**For the Nature Based Solutions case studies collection**

**WISE-UP to Climate: Water Infrastructure Solutions for the Tana Basin**

***What is the water management problem that was tackled with your case?***

The Tana, Kenya's longest river, flows for over 1,000 km with a catchment area of 95,000 km². The River Basin has significant development opportunities for hydropower, domestic water provision, and irrigation - planned as part of Kenya's Vision for 2030. The basin provides 65% of the national electricity needs from hydropower, and nearly all of Nairobi's domestic water supply for 4 million people. It does this through a series of water transfers and dams in the Upper Tana Basin. The basin also supports the livelihoods of around 6 million people, and is home to major biodiversity hot spots – some amphibian species are even named after the river.

Yet, within the basin there is fierce competition for water resources between many different activities and actors. These include irrigation, fishing, horticulture, rice production, hydropower, domestic water use, factories, and drinking water for Nairobi, as well as major growing towns such as Thika, Nyeri, and Karatina. It is therefore, both in economic and social terms – a growing concern for the Kenyan nation.

A critical challenge for the Tana River and those who manage it will be to adapt water management to climate change impacts and urban growth. At the same time, ways must be found that can help share the benefits equitably amongst the different users with different needs.

***What is your solution to this problem and how did it came to be?***

The WISE-UP to Climate project approach combines multi-criteria and multi-sector assessment of benefits and costs with engagement of basin stakeholders to meet basin needs under various plausible climates. A multi-disciplinary approach bridging the natural and social sciences better reveals the value and role that natural infrastructure can play in sustainable development. Stakeholder engagement is initiated right from project start, helping to guide and validate results and build ownership and cooperation. Sensitising key stakeholders in the Tana Basin on the use of evidence-based data can support decision making. A key part of the WISE-UP research is to understand the political-economic context in which decisions about river basin development are made. The aim is to better understand the interests of different stakeholders and their influence over investment choices, as well as the constraints they face. This helps identify opportunities to support positive changes in policy and planning, for equitable, sustainable and climate-compatible solutions.

***Why is your solution a Nature Based Solution?***

WISE-UP uses new tools and approaches to consider the role of natural infrastructure as a large scale 'nature-based solution' for climate change adaptation.

Over the past 50 years, agricultural intensification and expansion in the Upper Tana basin has led to increased soil erosion and river sedimentation. This has led to reduced farmland productivity and has adversely affected the performance of downstream water infrastructure such as dams and water treatment facilities. Although knowledge is available on current and proposed built infrastructure less information is available on the services already delivered by natural infrastructure. These natural services support local livelihoods and provide services to built infrastructure that often go unrecognised. WISE-UP to Climate demonstrates the application of natural infrastructure as a 'nature-based solution' for climate change adaptation and sustainable development. The project developed knowledge on how to use mixed portfolios of built water infrastructure (e.g. dams, levees, irrigation channels) and 'natural infrastructure' (e.g. wetlands, floodplains, watersheds) for poverty reduction, water-energy-food security, biodiversity conservation, and climate resilience. WISE-UP to Climate shows the application of optimal portfolios of built and natural infrastructure using dialogue with decision-makers to identify and agree trade-offs. The project has linked ecosystem services more directly into water infrastructure development in the Volta River Basin (Ghana principally, but also Burkina Faso) as well as the Tana River Basin in Kenya.

***What is the gain of your solution above so-called grey solutions? Why is it better to solve the local water problem with a nature-based solution? Improving water management productivity, aesthetics, other co-benefits, etc.?***

While benefits from river basins are generated by both built and natural infrastructure, decisions to endorse these benefits are often conflicting. These are complex trade-offs and decisions, often made in the absence of the full range of data and stakeholder voices needed. WISE-UP is working to untangle this complexity, but at

the same time retain the integrity of the results and the details needed by decision-makers at different levels. While river basin benefits to stakeholders are generated by both built and natural infrastructure, decisions supporting these benefits often conflict. It's at the negotiation about available information that the power imbalances become clear, and the positions of stakeholders become motivated by a range of needs and pressures. Through better understanding possible impacts, WISE-UP provides information that is valid to all sectors who have to equally adapt to climate change impacts.

It is not about choosing natural infrastructure over built options – as they both provide essential services to communities and nature. It is about understanding the natural system in place and how to work together within landscapes to build appropriate infrastructure that takes nature into account and harnesses its potential for optimal benefits.

***What hydrological and socio-economic evidence did your case-study provide that the current and/or projected impacts have or will be established?***

WISE-UP has demonstrated how benefits from natural infrastructure directly support hundreds of thousands of livelihoods in the Tana River basin in Kenya. Stakeholders helped WISE-UP to prioritize ecosystem services in the basin based on social importance, climate change impacts, and challenges to date based on the current use of dams in the basin. Services includes seasonal floodplain fish catch, flood recession agriculture, reservoir fisheries, estuary fisheries, floodplain cattle grazing, and sediment transport through the delta to the coast. Sediment transport from source to sea is important as it helps maintain beaches that are valuable to Kenya's tourism industry, and may be critical in limiting coastal salinisation of freshwater systems.

On average, the benefits accruing from this natural infrastructure are currently worth more than US$ 170 million per year, mainly to subsistence smallholder farmers and pastoralists in the Lower Tana basin. Removal or degradation of these benefits risks further heightening tensions over land and water resources in the Lower basin. Natural infrastructure in the Tana basin underpins the provision of services derived from current built water infrastructure worth on average US$ 139 million a year.

Maintaining flood flows is important for habitat regeneration and biodiversity needs, informal agriculture and livestock grazing. Pastoralists in the lower part of the basin travel long distances to graze their cattle, goats, sheep and even camels on the Tana floodplain. At any given time it is estimated that between one and two million animals graze in the lower Tana. During droughts the contribution of the floodplain to the pastoral economy becomes critical as other grazing areas dry up. WISE-UP estimates the current economic value of floodplain grazing as approximately USD 140 million per year, contributing to the livelihoods of many tens of thousands of people. By regulating river flows, the current stock of dams in the basin have reduced these benefits, including the value of floodplain grazing. Depending on climate change and river flow impacts, more dams are planned in the basin. It is critical that adaptation is used as a driver for sustainable development in the Tana, supporting downstream livelihood opportunities and livestock, as well as other floodplain benefits and biodiversity.

WISE-UP to Climate has shown that for the Tana River in Kenya, natural infrastructure contributes to the performance of existing built infrastructure. Healthy upstream watersheds, guided by sustainable agricultural practices, help to maintain irrigation productivity and hydropower production downstream. However, scaling-up watershed protection activities is needed to maintain the benefits provided downstream. These include soil protection and smarter agricultural practices to reduce sedimentation in reservoirs - reservoirs that provide Nairobi with drinking water and electricity generation.

Climate change will increase precipitation in Kenya, and this is likely to cause agriculture to change, bringing both risk and opportunity to the Tana Basin. Programmes such as the Nairobi Water Fund need to rapidly expand activities across the upper watershed and lower into the basin to counteract the impact of increased rainfall, and maximise the agricultural opportunities this can bring to Kenya. Combining trade-off modelling with future climate river flows provides options for which combinations of built and natural solutions work best together for different objectives.

***Why is this case a sustainable solution for the system – in other words: How does your case study add to the implementation of the SDGs and to water management as a benefit for people, ecosystems and values to the rest of the system as a whole.***

WISE UP responds to SDG 6, supporting water management approaches by finding the optimal infrastructure solutions in an uncertain climate future. Healthy, well-functioning natural infrastructure such as watersheds,

floodplains, wetlands and river habitat, help to optimise the long-term performance of engineered infrastructure, such as dams, reservoirs and irrigation systems. This can bring national and local economic benefits, help to sustain ecosystem functions, and contribute to storing carbon and broader landscape development.

IUCN's multi-partner programme, WISE-UP to Climate, has new tools to transform planning and investment in water infrastructure. Governments, financing institutions and project developers will now have capabilities for quantifying trade-offs between built and natural infrastructure across whole river basins. They will now be able to identify which combinations of investment in natural infrastructure and built infrastructure are the best bet for sustainable development and climate change resilience.

***What was the enabling environment (policy makers, governance, financers, and other stakeholders) that enabled and possibly improved possibilities to implement and manage the NBS? What were (if any) the bottle necks? And how is the return of investment (financial close) compared to financers?***

Discussions with decision makers to identify and agree trade-offs leads to conversations on more equitable and effective adaptation and development solutions that suit all stakeholders. But to get the most out of these conversations, and to learn from the experience in the room, you need the right tools and information. Bringing multi-disciplinary evidence and data together, and linking this with local and national level experience is key to build the adaptive capacity needed to integrate natural infrastructure into future river basin planning and investment choices.

WISE-UP operates right at the limit of current climate data in the Volta basin. Both built and natural infrastructure benefits will be sub-optimal unless climate impacts are included in river basin planning. The project engages basin stakeholders directly, allowing them to steer and actively guide the research based on their experience, needs, and understanding. Iterative learning and capacity building are critical to better understand how to make information and innovative tools practical, useful and trusted – taking science into policy circles and decision making processes. It helps us shape the future stages of WISE-UP research to continually evaluate the relevance of its work.

Basin lead partner ACCESS -the African Collaborative Center for Earth System Sciences- has worked with key basin stakeholders to develop possible scenarios for the development of the Tana River basin. Their workshops function as dual opportunities to build (i) capacity, understanding, and dialogue amongst diverse stakeholders, and (ii) technical implementation using project data to demonstrate trade-offs and options. They aim to develop skills and competencies among participants in the design and use of basin scenarios to inform decision-making and planning for alternative natural and built infrastructure options under a changing climate.

***Additional information and requirements on the case-study***

*Please indicate in which of the following themes your case-study fits best:*

a) Climate resilient cities / c) water use / availability d) delta extremes (floods/droughts) -ALL

*Please indicate where in the (imaginary) delta catchment your case-study is located (approximately):*

a) Upper / b) middle / c) lower section -ALL

*Please deliver the case-study information requested with inclusion of images, a vlog or video, infographics, etc. This will enable a wider public to engage into the topic and learn from your experiences.*

*Since we will be working with an online environment, please also add web-links to locations where more information can be found on your case-study (papers, your own webpage, etc.)*

WISE UP Shorthand: https://social.shorthand.com/IUCN_Water/ugTJkK5pcyj/wise-up-to-climate
ODI (2017) : « Making water infrastructure investment decisions in a changing climate : a political economy study of river basin development in Kenya » : https://www.odi.org/sites/odi.org.uk/files/resource-documents/11883.pdf
IWMI (2017): «Understanding the Hydrological Impacts of Climate Change in the Tana River Basin»: http://www.iwmi.cgiar.org/Publications/Working_Papers/working/wor178.pdf
WISE-UP to Climate webpage: http://www.waterandnature.org/initiatives/wise-climate
WISE UP blogs:
Inclusive water development: experiences from the WISE-UP Project:
http://www.waterandnature.org/blog/inclusive-water-development-experiences-wise-project
Built or natural infrastructure: a false dichotomy:

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| https://wle.cgiar.org/thrive/2015/03/05/built-or-natural-infrastructure-false-dichotomy<br>Participators scenarios development as social learning tool in the Tana River Basin: http://www.waterandnature.org/blog/participatory-scenarios-development-social-learning-tool-tana-river-basin<br>Striking a balance between nature and development: http://www.waterandnature.org/blog/striking-balance-between-nature-and-development |
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