and with nature, we can turn the tide, strengthening climate adaptation and building long term resilience.

But they also highlight the key challenges: the massive funding gap for adaptation in general and the lack of investment for large scale Nature-based Solutions in particular. These case studies are making a difference but to really transform national and global efforts to accelerate climate adaptation, the world needs to urgently and drastically ramp up investments in NbS for freshwater and coastal ecosystems. And there is no time to waste.

300 BILLION REASONS TO INVEST IN ADAPTATION

The Paris Agreement recognized that adaptation is a global challenge faced by all, so it established a Global Goal on Adaptation – to enhance adaptive capacity, strengthen resilience, and reduce vulnerability to climate change. This obliges parties to formulate and implement National Adaptation Plans, which must be periodically updated. But implementation needs serious investment, as well as alignment of national budgets with climate adaptation needs – and neither adaptation nor NbS have so far been treated with the importance and urgency they need. Even where countries have realistically assessed their long-term adaptation needs, huge implementation gaps remain due to a lack of finance.

There was an increase in international public adaptation finance flows to developing countries from US$22 billion in 2021 to US$28 billion in 2022, which reflects progress towards the Glasgow Climate Pact for doubling adaptation finance to US$38 by 2025. However, it still falls vastly short of what is required. UNEP's 2024 Adaptation Gap report estimated that the adaptation finance gap is between US$187-359 billion per year. Unsurprisingly, the IPCC warns that current global adaptation measures are insufficient and we are not adapting fast enough to the climate crisis. Sadly, the proof is clear in the daily stories about the damage inflicted by droughts, floods, fires and storms.

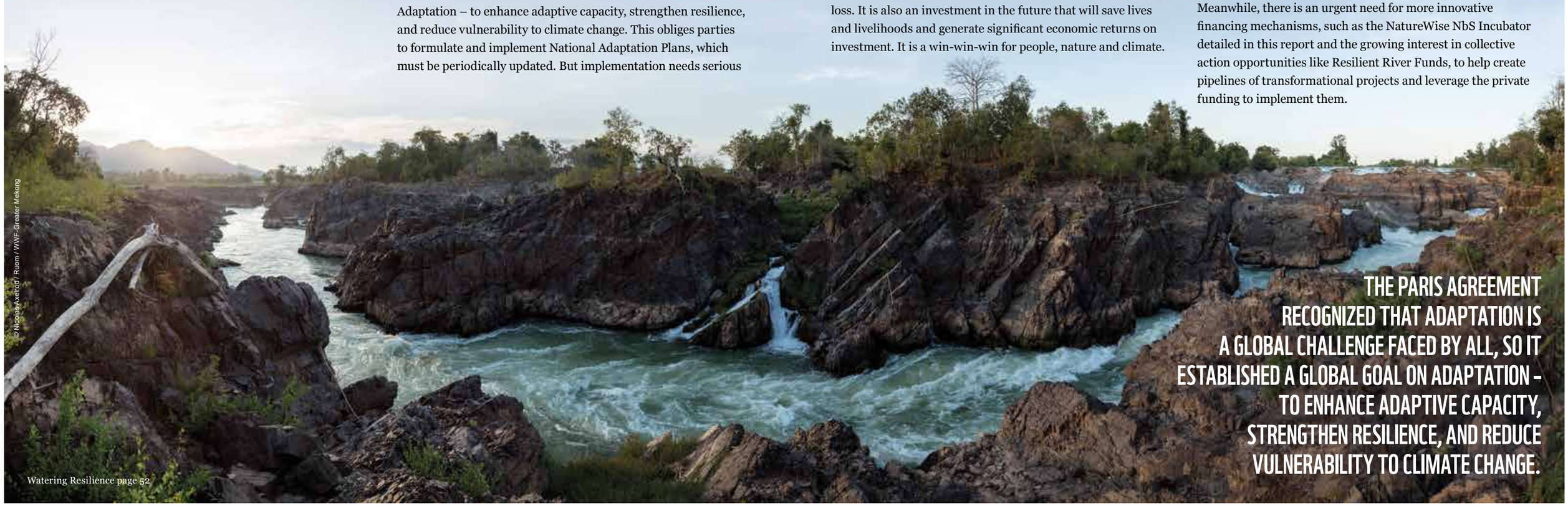
That's why WWF is calling for a step change in ambition: we need to scale up public climate finance for adaptation to US$300 billion per year, and ensure that a significant proportion of the extra funds are earmarked for Nature-based Solutions - given all the co-benefits for people and nature and the reduced risk of maladaptation. This sounds like a huge amount of money but it's far less than the subsidies that countries are paying to support activities that further fuel climate change, including US$7 trillion in fossil fuel subsidies, and drive greater nature loss. It is also an investment in the future that will save lives and livelihoods and generate significant economic returns on investment. It is a win-win-win for people, nature and climate.

PRIVATE SECTOR NEEDS TO BANK ON NATURE TO BUILD RESILIENCE

Investing in Nature-based Solutions also promises big wins for business and finance. Healthy ecosystems are the best natural insurance against the impacts of climate change - the extreme floods swamping supply chains and drowning factories, the devastating droughts stranding assets and operations. Companies and financial institutions are finally waking up to water and to the fact that the climate crisis is a water crisis. But they are still not doing nearly enough to adapt to today's impacts - let alone the worsening impacts to come. Many are making significant progress on reducing emissions to help mitigate climate change, but far too few are investing in efforts to strengthen adaptation and resilience.

Governments alone cannot accelerate climate adaptation as drastically and rapidly as necessary. The private sector must also throw its financial weight behind climate adaptation. Companies need to scale up collective action to build resilience in river basins, buffering their supply chains and operations, while also supporting more resilient societies. This involves not just investing in projects but advocating for action and policy changes by governments to underpin Nature-based Solutions for climate adaptation. An enabling environment is key to support an expansion in funding, so policies that lay the foundation for credible green investments should be implemented and supported.

Meanwhile, there is an urgent need for more innovative financing mechanisms, such as the NatureWise NbS Incubator detailed in this report and the growing interest in collective action opportunities like Resilient River Funds, to help create pipelines of transformational projects and leverage the private funding to implement them.



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THE PARIS AGREEMENT RECOGNIZED THAT ADAPTATION IS A GLOBAL CHALLENGE FACED BY ALL, SO IT ESTABLISHED A GLOBAL GOAL ON ADAPTATION – TO ENHANCE ADAPTIVE CAPACITY, STRENGTHEN RESILIENCE, AND REDUCE VULNERABILITY TO CLIMATE CHANGE.

POWER OF PRINCIPLES

Given the scale of the climate crisis, there will need to be some trade-offs in the rush to accelerate climate adaptation. The world must invest in the best mix of solutions, including 'grey' and 'green' infrastructure. But countries and companies should make these trade-offs in radically new ways, accounting for the many co-benefits of NbS, as well as internalising the costs and impacts of alternatives. The key to designing adaptation measures and deciding what to invest in comes down to five principles, which will help accelerate action and avoid maladaptation:

- Harness the power of nature first to help people adapt, in order to maximise all the co-benefits that come with Nature-based Solutions;
- Avoid harming nature when planning and implementing adaptation measures;
- Help nature adapt to climate change by enhancing ecosystem connectivity and natural dynamics for strengthened resilience;
- Support the most vulnerable groups first by providing support to communities that are most exposed to climate risks and with the least resources to adapt; and
- Work at system scale, based on science, to build resilience to climate change.

RISING TO THE FRESHWATER CHALLENGE

Currently, NbS are invariably small scale and disconnected. It is critical to start thinking and implementing NbS at a larger, river basin and landscape scale - to integrate, substantiate and accelerate action. Which is exactly what the Freshwater Challenge has been designed to do.

Country-led, the Freshwater Challenge is the largest freshwater restoration and protection initiative in history - with the aim of ensuring that 300,000km of degraded rivers and 350 million hectares of degraded wetlands (including mangroves) are under restoration by 2030, and conserving intact freshwater ecosystems. Launched at the UN Water Summit in March 2023 by six countries in the Global South, the initiative now boasts 47 Country Members as well as the European Union – primarily because of the importance of the role of healthy freshwater ecosystems in adapting to the worsening water-related impacts of climate change.

With momentum building behind the Challenge, it's time for other countries to join the initiative and then to assess and prioritise their rivers and wetlands for protection and restoration - and secure the funding necessary to achieve these national targets. Prioritizing rivers and wetlands helps countries fulfil their commitments under the Paris Climate Agreement, the Kunming-Montreal Global Biodiversity Framework, Ramsar and other global conventions. Most importantly, it ensures their societies and economies are more resilient and sustainable. And at the heart of this will be greater investment in Nature-based Solutions.

HARNESSING THE POWER OF NATURE

We need to prioritise Nature-based Solutions. And we need to start right now. The slower we move and the longer we leave it to invest in nature, the higher the price of climate adaptation will be – and the higher the cost to our communities and societies. Delaying is a lose-lose situation, an entirely false economy.

And Nature-based Solutions work. There is no more need for pilot projects. Nor more proof that they make a difference: they clearly do. As the stories in this report show in so many different ways, nature can be humanity's strongest ally against the worsening impacts of climate change: embracing its power is the only wise way forward for people and planet.

What we need to do is to trust in the power of nature to buffer us from the intensifying natural disruptions and disasters fuelled by climate change. What we need to do is to focus on redirecting funding into transformational NbS for climate adaptation. This is how we turn the tide. This is how we restore the natural health and dynamism of freshwater and coastal ecosystems - to power us towards a resilient, nature-positive and sustainable future.

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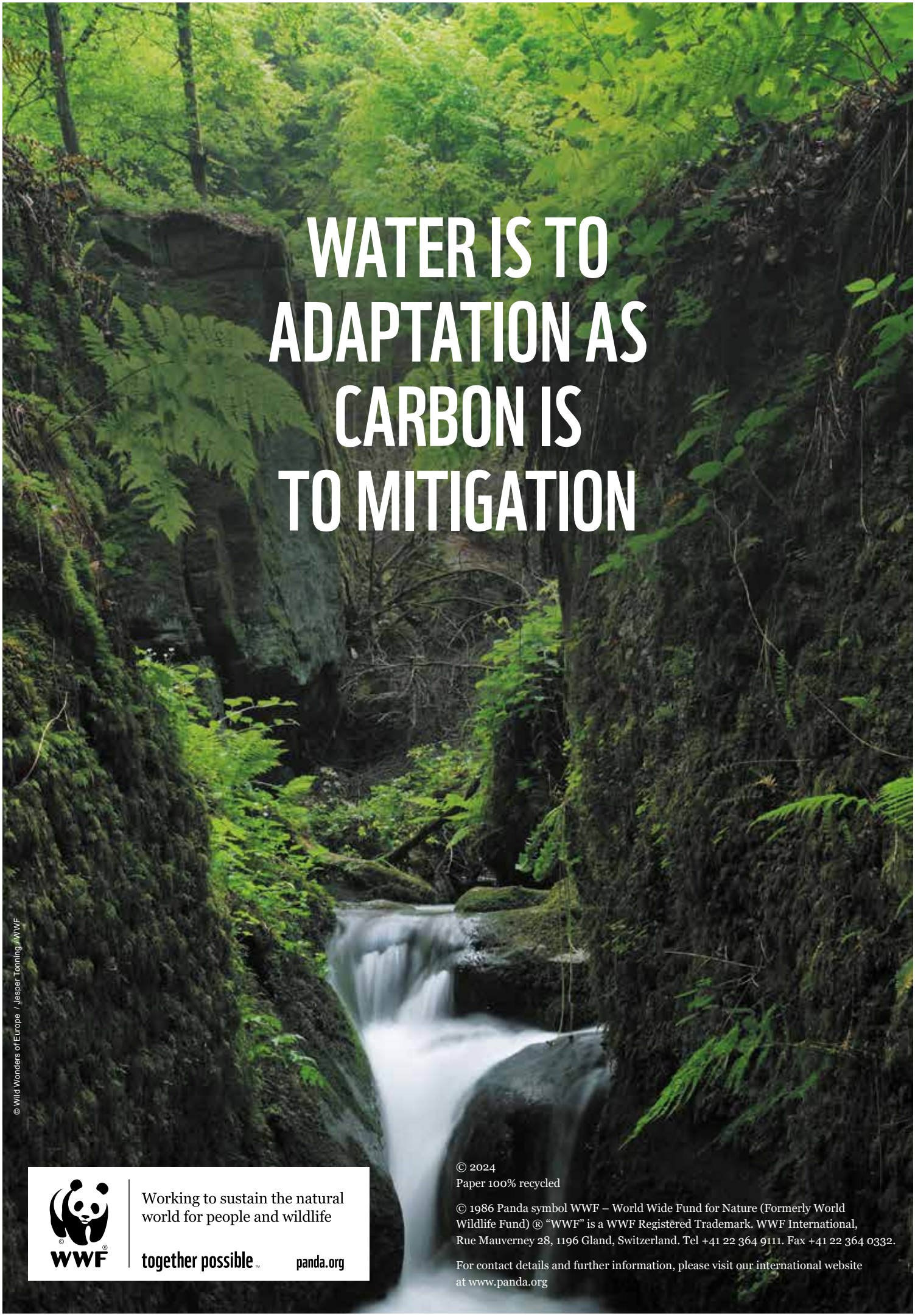
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