The Narubu game of many voices

How different perspectives and worldviews can influence the role of science in supporting policy

Narratives and Fact Sheets

Security and economic growth

Farmers and residents of the Ng'ombe River Basin are facing high and increasing risks from drought and floods. The main aim of Narubu's Water Policy is to strengthen the role of the water resources sector in sustaining economic growth and reducing poverty.

Of particular importance for the Ng'ombe River Basin is to expand irrigation to increase yields from crops, especially sugar cane as the major crop in the region and essential for jobs and development. Food security is also threatened by floods, like the devastating 2015 flood that resulted in many fatalities and huge damage to crops. Available public resources should ensure the greatest protection for droughts and floods as possible.

According to hydrologists and other experts, the greatest protection would result from completing the Kokuro dam, which would expand the reservoir and nearly double the area of irrigated agriculture, mostly sugar cane, which will be exported for sugar and ethanol production. The completed dam will also regulate river levels and flooding downstream by temporarily storing the flood volume and releasing it later, through a government supported integrated water management plan. Besides drought and flood control, the Kokuro dam will provide water to the water-scarce city of Mapaka.

Water efficiency measures, and even water pricing, have been suggested to reduce water demand for agriculture and urban centers, but it is the job of the government to make sure every farmer and city dweller has sufficient water. We don't need the market for this. It is important, of course, to assure that the dam and resulting reservoir meet all requirements for ecosystem protection, and those persons who must be relocated are appropriately compensated.

Even with the heightened dam, there will be residual risks, especially extreme droughts and floods. Natural flood measures for increasing water retention, like wetlands and forests, are far too limited in their scope to be of much use for drought and flood control. The government should provide access to long-term forecasts for droughts, and an early warning system, combined with emergency plans and rescue operations, for floods. Public investments in education can also improve resiliency against floods and droughts

Security and economic growth

Preferred options:

- Complete Kokuro dam ++
    - 1-stage investment (not incremental)
    - Cost: 90 budget units
- Expand irrigation system ++
    - 2-stage investment
    - Note, second stage of irrigation system will require the completion of Kokuro dam
    - Cost: 30 budget units/stage
- Long-term weather forecast combined with early warning system +
    - 1-stage investment
    - Cost: 80 budget units
    - All farmers can use long-term information to reduce flood and drought losses
- Education: entrepreneurship and flood resilience +
    - 3-stage investment
    - Cost: 10 budget units/stage
    - Addressing new income and subsistence options as well as flood risk reduction

Further Instructions:

Your aim is to reduce flood/drought risk and improve food production.

You may include additional goals (health, ecosystems, education etc.). They should be consistent with your narrative.

You are trying to fund solutions with "++". They are significantly more effective for achieving your goals than solution with only "+".

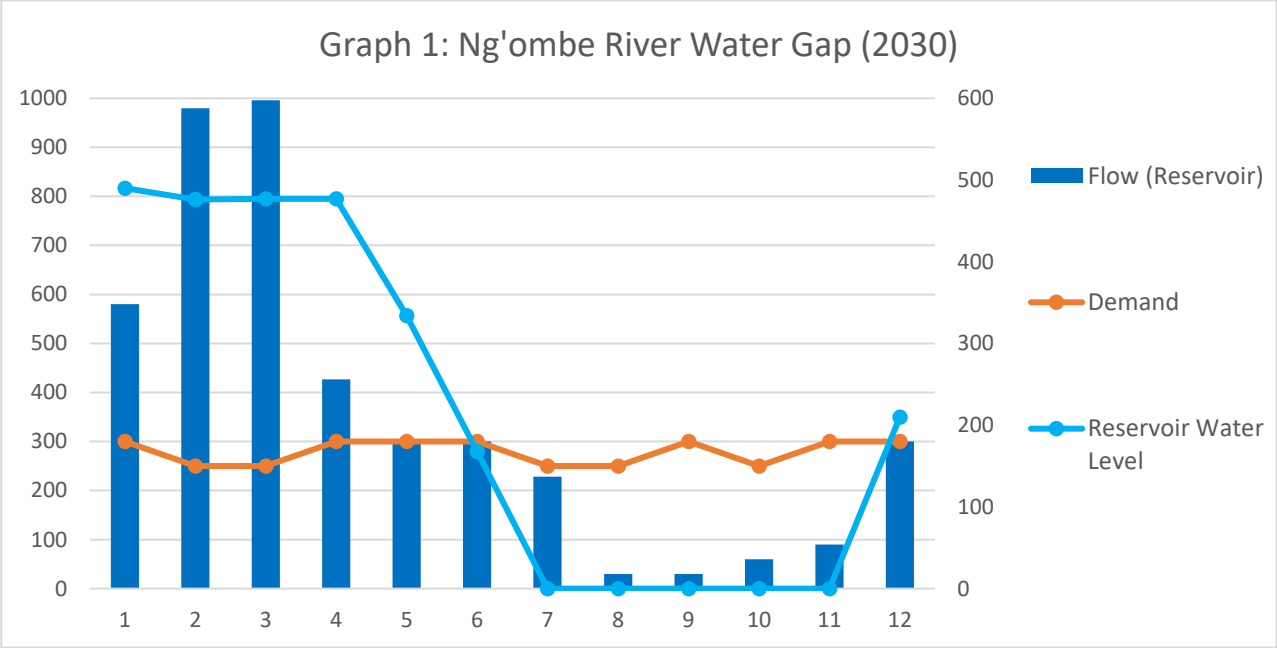
Security and economic growth

RESEARCH SUPPORTED FACT SHEET

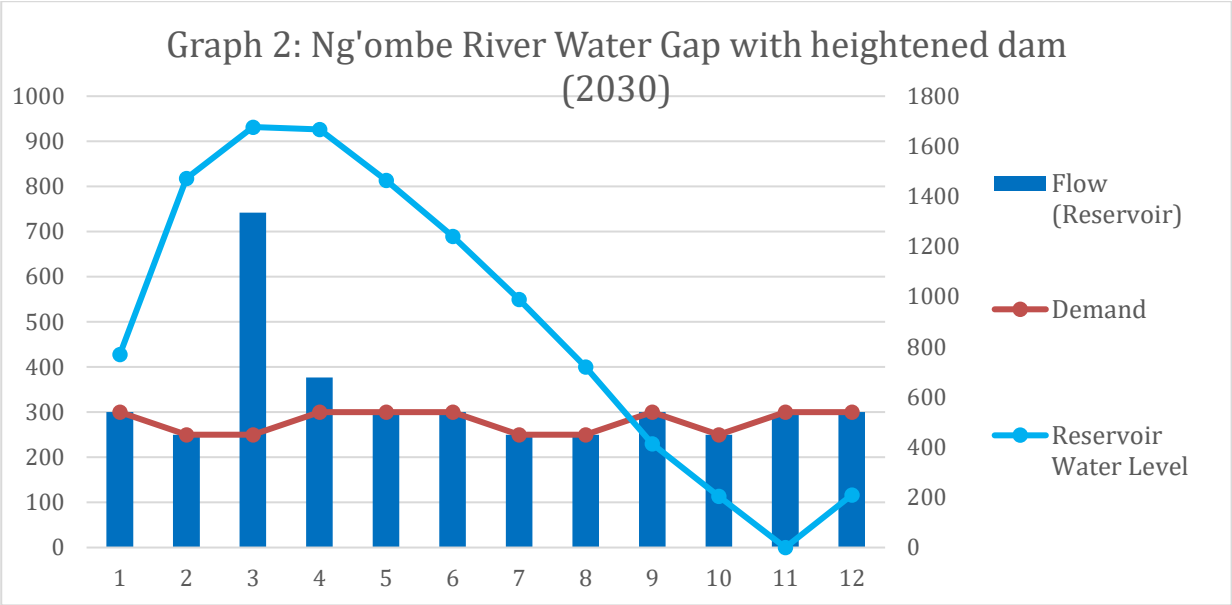
According to a recent report by the World Bank, Narubu has vast potential to eventually become a major food producer in the region. Only 16 percent of land suitable for farming is currently cultivated,. Improving agricultural productivity and ensuring access to food are now top priorities for Narubu's leaders. Agriculture contributes more than a quarter of Narubu's GDP and employs 80 percent of its labor force.

The Kokuro dam was built to harness the heavy precipitation in the rainy seasons and provide protection from floods and drought. Flow volumes of the river are highly variable with some years characterized by very low flows, while other years display runoff volumes equivalent to up to six times the mean value.

If shortages are to be avoided in the future then additional sources of water are immediately required to serve the rapidly expanding new areas and meet a rapidly increasing demand that is predicted to increase four fold by 2030 (see graph 1). In the dry season the reservoir dries out creating a gap between supply and demand.



Further expansion of the Kokuro Dam has been identified as the only option capable of providing sufficient water to augment supply before the predicted shortage will severely limit economic growth. Graph 2 demonstrates how new water demand can be met with the heightened dam and expanded reservoir. Even in the dry season the river water flow is sustained with the water stored during the rainy season.



The expanded reservoir will enable the doubling of irrigated sugar cane acreage. It will also help solve the water deficit in Mapaka (country capital) by increasing water supply to the city by 25%. Finally, the dam will protect against floods. In 2015 a major flood in the Lower Ng'ombe basin resulted in 71 deaths, including 15 school children. Over the past 20 years more than 500 people have lost their lives in floods.

The estimated reduction of downstream flow by 5% resulting from the new construction is not significant enough to affect biota negatively downstream. Although family graves will be inundated, and persons will be re-located – this will be dealt in great care under the Resettlement Action Plan.

Careful stewardship of the river

The Ng'ombe River is the life line of southern Narubu. Not only does the river enable a rich biodiversity, but by depositing sediment and nutrients, it is essential for agriculture along the river's entire reach. The fresh water reaching the estuary is vital for maintaining healthy mangroves that support fisheries that provides livelihoods to the local communities.

High water abstractions driven by water-intensive agriculture, especially sugar cane, are jeopardizing these ecosystem functions. Overconsumption of water is further worsened by plans to divert the river's water to the major urban center, Mapaka.

Completing the Kokuro dam is not the answer, rather it is the problem. By reducing the sediment deposited downstream and eventually the delta, fish habitat is endangered and fisheries decline; The mono-cropping of sugar cane has led to eroded soils, and the application of fertilizers risks serious water pollution. More worrying, the profits from sugar cane accrue mainly to the large commercial farmers. In addition, the greatly expanded reservoir will force whole villages to relocate with huge social and economic cost – the government cannot be relied upon to adequately compensate these misplaced persons. Finally, sacred burial grounds will be inundated.

What is needed, instead of expanding the Kokuro reservoir, is more holistic and sustainable development of the basin. The region has an unacceptably high number of stunted children under 5 years of age. Instead of sugar cane, it is important to foster investments in oilseed, cashew and fruit value chains because of the nutritional benefits they offer to the poor, as well as their resilience to flood events. Small farmers planting less water intensive crops should be supported with smart subsidies for seeds and other inputs, and with long-range weather forecasts.

Floods are increasing in their intensity mainly as a result of deforestation and destruction of wetlands, as well as climate change, which is leading to increased precipitation in this basin. The small farmers along the fertile Lower Ng'ombe Basin have learned to live with floods by building temporary and transportable homes that can be moved to higher ground in periods of heavy rains. This adaptive strategy could be supported with early warning systems. Moreover, investments in forestation and wetland restoration, by retaining moisture in the soil, will go a long way in reducing both drought and flood risk.

Careful stewardship of the river

Preferred options:

- Invest in wetland restoration ++
    - 1-stage investment
    - In order to have significant effect wetlands should be combined **with forestation**
    - Cost: 50 budget units
- Invest in forestation (stage 1 and stage 2) ++
    - 2-stage investment
    - In order to get significant effect has to be done **together with the wetland restoration**!
    - Cost: 30 budget units / stage
- Subsidize small scale agriculture +
    - 1-stage investment
    - Cost: 10 budget units / stage
- Flood warning system and improved systems for communicating long-term weather forecasts+
    - 1-stage investment
    - Cost: 80 budget units
- Education: entrepreneurship and flood resilience +
    - 3-stage investment
    - Cost: 10 budget units / stage

Further Instructions:

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Careful stewardship of the river

RESEARCH SUPPORTED FACT SHEET

The following critique of the Kokuro dam project is based on an expert report from an international NGO which champions the global struggle to protect rivers and the rights of communities that depend on them. According to this report:

- The Kokuro dam project will benefit mainly the large sugar cane interests, partly owned by foreign companies. Indeed, the analysis reported that the increased irrigated acreage belongs to only one person!
- While the annual flow downstream of the dam has been estimated at 5%, this is an average, and during dry periods the flow can be so low that it negatively impacts agriculture, fisheries and biota downstream.
- The dam will reduce flooding downstream for the 1 in 10 to 1 in 50 year floods; however, the dam can be overtopped for the more extreme floods occurring less frequently than 1 in 50 years. The dam thus creates a false sense of security.
- Estimates show that the increase of the size of the reservoir will lead to an increased risk (+20%) of intestinal and urinary bilharzia and malaria as observed in many other reservoirs on the continent.
- In addition, family graves are considered sacred places, and 100 will be inundated. Moreover, at least 1000 households will need to be relocated. While the government claims that this will be dealt with under the Resettlement Action Plan, past experience shows that persons will be relocated to desolate areas with little outlook for continuing their livelihoods.

Alternatives to the dam

To conserve the available water, the government should consider funding water efficiency investments. A study by the African Association of Water Engineers shows that reducing conveyance losses in irrigation systems, it is possible to reduce the Annual Water Use Rate of the irrigated areas by 25%. Moreover, Mapaka is facing serious water shortages, but this need not be solved by the ecologically questionable option of diverting water from another river basin since this same study showed that by preventing water leakages, urban water usage could be reduced by 50%.

Finally, according to a recent report by the African Development Bank, poverty and food insecurity are the main underlying causes in Narubu of chronic undernutrition, which currently affects 44 percent of children under five. Food availability is limited by low yields and inadequate access to markets for many citizens. In the poorest areas of the river basin more than 50 percent of children under 5 suffer from stunting. The ADB recommends that agriculture focus strongly on vitamin-intensive and water-saving crops.

Rational choice

Households and farmers in the Ng'ombe River Basin are at risk of floods and droughts; yet, these are not the only concerns of the population, and probably not the main ones. Diseases, including HIV/AIDS, pneumonia, malaria, and diarrhea, are the highest causes of death in the basin, and floods and droughts contribute to malnutrition and disease.. It is very important to allocate scarce public resources taking into account all the basin priorities, that is, the costs and benefits based on empirical risk analyses.

The costs and benefits of investments in drought and flood protection should thus determine how the public invests, whether in structural measures (e.g., heightening the Kokuro dam) or more ecological measures (e.g., forestation, support for small farmers,). Above all, the government should consider encouraging investments in health and education, which by building human capital enable the population to not only increase their resilience to flood and drought risk, but also to reduce their higher risks from disease. Education not only equalizes opportunities, but helps pull the poor out of rural poverty.

The problem with subsidized agricultural schemes is that they encourage farmers to produce crops that may be economically unsustainable. It is important that prices reflect true costs. For instance, offering free water to the large sugarcane producers results in more sugarcane production, crowding out crops that use less water. Moreover, free water will result in its overuse and waste. This is not a socially optimal use of water resources; nor is it equitable if the publicly financed dam and reservoir are disproportionally benefitting the large growers of sugarcane. Water pricing would enable farmers to make their own choices with regard to their crop choices, irrigation and even seeking alternative livelihoods. Of course, it is important that water is affordable to the poor through a needs-based pricing strategy or income supports.

Rational choice

Preferred options:

- Consideration of the costs and benefits of investments in the Kokuro dam and irrigation scheme, forestation and wetlands;
- Support for water pricing through public investment in monitoring systems ++
    - 1-stage investment
- Support for education (entrepreneurship and flood resilience) to empower individuals to choose alternative livelihoods and reduce risk +
    - 3-stage investment

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Rational choice

RESEARCH SUPPORT FACT SHEET

	Solution	*Preference*	*Cost*	*Stages*	*Flood Risk reduction (/stage)*	*Source or loss of income(or subsistence)*	*Dependencies*	*Other benefits*	*Other costs or barriers*
	Unit	*++,+,-,--*	*$*	*1-3*	*0-10*	*++,+,-,--*			
1	Completion of the upstream dam		90	1	10	++ Income for the sugar cane farmers; - Reduced income for small farmers - Reduced income from fisheries downstream;		Water supply to Maputo; Total cost much higher but supported by the World Bank subsidy	Reduction of downstream flow because of evaporation; Social and psychological costs of displaced persons;
2	Irrigation scheme for sugar cane		30	2	0	++ Income for sugar cane farmers;	Only 1 stage can work without the dam completion		
3	Wetland restoration		50	1	3	+ Income from fisheries	In order to get significant effect has to be done together with forestation (at least one stage)	Contribution to biodiversity (including migration corridors)	
4	Forestation		30	2	1	+ Subsistence (food, firewood)	In order to get significant effect has to be done together with the wetland restoration	Sequestration of CO2 Erosion reduction; Contribution to biodiversity (including pollination); Increased yield from remaining crops;	Reduced crop acreage
5	Support for small farmers for high nutrition crops		10	3	0	+ Subsistence food			
6	Long-term forecast combined with early warning system	+	80	1	5	+ All farmers can use long-term information to reduce flood and drought losses			
7	Education: entrepreneurship and flood resilience	+	20	3	1	+ Supporting new income and subsistence options		Evidence shows that educated households have fewer deaths from drought and flood	
8	Water pricing	++	80	1	0	- Reduces farmers' income		Increases water use efficiency; Domestic water use for sanitation remains free;	

Cost effectiveness of risk reduction
(cost in budget units of reducing the risk one level;
lower values mean better efficiency)

Completion of the upstream dam	9
Wetland restoration	17
Forestation	30
Long-term forecast combined with early warning system	16
Education: entrepreneurship and flood resilience	20