



# Pangani River Basin, Tanzania

WANI Case Study



IUCN WATER PROGRAMME



# WATER AND NATURE INITIATIVE (WANI) CASE STUDY

## PANGANI RIVER BASIN, TANZANIA

Climate change and the over exploitation of water resources is challenging the sustainability of the Pangani River Basin to deliver water services. Competition for diminishing water resources has led to tensions between the various stakeholders within the basin.

Together with the government of Tanzania and donor partners, WANI has responded to this crisis by supporting the implementation of Integrated Water Resources Management (IWRM). This sought to bring together a variety of stakeholders by creating platforms for dialogue and encouraged collaboration towards a common goal. The Pangani River Basin Management Project has generated technical information and developed participatory forums, mainstreamed climate change, supported the equitable provision and wise governance of freshwater for livelihoods and environment for current and future generations.

Initially designed as a demonstration site, the Pangani River Basin Management Project proved to be an adaptive process through which strong foundations of good governance, stakeholder participation and IWRM were cemented. Strong technical capabilities were combined with a long-term vision which continues to build on results. The Pangani River Basin shows how implementing IWRM at the basin level can demonstrate how mitigation actions reduce the adverse effects of climatic variability due to climate change.

Water was over-allocated: more water was allocated to be used than was actually available. Prospects for dealing with water allocation and climate change were weak. Therefore, key to sustainable basin management, and ecosystem health, is allocating water within the limits of availability, including an allocation to ecosystems. Through understanding environmental flows, there has been a move to base decisions on evidence of how changes in flow allocation impacts economic, social and environmental factors in the basin.

### Highlights

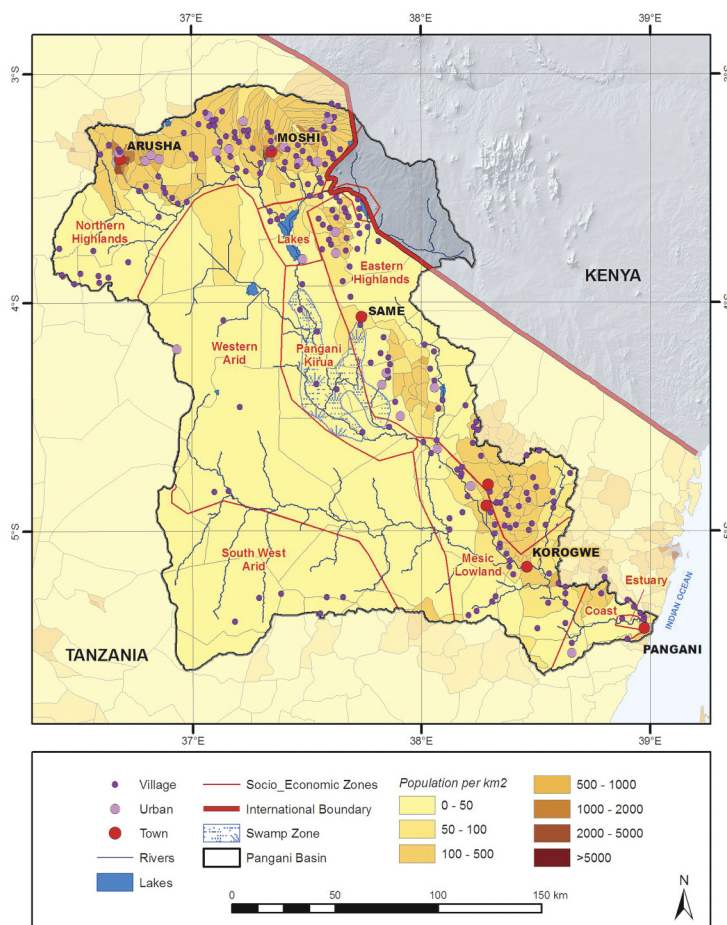
- Information developed in the project including on environmental flows, climate change, water governance and groundwater is being used in developing an IWRM plan for the basin.
- Pangani Basin Water Board has the tools, knowledge and capacity to implement a sustainable management plan.
- Application of environmental flows to assess the water flow and needs in the basin as the basis for developing scenarios for managing the allocation of water sustainably. A first in the country.
- Through the sub-catchment forums, water users empowered to participate in IWRM and climate change adaptation processes through dialogue and decentralized water governance.
- Increased knowledge and information on water resources and vulnerability to climate change through comprehensive assessments.



# INTRODUCTION

## A diverse ecosystem on which livelihoods depend

The Pangani river basin covers an area of 43,650km<sup>2</sup> with 95% in Tanzania and 5% in Kenya. The river begins as a series of small streams draining from Mt. Kilimanjaro, Mt Meru and the Pare and Usambara mountain ranges and flows into the Indian Ocean. Over three million people derive their livelihoods from the Pangani River Basin, primarily from agriculture and fisheries. Its fertile soils and ample rainfall have earned it the reputation of being the breadbasket of Tanzania. An estimated 55,000 hectares of the basin is intensely irrigated. The 500km long river also serves a series of hydro-electric power stations, which, combined, contribute towards 17% of Tanzania's national electricity needs.



**Figure 1.** Map of the Pangani River Basin (Source: *Future of the Basin Report* 2011, Tanzania, IUCN)

## Policies and institutions

In 2002, the Ministry of Water launched a new National Water Policy which recognized the important link between a healthy environment and productive livelihoods. Water for basic human needs is given the highest priority for water allocation, followed by water for maintenance of ecosystems. Determining water requirements for the environment has become a priority for the government and environmental flow assessments were required for Tanzanian rivers in order to implement the Water Policy.

The Pangani Basin Water Board was established in 1991 and works in accordance the Water Resources Management Act No. 11 of 2009 to implement a comprehensive, integrated and holistic approach to the management of water resources.

The Board comprises ten members, drawn from public institutions and the private sector (including representatives of catchment water committees, Local Government Associations, Ministry of Water, private sector water users and water related sectors). WANI worked in close collaboration with the Government of Tanzania and the Pangani Basin Water Board which provided a vital entry point into the water sector at basin level.

## Changing flow patterns of the Pangani River

Climate change is evident in the Pangani Basin and flows have been reduced from several hundred to less than 40 m<sup>3</sup> per second. As the model managed by the Pangani Basin Water Board indicates, different flow patterns are essential for maintaining the natural equilibrium of the river. Small floods, for

instance, may encourage fish to migrate along the river and lay eggs while larger floods spill on to floodplains, providing rich feeding and nursery areas for fish. Comparing the natural and present-day flow regimes from the perspective of these different flow patterns shows how it is changing and how it will continue to change in the future. A several of pressures on water resources in the basin have exacerbated this situation.

### Competition for water resources

There are a variety of water users within the Pangani Basin competing for water resources. As the number of claims over water increases, so too does the number of conflicts. Population growth, deforestation, increasing numbers of livestock and the expansion of cultivated land, as well as fishing, mining and hydroelectric power activities have led to excessive pressures on the basin's water resources. Ecosystems are in decline as a result and, with

aquatic resources supplying up to 25% of household income in parts of the basin, it is the poorest who are most adversely affected.

In view of the extremely disparate use of natural resources of the Basin, along with the multitude of different interests and hopes of stakeholders, the need for an integrated approach to its management cannot be underestimated. In the past, the 'sectoral' approach to the management created conflict between sectors regarding priorities in the basin. The future development of this and other basins in Tanzania depends on a successful transition to sustainable water management. As Washington Mutayoba, former Director of Water Resources in the Tanzanian Ministry of Water, says, "In this country there is tremendous pressure on our natural resources," ... "You need to integrate planning by knowing what is available and understanding demands."

## OPTIONS FOR INTEGRATED WATER MANAGEMENT

As a response to these serious issues, the PBWB and WANI convened a stakeholder platform in 2002 to look at options for Integrated Water Resource Management. This type of management "promotes coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems".<sup>1</sup>

WANI and partners agreed to implement effective monitoring and data collection systems to increase understanding of environmental, economic (see box below) and social implications of different river flow scenarios under expected climatic conditions and increase capacity to collect and analyze such flow assessment information. This led to the development of a comprehensive assessment of environmental flow requirements to effectively conserve the basin's natural resources. Simultaneously, WANI and

partners facilitated negotiations between stakeholders and increased community participation. Support was given for legal reviews and multi-stakeholder consultations to be carried out to improve management planning and implement rational systems of water allocation.

Crucially, WANI did not set out to shape new policy on water management, but instead worked with the Government and other partners to test implementation of the National Water Policy and the National Water Sector Development Strategy (2005-2015). Working closely with the Government of Tanzania, the focus was on operationalising ambitious reforms that called for the establishment of catchment water forums and prioritization of water allocation for 1) meeting basic human needs and 2) the needs of ecosystems. "Previous water policy was driven purely by the need to supply and deliver," explains Washington Mutayoba, "Now we are looking at the bigger picture, climate change and all."

<sup>1</sup> GWP (2009) Lessons from Integrated Water Resources Management in Practice, Global Water Partnership, Policy briefing 9

### Box 1. Economic valuation of the Pangani River Basin

A detailed study was conducted in 2003 on the economic value of water resources in the Pangani Basin. The report reviewed water usage in domestic consumption, livestock, irrigated agriculture, environmental goods and services and hydropower production. Detailed surveys were undertaken to calculate specific figures of water usage from growing cotton to herding cattle as well as overall household income/expenditure figures to determine the role water plays in livelihoods. The report concludes, among many other facts, that the Pangani Basin Water Board will need about 400 million Tanzanian shillings annually to improve the management of water resources in the basin. These values presented in the report are preliminary estimates which provide a starting point for understanding the economic magnitude involved for the use of water in different areas of the Basin.

The economic project also conducted a feasibility study examining Payment for Environmental Services and proposed a mechanism for this in the Pangani Basin. This was one of the first investigations of the viability of Payment for Environmental Services in Tanzania.

## TOWARDS SOLUTIONS

### Laying the foundations

In early 2003, WANI supported global learning Initiatives related to water governance, environmental flows and environmental economics. Pangani stakeholder platforms brought people together and provided a space for discussion and negotiation. The Pangani Basin Situation Analysis (IUCN 2003), Pangani stakeholder platforms and dialogues, preliminary environmental flows and economics assessments all provided a strong basis for the development of the larger Pangani River Basin Management Project. These initial interventions were vital to: forging partnerships and building trust among partners; understanding natural resource management issues at the local level; developing and testing methodologies; considering strategies for scaling-up; and providing opportunity for partners to tailor the intervention to their needs and priorities.

### Governance structures and IWRM plan in the Pangani Basin

Experience gained among the partners in the dialogue forums was the starting point for scaling-up governance processes to the sub-catchment level. The partners (PBWO, PAMOJA Trust and IUCN) drafted a *Roadmap for the establishment of the Kikuletwa sub-Catchment forum*. Under the roadmap, a preparatory phase was completed comprising a water-use audit, policy review, and

institutional mapping. In addition, a series of consultation and training workshops with local government and water users raised awareness about IWRM and climate change. It was recognized that because of the complexity of local water management issues, operationalizing the forum is a long term process.

The PBWB coordinated other sectors and stakeholders to lay the ground work for eventually developing an Integrated Water Resources Management Plan. Stakeholders were able to interact with the Pangani Basin Water Board and submit applications to participate in Pangani Basin water management.

WANI was instrumental in preparing the necessary groundwork for developing water management in the Pangani Basin through the interventions described above. Since 2007, framework has been taken forward by other partners. Governance structures including Water Users Associations (WUA) across the basin in different sub-catchments have been created which aim to promote community participation in IWRM planning and implementation processes. The project also focused on development of the overarching Kikuletwa Catchment Forum which brought together different WUAs in the catchment. Similar approaches are being undertaken in other catchments within the



Pangani Basin. Lessons learned about the capacity building to develop Water User Associations have been synthesized and disseminated to the Ministry of Water and other basins. In addition, groundwater assessments have been undertaken. All of these management components have been integrated into drafting the IWRM plan and further steps to development and implement actions.

### **A different approach: providing spaces for stakeholder dialogue through small-scale infrastructure development**

As a result of the early dialogues in the pilot phase, the larger initiative included some small-scale infrastructure developments to address the water conflicts. Perhaps one of the most important contributions was recognizing that to have a significant and sustainable impact on the large number of water-related conflicts in Pangani Basin, a different approach was needed for scaling up the intervention. Providing the space for continued dialogue between the different stakeholders in the basin relating to water management issues, and future climatic vulnerability and future climatic risk was an essential ingredient for success.

### **Environmental flows and climate change**

The Pangani Basin Flow Assessment, (2005-2011), brought together a core team of Tanzanian specialists in a range of disciplines related to river – biophysical, social, economics, water management and policy making – and an international team of flow-assessment specialists from South Africa. As the first assessment of its kind in the area, the study used cutting edge methodologies to gather specific information on hydrology and the economic, social and ecological impacts of changes in river flow regimes. A series of 17 reports have been produced that have provided information into the flow assessment.

Building on this information, stakeholders have gained an understanding of social, economic and environmental trade-offs for different water allocations through the development of a number of scenarios. The technical outputs of the Pangani Flow Assessment such as long-term current-day hydrological data, baseline data on the condition of

rivers, wetlands and the estuary, provided invaluable data. This has been formulated into scenarios, including climate change affects, to assess a wide range of future development pathways, to inform possible water-resource planning decisions in the basin.

### **Contributing to global networks**

As a result of experience in the Pangani, a global Environmental Flows Network was established ([www.eflownet.org](http://www.eflownet.org)) to facilitate awareness raising, capacity building and implementation of environmental flows within East and Southern Africa and worldwide. The Network's overall aim is to allow people to access, share and discuss information, knowledge, experiences and case studies related to environmental flows. The environmental flows



*Climate change vulnerability assessment in Mbuguni Village*

approach and tools demonstrated in the Pangani Basin has global resonance, not just as a theoretic, hydrological set of measurements, but as a pivotal element in developing holistic water management solutions.

As a result of collaboration between the water and the climate change specialists, a study by the University of Cape Town (Tadross and Wolski, 2010) was completed which developed a climate change model for the Pangani Basin to increase understanding of climate change impacts. The report concluded that anticipated climate change impacts will have consequences on water resources in the Basin including increased evaporation, increased



Sampling during the environmental flows assessment study at the estuary, Pangani Town

snow melt on Mt. Kilimanjaro (leading to short-term increase in water resources), increase in bush fires, decreased rainfall, decreased river flows, decreased groundwater recharge, a lowered groundwater table and drying of wetlands. With this information, management scenarios and decisions can be formulated to try and combat the effects that these changes will have in the basin and the impacts on people and livelihoods.

### Leadership and learning: informing and educating stakeholders

Stakeholders participated in a number of events to exchange experiences and raise awareness about the results of the assessments and actions. For example, during the assessment of environmental flow requirements, the *State of the Basin Report* was launched in Moshi by the Permanent Secretary for the Ministry of Water summarizing the findings of the

socio-economic survey and the river and estuary health assessments. Additional technical information on macroeconomics, hydroelectric power modeling, hydraulic modeling, fisheries, fish and invertebrate life histories and vegetation was commissioned by project partners in November 2006 to support the process through separate consultancies. The report is being used to raise awareness among decision-makers on the condition of the Pangani River System. Additionally, an Environmental Flow Workshop was held in Morogoro, Tanzania which included other individuals and organizations interested or actively involved in flow assessments to exchange information and create a learning environment. "The environment is supposed to sustain people. Our responsibility is to raise awareness. We will do this by scenario proposing. Show it to them and let them understand," explains Pangani Basin Water Officer Hamza Sadiki.

### Lesson learned on Environmental Flow assessments and planning for the future

A review was undertaken of the Pangani Environmental Flow Assessment along with assessments in other regions of Tanzania and Kenya. This provided a critical analysis of environmental water requirement studies and assessment that have been carried out in Tanzania including Pangani, Wami-Ruvu, Mara and Ruaha. Lessons learned have been disseminated to stakeholders, including the Ministry of Water. In 2010, a series of recommendations on implementing environmental flows were made.

Scenarios using hydrological data sets for 2025 (see Table 1) have recently been made available in the *Future of the Basin Report*, which aim to determine how different water allocations will impact economic development, environmental health and social well-

**Table 1.** Gains and losses for different sectors and scenarios per year in the Pangani River Basin in TZS millions per year (US dollar 1 = 1344.28 from 2009) Source: Adapted from PBWO/IUCN (2009)

	Present Day (PD)	Max Agriculture	Max HEP	Optimize PD+HEP	High Environment	Additional Storage and Optimize PD
Hydroelectric Power (HEP)	2,380,642	-606,842	547,991	552,606	-4,037	25,315
Agriculture	202,391	15,540	-38,871	-69,370	-62,798	-51,365
Natural Resources	34,809	175	-516	-157	661	605
Ecosystems Services	327	-91	183	388	322	184
Total	2,618,170	-591,218	508,788	483,417	-65,852	-25,262
% change		<b>-22.58</b>	<b>19.43</b>	<b>18.46</b>	<b>-2.52</b>	<b>-0.96</b>



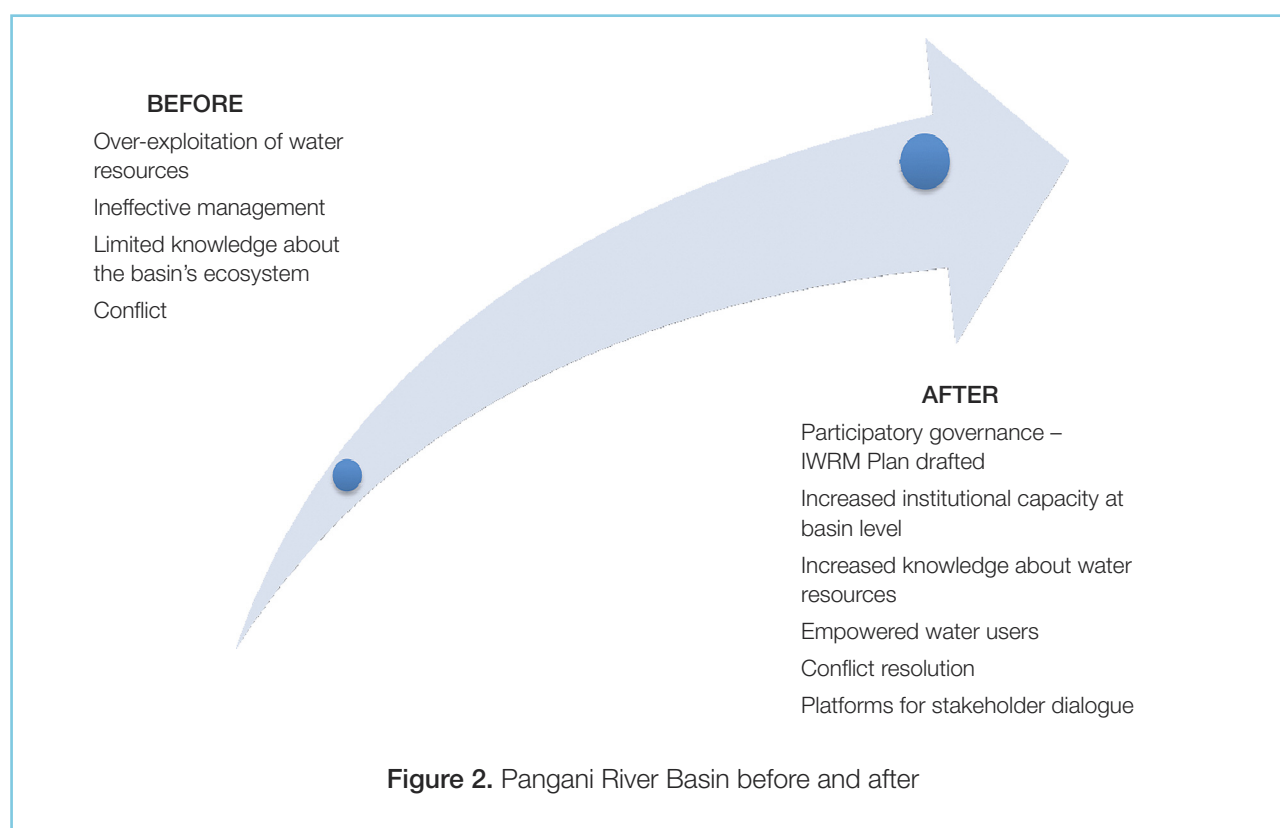
being in the basin, taking into account the changing climate. The negative numbers in Table 1 show the sectoral losses in financial terms on the Basin and the positive numbers show the sectoral gains financially depending on which scenario is followed. 'Natural resources' refers to the provisioning of services such as fish and timber. 'Ecosystem services' refers to regulatory services such as water treatment by wetlands and fish nurseries in estuaries. There are tradeoffs involved in every scenario. The overall picture in Figure 3 shows that there is no one scenario that is financially beneficial in terms of all three criteria (economic, social and ecological). Economic outputs were generally the most sensitive, with differences between scenarios frequently being greater than 20%. Social wellbeing within the basin changes negatively under most scenarios, but by relatively small percentage.

Following the technical work already completed in this project, focus now switches to stakeholders and the government. This information gives further insight into how stakeholders can make social, economic and environmental trade-offs for different water allocations under possible future climate conditions. Increasing knowledge and information about possible future scenarios has also brought the water and climate change sectors closer together. If a scenario could be agreed on, then the next sequence of technical work could begin. This would be to help lay out a basin water management plan, which would guide future decisions on water allocations, and a monitoring programme, which would check if the environmental flows are being maintained in the river, and the agreed desired river state is being achieved.

## WHAT HAS CHANGED?

With over-exploitation of water resources and conflicts arising due to a diminishing river flow, the Pangani River Basin was facing an uncertain future. However, as a result of trying and adapting

interventions on the ground in the basin, some solutions and ways forward have been developed. These should help water managers and basin stakeholders to be able to cope better with water



scarcity and climatic variability and to manage future changes in the basin adaptively. Through the sub-catchment forums, water users have been empowered to participate in IWRM and climate change adaptation processes through dialogue and decentralized water governance.

There is now an increased understanding of environmental, economic and social implications of different river flow scenarios under expected climatic conditions and increased capacity to collect and analyze such information. The water sector's vulnerability to climate change is now better understood and pilot actions have generated lessons in adaptation. "With these kinds of realities, we have to work together," says Chairman Yusuph M. Yusuph, a rice, maize and ginger farmer in the lowlands. These activities have simultaneously built up the capacity of country institutions through training and workshops and disseminated knowledge about the basin among water users.

Institutional and information gaps between the basin and national level processes have now been bridged through studies, exchange of knowledge and collaboration between climate change and water sectors. The Pangani Basin Water Board now has the information needed to manage the basin in ways which support nature as well as people and their livelihoods.

## The future

With WANI and donor interventions finally having come to an end in 2011, the focus is now on the Pangani River Basin stakeholders and the government of Tanzania to continue working towards a future where water resources are used sustainably, maintaining both ecosystems health and people's livelihood security. Stakeholders are now gaining understanding of social, economic and environmental trade-offs for different water allocations through the development of a number of scenarios. The PBWB and the Tanzanian team of specialists have the tools and skills to help the basin's stakeholders further explore outlined scenarios, or to investigate new ones, as they seek the optimum trade-off between development and resource protection for this basin. The Pangani Basin has strong social and governance structures that can help identify this desired trade-off point and drive the process of setting up a basin-wide water-allocation plan.

The Pangani River Basin Management project was also a catalyst for the creation of the Wami Ruvu project which is focusing on building water governance capacity to secure the future of the Ruvu River in the Wami Ruvu Basin. The results from Pangani and the lessons learned have supported the roll-out of the Wami Ruvu project and activities at the national level as well as water governance projects in Uganda and Kenya and wider across the Western Indian Ocean Region through projects such as Wio-Lab.

### **Donor support**

The initial pilot project was supported by the Water and Nature Initiative – funded through the Government of the Netherlands (DGIS), the UK's Department for International Development (DFID) and the World Water Council. The Pangani Basin Water Board implemented the Pangani River Basin Management Project with technical assistance from the International Union for Conservation of Nature (IUCN), the Netherlands Development Organization (SNV) and the local NGO PAMOJA. The project was financially supported by the IUCN Water & Nature Initiative (WANI), the Government of Tanzania, the European Commission through a grant from EU-ACP Water Facility, and the Global Environment Facility through UNDP.

Additional components complementing the project are being supported by the Climate Change and Development Project, a Pan-African project funded by the Ministry for Foreign Affairs of Finland and implemented by IUCN and the Global Water Initiative (GWI), which is a partnership in three regions and 13 countries funded by the Howard G. Buffet Foundation.





**INTERNATIONAL UNION  
FOR CONSERVATION OF NATURE**

WORLD HEADQUARTERS  
Rue Mauverney 28  
1196 Gland, Switzerland  
[water@iucn.org](mailto:water@iucn.org)  
Tel +41 22 999 0000  
Fax +41 22 999 0002  
[www.iucn.org/water](http://www.iucn.org/water)  
[www.waterandnature.org](http://www.waterandnature.org)

Design: Tim Davis, DJEnvironmental, UK  
Print: UNI global union, Nyon, Switzerland  
Photo credits: Cover IUCN/ Taco Anema, all others  
IUCN/Onesmo Zakaria