



WWF

10 RIVERS AT RISK

HYDROPOWER DAMS THREATEN DIVERSE BENEFITS
OF FREE FLOWING RIVERS



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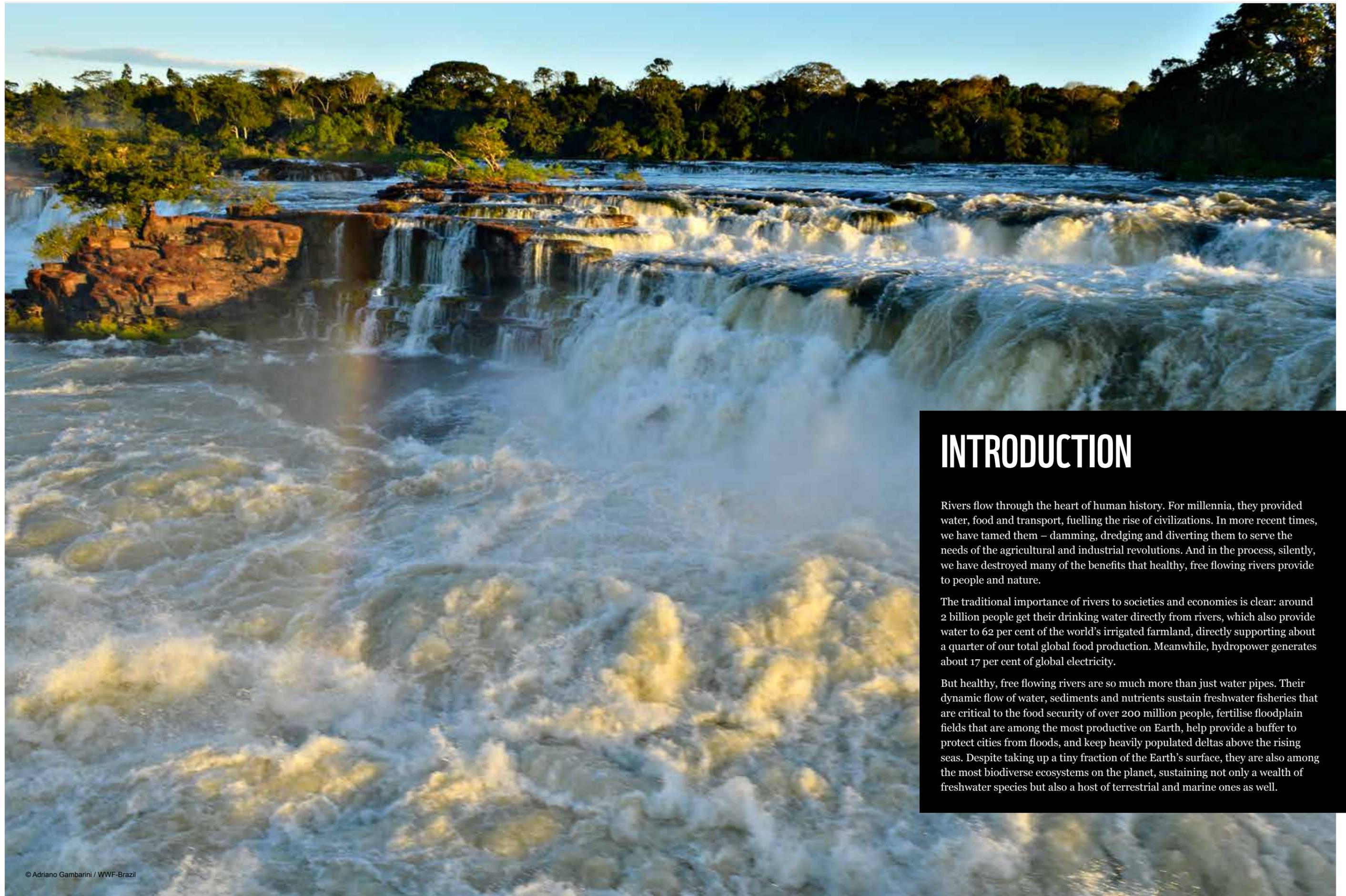
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INTRODUCTION

Rivers flow through the heart of human history. For millennia, they provided water, food and transport, fuelling the rise of civilizations. In more recent times, we have tamed them – damming, dredging and diverting them to serve the needs of the agricultural and industrial revolutions. And in the process, silently, we have destroyed many of the benefits that healthy, free flowing rivers provide to people and nature.

The traditional importance of rivers to societies and economies is clear: around 2 billion people get their drinking water directly from rivers, which also provide water to 62 per cent of the world's irrigated farmland, directly supporting about a quarter of our total global food production. Meanwhile, hydropower generates about 17 per cent of global electricity.

But healthy, free flowing rivers are so much more than just water pipes. Their dynamic flow of water, sediments and nutrients sustain freshwater fisheries that are critical to the food security of over 200 million people, fertilise floodplain fields that are among the most productive on Earth, help provide a buffer to protect cities from floods, and keep heavily populated deltas above the rising seas. Despite taking up a tiny fraction of the Earth's surface, they are also among the most biodiverse ecosystems on the planet, sustaining not only a wealth of freshwater species but also a host of terrestrial and marine ones as well.

But these 'hidden' benefits have invariably been undervalued and overlooked by decision makers – until, that is, they are lost. Healthy rivers are now the exception rather than the rule. The clearest sign of the damage we have done - and are still doing - is the shocking decline in freshwater biodiversity. Over the past 50 years, freshwater species populations have collapsed by 84 per cent on average.

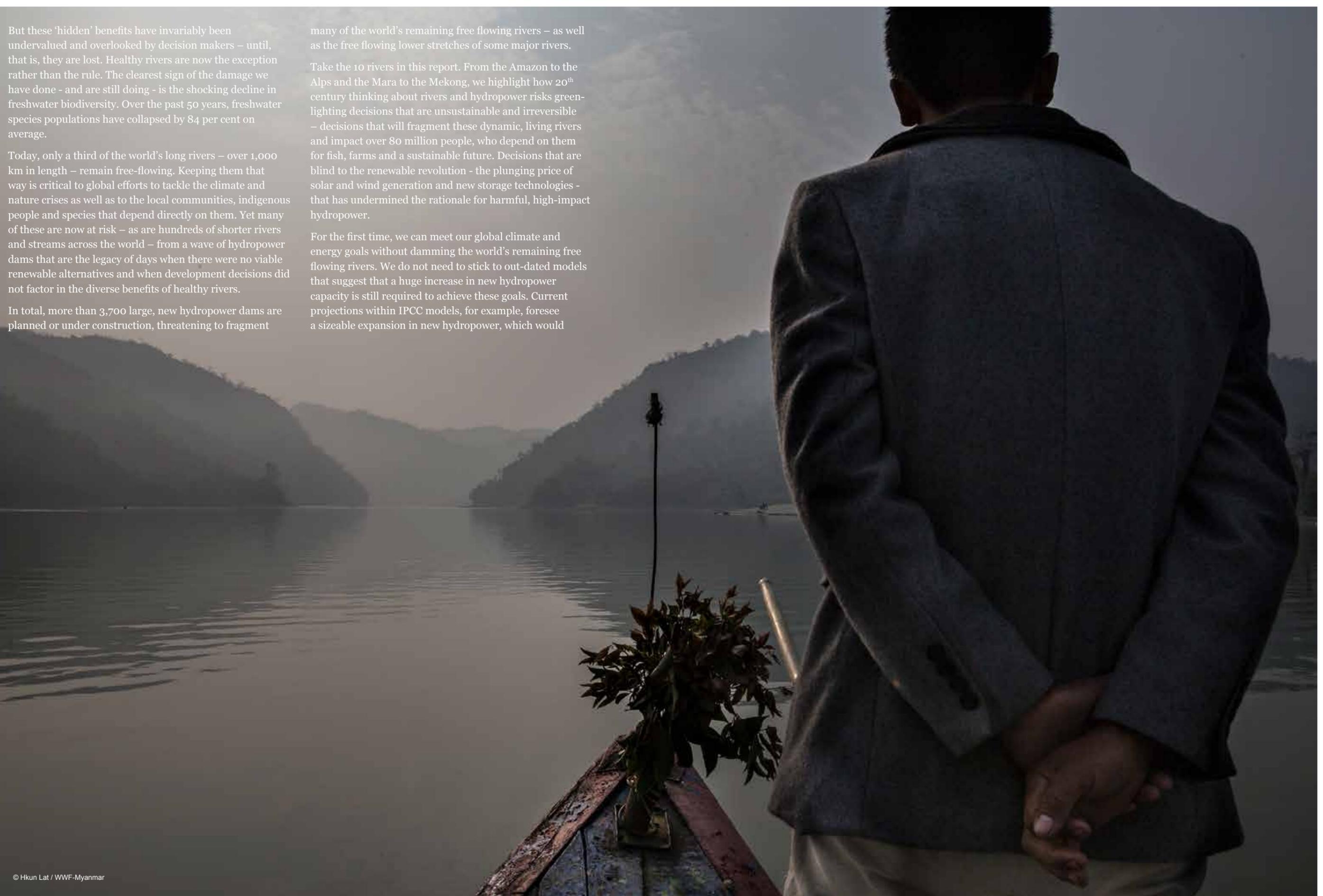
Today, only a third of the world's long rivers – over 1,000 km in length – remain free-flowing. Keeping them that way is critical to global efforts to tackle the climate and nature crises as well as to the local communities, indigenous people and species that depend directly on them. Yet many of these are now at risk – as are hundreds of shorter rivers and streams across the world – from a wave of hydropower dams that are the legacy of days when there were no viable renewable alternatives and when development decisions did not factor in the diverse benefits of healthy rivers.

In total, more than 3,700 large, new hydropower dams are planned or under construction, threatening to fragment

many of the world's remaining free flowing rivers – as well as the free flowing lower stretches of some major rivers.

Take the 10 rivers in this report. From the Amazon to the Alps and the Mara to the Mekong, we highlight how 20th century thinking about rivers and hydropower risks green-lighting decisions that are unsustainable and irreversible – decisions that will fragment these dynamic, living rivers and impact over 80 million people, who depend on them for fish, farms and a sustainable future. Decisions that are blind to the renewable revolution - the plunging price of solar and wind generation and new storage technologies - that has undermined the rationale for harmful, high-impact hydropower.

For the first time, we can meet our global climate and energy goals without damming the world's remaining free flowing rivers. We do not need to stick to out-dated models that suggest that a huge increase in new hydropower capacity is still required to achieve these goals. Current projections within IPCC models, for example, foresee a sizeable expansion in new hydropower, which would



fragment another 260,000km of river, with more than 70 per cent of new development taking place in highly productive and biodiverse river basins. But these forecasts underestimate the impact of the renewable revolution.

Wind and solar power have improved dramatically in efficiency terms in recent years, while their prices have plummeted. In many cases, solar is now the cheapest form of generation – and costs are expected to keep on falling. It is now possible for countries to create power grids that are low carbon, low cost and low conflict with rivers and communities – a LowCx3 approach that would avoid up to 90 per cent of potential hydropower-related river fragmentation and offers a brighter future for people, nature and climate.

This renewable revolution means the world could keep global warming below 1.5C and provide power to the billion people who currently lack access to electricity without sacrificing the diverse benefits of free flowing rivers, like the Irrawaddy, Kavango, Tapajos and Vjosa – or the other six rivers at risk in this report. But it will require countries, developers and investors to accelerate the renewable revolution, rather than sticking with the unsustainable status quo.

In some regions, hydropower may play a role in LowCx3 power systems, particularly in helping to balance the intermittent power supplies of wind and solar, and in countries which suffer low electricity access. In others, like Europe which already boasts the world's most fragmented rivers, new hydropower should not be part of the energy mix. Overall, the challenge now is to avoid giving the go ahead to the type of poorly-planned, harmful hydropower projects detailed in this report.

Renewable alternatives could replace the generating power of the proposed Myitson dam on the Irrawaddy river: there will never be any way to replace the sediment, fisheries and other ecosystem services that would be lost if the destructive dam were built. The benefits of a free flowing Sepik river – the most biodiverse in Papua New Guinea - are more valuable to the 400,000 people who depend on it than the promised riches from a mine that a planned hydropower dam would fuel: riches that would end up in the pockets of people far from Sepik. At the other end of the scale, small hydropower projects on the much shorter (and glacial) Isel river in the Austrian Alps will provide negligible additional power in exchange for substantial social and environmental costs. In South America, the combined impact of numerous small dams in its headwaters threaten the natural water flow that is the lifeblood of the Pantanal, the world's largest tropical wetland – the health of which is critical to local communities and distant cities as well as home to over 4,000 species.

Or take the dam on the Tapajos, one of the most important tributaries of the Amazon: it would block

fish migration routes, threatening the future of freshwater fisheries that are vital to local communities and indigenous people as well as food for endangered river dolphins. Or planned dams on the Mara River in Kenya that would impact over 1 million people downstream as well as the world's best known wildlife migration. Or an utterly unnecessary hydropower scheme on the lower Vistula in Poland, which would seal the fate of the entire basin once and for all. Or a proposed dam on Angola's Kavango River, which would threaten the future of the Okavango Delta World Heritage Site – and the extraordinary biodiversity that depends on it and which sustains local communities and fuels Botswana's tourism industry.

The global climate and nature crises pose an existential threat to our future. Continuing to adhere to 20th Century energy 'solutions' is a recipe for disaster. Such as damming Europe's last free flowing river – the Vjosa in Albania – to produce a negligible amount of power. 21st Century thinking would opt for sustainable renewable alternatives, while transforming this spectacular river into a National Park rather than yet another dam-choked river in Europe. LowCx3 thinking would also avoid a series of new hydropower dams on the lower Mekong in Laos, which would threaten the world's largest freshwater fishery and the resilience of the downstream delta. Already the Mekong delta is sinking or shrinking due to a lack of sediment flowing down South East Asia's mightiest river. New dams on the mainstem would trap even more sediment, and speed up the erosion of the delta, putting at risk one of the region's richest rice baskets, thriving economies, and the homes and livelihoods of millions.

High impact hydropower projects like these will provide profits to developers and their political and business allies in the short term – with rivers, communities and nature





paying the long term price. Companies and supply chains that depend on healthy rivers will also be left to count the cost. As, increasingly, will insurers. Already prone to greater schedule delays and cost overruns than other renewable power projects, hydropower dams in many areas will become increasingly risky due to the impacts of climate change. More intense droughts will cut power generation, while more extreme storms and rainfall could threaten the structural integrity of dams themselves.

The good news is that we are not locked into this path yet. We can still opt for a brighter future by ensuring that countries pursue the best overall LowCx3 energy mix for each situation, which will involve taking a system-wide approach and factoring the benefits of healthy rivers and the realities of the renewable revolution into development decisions. This would help to save the 10 rivers in this report – and many others around the world - for the benefit of people and nature.

In some situations, low impact hydropower - including modernising existing plants, adding turbines to storage dams and LowCx3 pumped storage - will still be part of the best overall energy mix. Mexico has already announced that it will not build new hydropower dams but will still be able to generate more power by investing in refurbishing and retrofitting existing dams.

However, new hydropower developments should avoid free

flowing rivers and protected areas – where 500 hydropower dams are currently planned. It's also well past the point when public subsidies should be handed out to harmful hydropower, particularly small hydropower projects in Europe that are unnecessary and invariably only viable because of the subsidies. Indeed, in Europe, it's actually time to invest in the very opposite approach – in removing obsolete hydropower dams, which is a proven way to bring life back to the continent's dying rivers.

Indeed, these are both key pillars of the Emergency Recovery Plan for freshwater biodiversity: keep rivers free flowing and restore natural flows whenever possible. It is critical for this plan and indicators to track rivers' status to be incorporated into the new global framework for nature to be agreed at the Convention on Biological Diversity conference in China in 2022 – and for countries to then live up to their commitments. This would turn the tide, bending the curve of freshwater biodiversity from decades of decline upwards towards recovery and a nature-positive and resilient future. It would also boost global efforts to adapt to the worsening impacts of climate change since free flowing rivers and healthy, connected floodplains are critical to building resilience, particularly in the world's increasingly vulnerable deltas.

And it would make it very hard for governments, developers and investors to plough ahead with the harmful hydropower projects that loom over the 10 rivers at risk in this report.

SAVE THE SEPIK

“It is our identity, our life, and the heartbeat of our culture. A life without the Sepik River as we know it would devastate our communities forever.” — Emmanuel Peni, community campaigner

From its source in Papua New Guinea’s northern, cloud forested mountains, the Sepik river winds its way eastwards over 1,120km down to the sea through tropical rainforest and lowland mangroves, diverse habitats of global significance for biodiversity - and life-sustaining importance for local communities.

With 1,500 lakes and other associated wetlands, the Sepik is the longest free flowing river system in PNG. It is also one of the largest and most intact freshwater basins in the whole of the Asia Pacific region, encompassing two Global 200 ecoregions, three endemic bird areas and three centres of plant diversity. The Upper Basin came close to being nominated for World Heritage status in 2006, while the river was proposed as a Ramsar Wetland of International Importance in 2017.

Although the Sepik basin is one of the least developed areas in PNG, it’s nevertheless home to some 430,000 people, who depend almost entirely on products from the river and its surrounding forests for their livelihoods. The Sepik River provides them with food, water for drinking, washing and transport, and it fertilizes its banks that sustain fruit and vegetable gardens, and plantations of sago and tobacco. The local economy is built on the sale of sago, fish, freshwater prawns, eels, turtles, and the eggs, skins and meat of croco-

diles. In a richly diverse region in cultural terms – more than 300 languages are spoken in an area the size of France – the river is at the beating heart of every village.

But PNG’s rich natural resources could now prove disastrous for the people of the Sepik River. PanAust – an Australian-registered but actually Chinese-state-owned company – is on the point of



beginning development of the largest mine in the country and one of the largest in the world to get at the region’s deposits of copper, silver and gold.

The giant plan on the Frieda river, a major tributary of the Sepik, includes the open-pit mine itself as well as a hydro-power plant, power grid, and road, air and seaport construction. It also includes a tailings dam (where mining waste and toxic by-products are stored) two and a half times the size of Sydney harbour.

With estimated annual revenues of US\$1.5 billion for the next 30 years, it’s not hard to see why PanAust and its backers want the project to go ahead. Although it’s less obvious why the government would since tax concessions and the company’s complex, foreign ownership structure means that the people of PNG will see little of that - the people of the Sepik even less. Meanwhile, local communities will bear the brunt of the social and environmental impacts.

Opponents warn that the mine would be a disaster waiting to happen: in an area of high seismic activity and extreme rainfall, the chances of damage to the tailings dam are high – yet PanAust’s Environmental Impact Statement

lacked any information or analysis on the possibility of a dam break. Running mining activities over an area of some 16,000 hectares within the Sepik river basin will devastate the local region even without the possibility of a catastrophic dam break. The hydropower dam needed to run the mine will severely impact the natural flow of the Sepik that is critical for people and nature downstream, and the toxic chemicals from the mineworks could poison the river.

The United Nations was so concerned about the proposed development that 10 special rapporteurs looked into it. They came away voicing “serious concerns” that “the project and its implementation so far appears to disregard the human rights of those affected”. Free prior and informed consent has been ignored.

Heading the campaign for a total ban on the mine development are the people of the Sepik River themselves, who have come together to campaign to Save The Sepik. In an unprecedented move, chiefs from 28 *haus tambarans* – ‘spirit houses’ that are the cultural and political hub of villages in the region – representing 78,000 people issued a collective Supreme Sukundimi Declaration demanding an end to the project.

“We have gathered together as Guardians of the River to stand firm as one,” said the Chiefs. “The Sepik River is not ours. We are only vessels of the Sepik Spirit that dwells to protect it. We will guard it with our lives.”

MEKONG BLUES

The Mekong – flowing nearly 5,000km from the Tibetan plateau to the sea – is one of the world’s great rivers. Home to over 1,000 fish species, the lower Mekong supports one of the world’s largest and most productive freshwater fisheries, yielding around 2 million tonnes of fish per year. What’s more, the Mekong delta is the rice bowl of Viet Nam with its fertile fields - nourished by the sediment carried downstream by the natural cycles of the river - producing around half of the country’s total rice harvest.

It’s hard to overstate quite how important a healthy, free flowing lower Mekong is to the 60 million people who live there. Fish are the cheapest source of animal protein in the region, and more than two-thirds of the population of the lower basin benefit from wild capture fisheries. Meanwhile, rice provides around 75 per cent of the Vietnamese population’s daily calories as well as significant export income.

But all this is under threat from four large hydropower dams, which Laos plans to build across the main channel of the river.

Laos wants to use hydropower to become the ‘battery of Southeast Asia’, selling electricity across the border to Thailand and other states. It has constructed more than 50 hydropower dams in its portion of the Mekong basin over the past 15 years, and a further 50 are under construction around the country. One of the most controversial dams - Xayaburi on the Mekong’s mainstem - is already operational.

The proposed new dams would devastate the downstream fisheries and fields that so many people rely on, not to mention the threat they would pose to critically endangered species, such as the Mekong’s 89 surviving river dolphins and the Mekong Giant catfish. One of the dams would also negatively impact the World Heritage site of Luang Prabang.

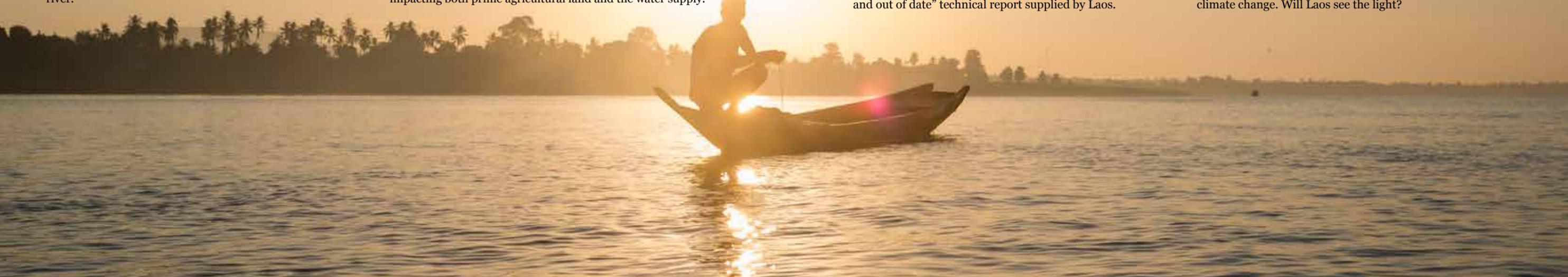
A two-year drought in the region underlined the stress that the Mekong is experiencing – fishers say their stocks have fallen dramatically, while depleted sediment flows have increased the risk that river banks, buildings, roads, bridges and farm land will collapse and that saltwater will intrude ever further, impacting both prime agricultural land and the water supply.

Indeed, stretches of the famously muddy Mekong have turned blue in recent years. To some, it may look beautiful but a healthy Mekong should be brown with sediment. The delta is already sinking and shrinking because existing dams on the upper Mekong and unsustainable sand mining have slashed the amount of sediment reaching the delta. Building all the planned dams on the Mekong could see the sediment supply reduced to just 10 per cent of natural levels. Coupled with excessive groundwater abstraction and sea level rise due to climate change, this could result in half of this great delta disappearing under the waves by the end of the century.

The irony of all this is that Laos can’t afford to build these dams, and the ‘battery of SE Asia’ may turn out to be irrelevant and unused. Between them, the dams on the main channel of the Mekong will cost around US\$12.5 billion. With a GDP of only US\$18 billion, Laos will have to fund the construction through bank debt – and Laos has already lost control of its national power grid, after its sovereign reserves fell during the Covid pandemic. At the same time, demand in Thailand has slumped and it has not confirmed that it will purchase any of Laos’ electricity. Thailand has also raised multiple concerns over the environmental impacts of the US\$2 billion Sanakham dam, flatly rejecting the “insufficient and out of date” technical report supplied by Laos.

What’s more, just across the border, Cambodia has demonstrated that another path is possible. In 2020, the government imposed a 10-year moratorium on dams on the mainstem, halting plans to construct the controversial Sambor and Stung Treng hydropower projects. This widely praised decision seems to have been partly based on the devastating impact that the proposed dams would have had on the river’s hugely productive fisheries – fisheries that feed millions of people in Cambodia and Viet Nam. Subsequently, Cambodia has joined other states in the region, including China, Thailand and Viet Nam, in pumping more investment into solar power.

But Laos seems intent on carrying on dam construction, without factoring in the impact the new dams will have not only on the people of Laos but even more so on communities and countries downstream. Cambodia has shown that the days of building new hydropower dams on the Lower Mekong’s mainstem are - or should be - over. There are renewable alternatives now that will not threaten irreplaceable fisheries or help speed up the sinking and shrinking of the delta. Keeping the lower Mekong free flowing is the best and most cost effective adaptation strategy for a region that is one of the most vulnerable in the world to climate change. Will Laos see the light?



KEEP MYANMAR'S LIFEBLOOD FREE FLOWING

Few nations on Earth rely on a river as much as Myanmar relies on the mighty Irrawaddy – one of the last two, long, free flowing rivers in Southeast Asia.

Starting at the confluence of the N'mai and Mali rivers, themselves fed by the glaciers of the Himalayas, it flows over 2,000km from north to south and passes through 12 diverse ecoregions to its delta on the Andaman Sea. On the way, it provides diverse values that underpin Myanmar's society and economy, from sustaining productive freshwater fisheries to nourishing the country's rice paddies, and supplying water for communities, cities and companies.

Home to 34 million people, the hugely biodiverse Irrawaddy basin also shelters 1,400 mammal, bird and reptile species, and an estimated 550 species of fish, many of which have yet to be scientifically 'discovered'. It's also one of the last refuges of the eponymous Irrawaddy dolphin – fewer than 80 of the critically endangered animals remain in the river.

As well as its importance for people and nature, the Irrawaddy carries a particularly high sediment load: the 260 million tonnes that flow downstream each year are essential for keeping the fertile lands of its densely populated, rice-growing delta from sinking and shrinking. But this critical

sediment supply will be drastically reduced if plans for a US\$3.6 billion, 6,000-megawatt hydropower dam at Myitsone ever get the final go-ahead.

Fifty percent of people in Myanmar lack access to electricity, but there are better, lower impact ways to generate power than the controversial Myitsone dam. The Chinese-funded project at the head of the Irrawaddy River – in an area steeped in cultural and spiritual significance – has been deeply unpopular with the people of Myanmar since it was first mooted, uniting groups across the country in protest.

Construction plans have been on hold since 2011, and a comprehensive Strategic Environmental Assessment (SEA) released in 2018 by the International Finance Corporation strongly recommends against building the dam, along with any other hydropower projects on the main stems of Myanmar's major rivers, including the Salween. As the SEA

noted, "if constructed, the Myitsone dam would break river connectivity, trap sediment, and alter the river flow on a wide scale."

But despite clear warnings from scientists and the opposition of around 85 per cent of the population, there's a very real possibility that the dam could still be built. Political turmoil in Myanmar, ongoing pressure from the project's Chinese backers, and a lack of transparency are creating an uncertain future for the Irrawaddy. A holistic, common vision for this fast-developing nation's energy generation – which factors in the diverse benefits of free flowing rivers as well as the true social and environmental costs of hydropower on rivers, nature and people – is urgently needed before it's too late.

The plunging price of alternative renewables, such as solar and wind, means that countries can generate power from sources that are low carbon, low cost and low impact with rivers and communities. Investing in this renewable revolution will enable Myanmar to avoid high impact projects such as Myitsone – to generate power for its people, without sacrificing the life-giving services of the Irrawaddy river.



DAMS COULD DOOM MARA MIGRATION

A large herd of wildebeest is crossing the Mara River. The animals are wading through the water, with some in the foreground and others further back. The water is a muddy, light brown color. The background shows a dry, brownish bank with some sparse vegetation.

Stretching 395km from its source in Kenya's Rift Valley to where it flows into Lake Victoria in Tanzania, the Mara River plays an essential role in one of the world's greatest wildlife spectacles. Its basin hosts the highest density of large herbivores on the planet, and each year more than a million wildebeest, half a million gazelle and 200,000 zebra migrate from the Serengeti park in Tanzania to the Maasai Mara reserve in Kenya in search of water and grazing. As the only source of water in the dry season, the Mara River makes this vast exodus possible.

A recent [WWF report](#) provided the first in-depth study of the remarkable freshwater biodiversity in the basin, identifying 473 endemic species, including 4 mammals, 20 amphibians, 40 fishes, 88 waterbirds and 141 vascular plants. Other endemic species remain to be described.

But the health of the free flowing Mara is also critical for people, sustaining the livelihoods of 1.1 million people, while contributing between 10-15 per cent of the GDP of both Kenya and Tanzania. Tourists visit from all over the world to see the wildlife, while agricultural land – nourished by the river – is fast increasing in area. The river also helps to sustain the con-

tinents most productive freshwater fisheries in Lake Victoria, which yield about a million tonnes of fish each year.

But the river is at risk. In recent years, droughts coupled with human activities, including water abstraction for agriculture and tourism, have led to erratic flows, upsetting the delicate natural balance and degrading vital wetlands. With the basin's human population growing by three per cent each year and the increasing impacts of climate change, these pressures are intensifying all the time.

The river's resilience in the face of these threats depends on it remaining free flowing. For now, the main channel of the Mara remains unblocked by hydropower dams. Several, though, are planned within the Mara basin, including large multipurpose dams at Norera in Kenya and Borenga in Tanzania. These had initially been approached as joint projects, but the two nations are still reviewing the ecological impacts of such major river infrastructure.

Tanzania is now calling for the dams to be halted to protect the Serengeti-Mara ecosystem on which so much depends, and with good reason. Disrupt the natural flow of the Mara River - its life-giving flow of water, sediment and nutrients - beyond a certain point and the mass migrations will fade into memories, as will much of its unique biodiversity. Life will grow much tougher too for all the people across the basin who depend on a healthy river for their livelihoods - from fishers and farmers to Maasai pastoralists.

Keep it free flowing and a resilient Mara will be able to sustain people and nature despite the worsening impacts of our warming world.



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DELTA IN DANGER

Regarded as one of the Seven Natural Wonders of Africa, Botswana's Okavango Delta became the 1,000th World Heritage site in 2014. The largest inland delta in the world, it's formed where the waters of the Kavango River flow into the flat basin of the Kalahari Desert - creating a dynamic wilderness unlike anything else on Earth.

Rainfall in the highlands of Angola fills the Kavango River in January and February, the seasonal flood pulse flowing some

1200km downstream in a month, then fanning out across the sands until the peak in June when the delta has swollen to three times its dry season size.

The delta's gloriously beautiful floodplains are rich in biodiversity from fish to birds and some of the most endangered large mammals in the world. A thriving nature-based tourism industry is key to the local (and national) economy, while freshwater fishes provide food and

livelihoods for local communities, who rely on the natural resources of this unique ecosystem.

But the river that feeds the Okavango Delta is at risk, threatening the future of this unique ecosystem and the people and nature it sustains. The largest threat is a proposed hydropower dam at Mucundi in Angola, which would fragment the river, disrupting the natural flow of water, sediments and nutrients that keeps the delta dynamic and healthy.

Damming the free flowing Kavango would irreversibly alter the delta, which is already under pressure from the growing demand for water for agriculture upstream. Meanwhile, climate change is set to make things worse with an increase in temperature of up to 3°C projected for the region, which

would disrupt rainfall patterns and put extra strain on communities and wildlife. A healthy Kavango would enable both people and nature to adapt, a dam-choked river would further undermine their resilience.

And it's not as if there are no alternatives. Investments in renewables such as solar and wind promise a faster path to power generation and much lower impact on the river, communities, wildlife and the delta. Sustainable development of the region is possible but only by safeguarding the river that flows through the heart of it. Instead of sacrificing the river's diverse benefits purely to fuel a hydropower dam, it would be better to protect the health of the Kavango so it can power a better long term future for people and nature.

VICTORY FOR VJOSA?

Rising as the Aoos river in Greece and draining into the Adriatic sea after its free flowing journey through Albania, the Vjosa River and its tributaries form a unique network, the last wild river system in Europe outside Russia.

Largely pristine, the Vjosa has enormous ecological value. It boasts 15 priority habitats as it winds its way through high canyons, braided river sections, islands, oxbows and meanders, reaching widths of more than 2km as it opens into extensive wetlands in its lower stretch. The distinct and varied ecosystems of the river support great biodiversity, from migratory fishes and birds to endemic endangered plants. In all, over 1,100 species are present in the catchment.

The Vjosa River also provides plentiful goods and services to local communities. Fishing is an important source of food and income, while its rich sediment supports crops and livestock production. Growing numbers of tourists are visiting the region, some drawn by the adrenaline of rafting and kayaking opportunities, others by the serenity of one of Europe's last largely intact riverscapes. Many small-scale businesses and ecotourism companies have sprung up to cater to them.

You can probably guess the next bit. Despite all this, hydropower developers want to build a series of dams across the Vjosa - as well as countless other rivers across the Balkans - posing an existential threat to the Blue Heart of Europe. If they succeed, the results will be catastrophic. If the Kalivac and Pocem plants were constructed, over 2/3rds of the river system's 1100km would be blocked to migratory fish, such as the critically endangered European eel.

Quite apart from the inevitable loss of biodiversity, the dams would also trap around 5 million tonnes of sediment each year (the equivalent of 250,000

truckloads) that is essential for the health of the system as a whole. Fish populations will crash, farmlands will be permanently flooded, communities displaced. Tourists will have much less reason to visit.

But the future looks brighter for the Vjosa after a series of decisions by the Albanian government and the country's courts to block hydropower plans, including the final rejection in May 2021 of the controversial Kalivac dam, following a concerted campaign by local communities and international organisations.

The Kalivac victory was cause for real celebration. But it also underlines two key points about hydropower plants. Firstly, they often come back from the dead, brought back to life by future governments. And secondly, hydropower dams are rarely alone. Indeed, there are a total of 38 hydropower dams planned for the catchment of the Vjosa, including 8 on its main channel.

But planning has been hopelessly inadequate - and often murky. The proposal for the controversial Pocem dam - a structure 25m high across the main channel in one of the most ecologically valuable parts of the whole river - came with an Environmental Impact Assessment that had been 60 per cent copied and pasted from other sources, contained no survey of flora or fauna, no data on rare species, no evaluation of hydrological, morphological or ecological processes, and no discussion of the long-term effects of the construction. Meanwhile, a far more detailed Sustainable Asset Valuation of the plans - which took into account lost ecosystem goods and services, lost agricultural production and lost tourist revenues, while also incorporating climate change and future energy price projections - found that they produced a net negative value of more than €550 million over a 60-year period.

Thanks to determined campaigners, the Pocem dam was also halted.

But the Vjosa is still not safe. The Albanian government did commit to protecting the Vjosa as a "nature reserve" but that is nowhere near enough. That's why a campaign led by EcoAlbania, Riverwatch and EuroNatur is calling for the creation of the Vjosa National Park, which would protect the whole river and would be the first of its kind in Europe. Without this, the river will remain at risk because halting harmful hydropower dams is only part of the solution. We also need durable ways to protect our rivers so that dead hydropower dams stay dead.

This is a critical issue beyond the Vjosa basin. There are thousands of planned hydropower dams across the Balkans, which will generate negligible amounts of electricity in return for significant social and environmental costs. These plans should be axed. Instead, governments and developers should focus on upgrading existing plants to reduce their environmental impacts or removing those that are no longer viable. Alternative renewables can supply additional electricity at lower cost and lower conflict with rivers and communities.

Indeed, Albania has excellent potential to develop other renewable sources to meet its energy needs - primarily solar, then wind. As the President himself says, it should focus on these and leave the Blue Heart of Europe beating.

VJOSA
NO DAMS

HIGH MOUNTAIN HYDROPOWER: SMALL PLANTS, BIG IMPACTS

“If we obstruct our rivers, we obstruct our future.” – Renate Hölzl, local river activist

To see the last free-flowing glacial river in the European Alps, you need to head to Austria’s East Tyrol region, where the clear waters of the Isel and its tributaries run through gorges, waterfalls, wide gravel banks and floodplain forests. Still in a near natural state, the river system is a habitat for many protected and endangered animal and plant species, its preservation all the more precious after widespread development has permanently changed most riverine ecosystems across Tyrol and beyond. The river is also a draw for tourists, who come to enjoy the scenery, raft the rapids and bring money to the local economy.

But the River Isel is itself at risk of destruction. The hydropower lobby has been trying for years to construct a series of dams across free-flowing channels and tributaries, and the Tyrolean authorities have shown themselves unwilling – in the face of political pressure and economic interests of developers – to protect the unique riches of one of Europe’s last natural river systems.

There are more than 1,000 hydropower plants already in operation across Tyrol as a whole, with at least six plants planned, in the approval process, or under construction in the Isel system.

These plants will alter the sediment and water balance of the Isel, threatening the natural river dynamics that maintain critical ecosystem goods and services. This rare natural treasure will become just another casualty in the hunt for profit.

There are murky political forces involved in the proposals. The Tyrolean government has been unaccountably reluctant to carry out proper assessments of the cumulative effects of hydropower construction on the Isel and its tributaries, and at first ducked EU calls to include the River Isel in the Natura 2000 protection scheme. When it finally caved to pressure and did so in 2015, it mysteriously left out stretches of three key tributaries, where power plants were already proposed. Clearly, there’s no ecological justification for the omission, since if you cut off key channels to the main river you might as well cut off the main river itself.



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So what makes these planned power plants so vital? Good question. The most egregious example is at Haslach-Kalserbach on a tributary of the Isel, where a €30 million power plant project is in process. It’s located at a site prone to landslides, floods and avalanches, and the municipality will slump heavily into debt to finance the project. And how many local people will it supply with electricity? There are around 1,100 in the community. Do the maths and that works out at a cost of almost €30,000 per inhabitant. And, of course, there is the cost to the environment as well. It’s impossible not to be deeply cynical about the vested interests involved in giving this project the go-ahead.

Other projects are scarcely better. One completed plant at Lesachbach is located just a few hundred metres beyond the boundary of a strictly protected national park in a stretch of water that the provincial government itself has called the “last river section of its kind in East Tyrol, and particularly rare for all of Tyrol.” The affected river stretch had very good ecological status – but not any longer. And all for a negligible amount of electricity.

Still, the plans for more plants have met with predictably strong opposition from local initiatives, communities, environmental organizations, fishers, kayakers and many others. A total of 43 groups have joined with WWF and renowned scientific voices to launch a manifesto for the protection of the East Tyrolean glacial rivers, opposing all future hydropower development in the region, and calling for the formal protection of the entire wild river landscape, including the Isel and its tributaries, as a nature reserve.

It remains to be seen whether the Tyrolean government will keep on ignoring the obligations of European nature conservation laws and a broad alliance of local, national and international organizations, and allow construction of the dams to proceed. They can choose to protect their unique natural heritage for the benefit of future generations, or to protect the short-term profits of the dam-building lobby. In the Isel’s case, it really is that simple.

DEATH SENTENCE FOR THE VISTULA

The Vistula is Poland's longest river, rising in the Carpathian Mountains and passing through the country's largest cities before draining into the Baltic Sea after a course of more than 1,000km. The river has been at the heart of national life for many hundreds of years, and is sometimes used as a symbol for Poland itself.

But current plans threaten to wreck much of what's left of the river's natural cycles, and cause great harm to this once proud waterway. Developers are proposing to build a dam across the main channel of the Vistula at Siarzewo in order to create a reservoir to guard against flood risk and produce hydropower. But as is so often the case with such mammoth infrastructure projects, this 20th century thinking appears designed to generate short term profits for the developers rather than long term benefits for the people of Poland. Indeed, it is likely to cause problems rather than solve them.

Take one of its main justifications - providing protection for an older dam that doesn't function properly: a classic case of two wrongs not making a right. In 1970, the authorities dammed the main channel of the Vistula at Włocławek, creating a 58km reservoir to aid in flood mitigation and

produce hydroelectricity. Sound familiar? Well it doesn't do either very effectively. In terms of flooding, scientists say that the Włocławek reservoir actually worsens the risk by slowing flows, which allows soft, spongy ice to form and cause so-called 'ice-jam' floods. Building another dam at Siarzewo with a view to reducing the pressure at Włocławek could in fact compound the problem by causing more ice-jams. Environmental impact assessment modelling shows the proposed dam will have no relevance for flood prevention.

As for the hydropower benefits of another dam, they'll be negligible at best: the same amount of energy could be generated by 44 wind turbines - with none of the destructive basin-wide social and economic impacts. And yet the project is going to cost about €1 billion of public money (twice its original estimate). Given how little ordinary people will benefit, and how much money the developers will make, this is a blatant example of using public funds to privatize hydropower profits, leaving ordinary people in a worse situation.

Speaking of which, upstream of the dam the warmer water

in the reservoir will evaporate more quickly, reducing levels in the main channel, and the stagnant water on the flooded land will release high levels of greenhouse gases as well as producing toxic blooms. Below the dam, increased erosive force will scour out the bottom channel of the Vistula, further lowering water levels and intensifying water stress. Local communities and tourism will both be negatively affected.

What is more, if it goes ahead, the project will permanently cut off nearly 70,000km of the Vistula's river system from the Baltic Sea and kill any hopes of removing the Włocławek dam. Migratory fish populations have already fallen by 93% across Europe and the Siarzewo dam would likely result in the permanent loss of migratory species of trout, salmon and vimba bream in the Vistula basin. The chances of restoring Poland's extinct population of Atlantic/Baltic sturgeon (*Acipenser oxyrinchus*) will definitely be lost. Three Natura 2000 sites will be devastated by the Siarzewo dam's reservoir, while the project breaches Poland's commitments under the EU Water Framework Directive, the Nature Conservation Act, and the EU Biodiversity

Strategy. How many reasons does the country need to abandon such a disastrous dam?

Want to know what Poland should do? Obviously, the government should scrap the Siarzewo dam and in August 2021, the Minister of Climate and Environment did take a step in this direction by annulling the environmental permit for the project, although the fight is far from over. But it should also dismantle the faulty dam at Włocławek. This would cost less than a tenth of the current proposals, would reduce overall flood risk and would help to restore the health and biodiversity of the entire river ecosystem - bringing life back to the basin and benefiting people and nature across the country. The dam removal movement is gathering pace across Europe: Poland could become one of its leading champions on the continent, rather than remaining stuck in a destructive 20th century mindset.

The choice is clear: a dying river basin choked by dams that do not deliver significant power or flood protection or lower impact renewable energy and a more resilient, living, free flowing river. Only a profit-driven developer could possibly think the first is the best option.

TRAGEDY FOR THE TAPAJÓS

The 2,000km long Tapajós River in Brazil is one of the largest, free flowing tributaries of the Amazon, accounting for around 6 per cent of the water in the entire basin. Unusually for the region, it is also a fast-flowing, clearwater river, which sustains diverse communities as well as extraordinarily rich biodiversity.

Flowing through habitats ranging from cerrado savanna to rainforests, the Tapajós boasts a treasure trove of species, including at least 325 freshwater fishes - 65 of which are endemic to the river. But scientists believe that many more are still waiting to be discovered, estimating that there are more than 500 fish species swimming in the Tapajós basin. Thousands of other plant and animal species also rely on the river, including many iconic, threatened species, such as river dolphins, giant otters, giant anteaters and jaguars.

Indigenous people and local communities depend on the Tapajós to support their fisheries, fertilize their fields, provide clean water, and sustain their livelihoods and cultures. Natural flows and flood pulses are critical to life along the river, where conditions can

fluctuate widely in the wet and dry seasons.

Unfortunately, all this is under threat. The Tapajós River is the last of the large free flowing tributaries on the right bank of the Amazon River and regarded as one of the best remaining opportunities for hydropower generation. A total of 42 dams are currently planned in the basin, including a series of five barrages comprising the huge Tapajós River Hydroelectric Complex.

If all these dams were built, the environmental and social consequences would be disastrous. An estimated 2,000km² of Indigenous territories would be flooded by reservoirs. The dams would alter the river's natural water flow, depth, temperature, sedimentation and oxygen levels, and would destroy the delicate ecosystems - and threaten the wealth of wildlife - that the river currently supports. The rapids and waterfalls that characterize the Tapajós would be destroyed, fisheries would disappear as migration routes were cut, and floodplain fertility would fall.

What's more, the hydropower dams themselves are based on out-dated forecasts - and 20th century thinking - which do not take into account increasing energy efficiency and the plunging price of wind and solar technologies. Nor do they properly factor in the impact on communities and wildlife

or the broader, knock-on consequences of the loss of all the diverse benefits that a healthy, free flowing Tapajós provides to people and nature.

And to efforts to tackle the climate crisis. One study shows that the carbon and methane emissions from the construction of the dams and from their reservoirs would generate greenhouse gas emissions comparable to a natural gas plant, with the worst of the five dams - at Cachoeira do Caí - producing total emissions that would exceed a coal-fired power station.

Nevertheless, despite the pervasive influence of Brazilian construction lobby and the ardently pro-dam position of the Bolsonaro government, opposition to the dams has been - and continues to be - immense. The indigenous Mundurucu tribe, in particular, has fought tirelessly to protect their ancient lands, and court battles have been raging for years. There were encouraging signs in 2016 when the environmental licence for the largest proposed dam at São Luiz do Tapajós was officially cancelled, but dams often come back from the dead. And there are still many more on the drawing board.

But this is not a battle that the world can leave to Brazil. If the hydropower complex on the Tapajós goes ahead, the immediate impact will be felt by indigenous people and local communities - and nature - in the river basin. But ultimately the effects will be felt all over the world: this is a looming tragedy that should concern the entire global community.





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PANTANAL IN PERIL

The waters of the Upper Paraguay river basin are the lifeblood of the Pantanal, the world's largest tropical wetland. Both a World Heritage site and Ramsar wetland of international importance, the Pantanal sustains local communities of farmers and fishers as well as providing water and other benefits to cities downstream.

It is also home to an astonishing diversity of species - over 4,000 and counting. It boasts jaguar, capybara, giant otter and tapir among its 159 mammals along with 98 reptiles, including the world's largest concentration of caimans. Of its

325 fish species, 23 undertake long distance migrations to spawn in upland tributaries – several of these are important for artisanal, recreational and commercial fisheries.

All this depends on the connectivity and natural flow of the rivers of the Upper Paraguay basin, which underpin the health of the entire Pantanal ecosystem. Eighty percent of the Pantanal floodplains are submerged during the rainy season, in a cycle that renews aquatic and terrestrial productivity. If this ecological balance were upset, the dynamics of the Pantanal would be fatally undermined.

One sure way of doing that would be to follow through with the current plans for hydropower development in the Upper Paraguay Basin, which threatens the future of this unique region.

While the basin has so far escaped dam building on a significant scale, the number of hydropower developments has more than doubled in the last 20 years. Today there are 57 operating plants in the Upper Paraguay Basin. Although most of these dams are small, their cumulative impact can significantly alter the natural cycles of the river.

Fishers on the basin's Jauru River – where 5 small plants and 1 larger one have already been constructed – have reported that the fish they rely on for their livelihoods have disappeared. Migratory routes have been cut, while the Pantanal itself is being starved of the natural flood cycles it

needs to sustain the myriad benefits it provides to people and nature.

And this is only the beginning. An additional 80 hydropower dams are planned, which would close off another 11,000-12,000km of free flowing river channels in the Upper Paraguay Basin. If all the dams were built, 40 per cent of the total flow into the Pantanal would pass through one or more hydropower plants on its way.

If that happens, it would be for the Pantanal. But it doesn't have to happen. As in all of these cases, alternative renewables could produce enough energy for the region - while creating more jobs - without destroying the rivers that quite literally give it life. Hydropower still has a place in the overall mix, but to bet the house on it in the Upper Paraguay Basin would be to pointlessly gamble away the future.

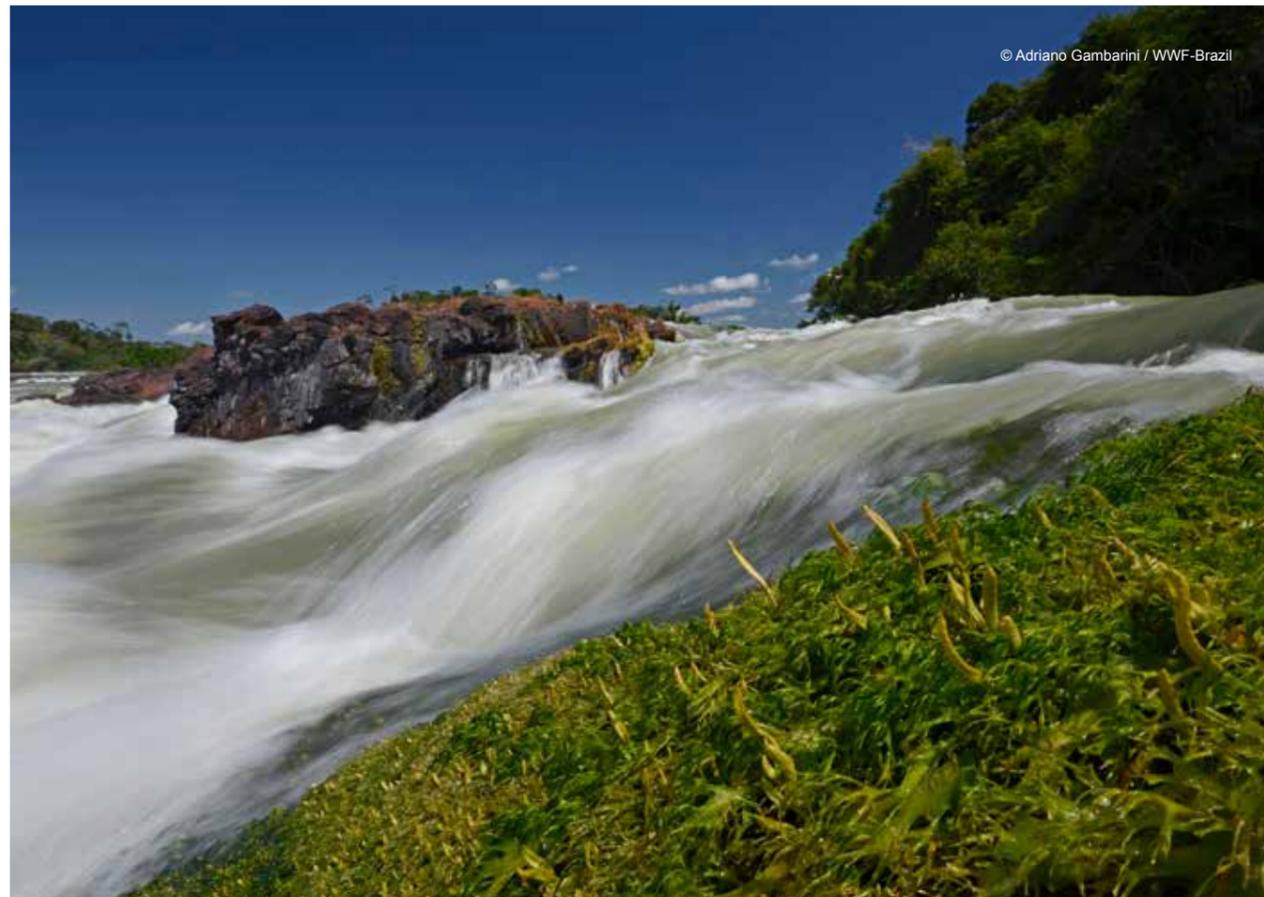
TAKING THE LOWCX3 ROAD TO A BRIGHTER FUTURE

The 10 iconic rivers in this report are just a snapshot of all the free flowing rivers across the world that are threatened by poorly planned, high impact hydropower. A study in the journal *Global Sustainability* found that over 260,000 kilometres of free-flowing rivers - that's more than six times around the Earth - could be lost if thousands of planned hydropower dams were built. And yet these projects would collectively generate less than 2 per cent of the renewable energy needed by 2050 to keep global temperature rise below 1.5° C - a minute contribution to mitigating global warming with devastating consequences for the remaining free-flowing rivers, the people and nature that depend on them, and global efforts to adapt to the worsening impacts of climate change.

Connected and healthy rivers deliver diverse benefits that are often overlooked: freshwater fish stocks that are critical to the food security of hundreds of millions of people, delivery

of sediments that nourish agriculture and keep deltas above rising seas, and floodplains that help mitigate the impact of extreme floods and support a wealth of biodiversity. With the impacts of climate change being felt primarily through water, safeguarding free flowing rivers is central to adaptation and resilience, particularly in the world's increasingly vulnerable deltas.

We no longer have to choose between renewable energy and healthy rivers. We can abandon 20th Century thinking as there are better 21st Century solutions now. Thanks to the plunging price of solar and wind generation, and battery storage technologies as well as tools for siting low-impact renewables, we can secure a brighter future for people, rivers, nature and climate by developing power grids that are LowCx3 - low-cost, low-carbon and low conflict with communities and rivers.

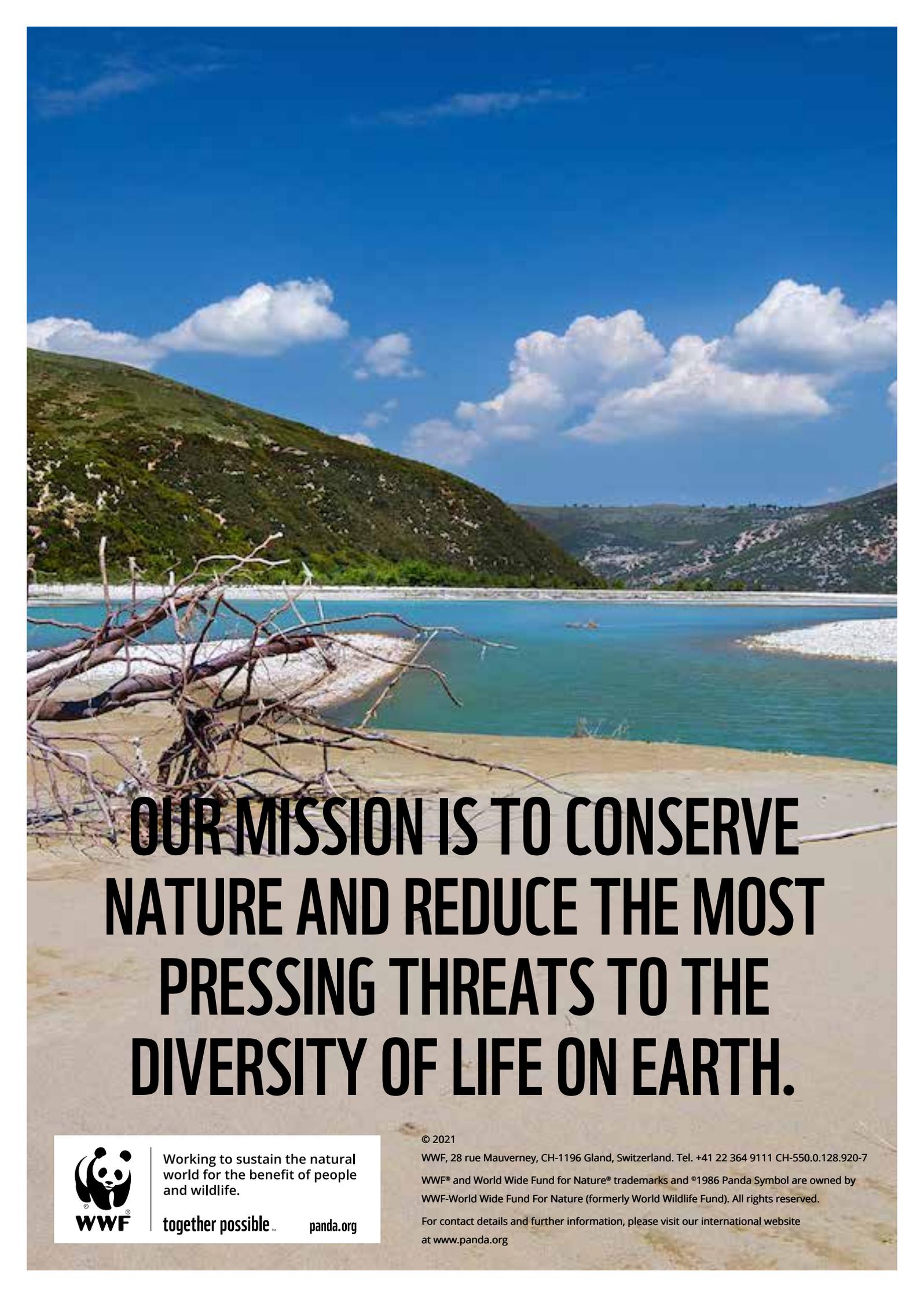


- **Commit to a LowCx3 pathway:** Governments must pursue 21st Century solutions, implementing system-scale planning and licensing focused on integrated power systems to identify and develop those that are low cost, low carbon and low conflict. Developers and investors should support the transition by having an agnostic view as to the best LowCx3 options.
- **Reassess all planned hydropower:** Countries should thoroughly reconsider all new hydropower projects in the light of the renewable revolution. They should factor in the full value of healthy, free flowing rivers to people and nature as well as the availability of lower impact alternatives and the greater risks associated with high impact hydropower, including social conflict, environmental damage and longer construction times as well as threats to hydropower operations posed by increasing droughts and floods. New hydropower projects that impact critical free flowing rivers or are in Protected Areas and areas of high conservation value should be avoided. If a low impact hydropower project is assessed to be part of the best overall energy mix, all efforts must be made to minimise its impact from siting to construction and operation. Investors should not finance any project until it has been thoroughly assessed and proven to be low impact and part of the best overall energy mix.

- **Prioritize free flowing rivers:** Governments must agree to ambitious targets for 2030 that will safeguard critical, free flowing rivers in the new global framework on nature, which will be agreed at the Convention on Biological Diversity conference in China in 2022 – building on the freshwater transition outlined in the 5th Global Biodiversity Outlook. But agreeing an ambitious agenda for the next decade is not enough: countries must commit to implementing the solutions that will achieve the targets they have set.
- **Value and restore free flowing rivers:** Last but not least, it's time to value the diverse benefits that healthy, free flowing rivers provide to people and nature, and how central they are to climate adaptation, and to achieving the SDGs and CBD targets. It's time to factor them fully into decisions about hydropower, including restoring rivers where possible by removing dams that are either obsolete or no longer financially viable and re-operating dams to meet environmental flow needs.

It is now possible for us to meet global climate and energy goals without sacrificing critical, free flowing rivers, including the 10 highlighted in this report. Together we can accelerate the renewable revolution and help deliver a carbon neutral and nature positive world.





**OUR MISSION IS TO CONSERVE
NATURE AND REDUCE THE MOST
PRESSING THREATS TO THE
DIVERSITY OF LIFE ON EARTH.**



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