Applying a Nexus Tool to Support Transboundary Water Allocation Reform in the Incomati

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Background

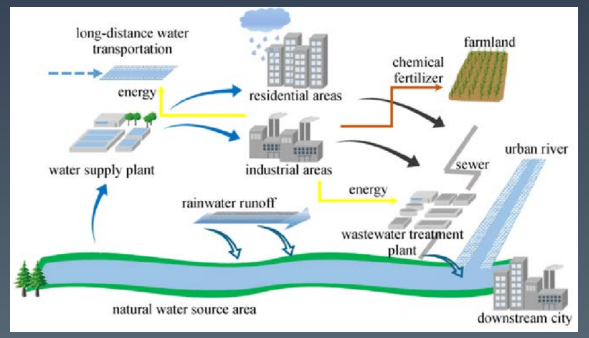
Countries: Eswatini, Mozambique, South Africa

River Basin Commission: INMACOM formed in 2021

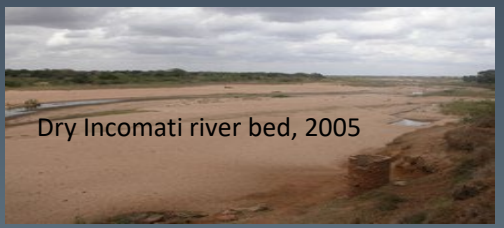
Size: 49,000 km^2
Length of main river: 480 km
Population: 2.3 million

Water use is intense in the basin

Amount of the water generated in the basin being withdrawn by human consumption (van der Zaag et al., 2003).

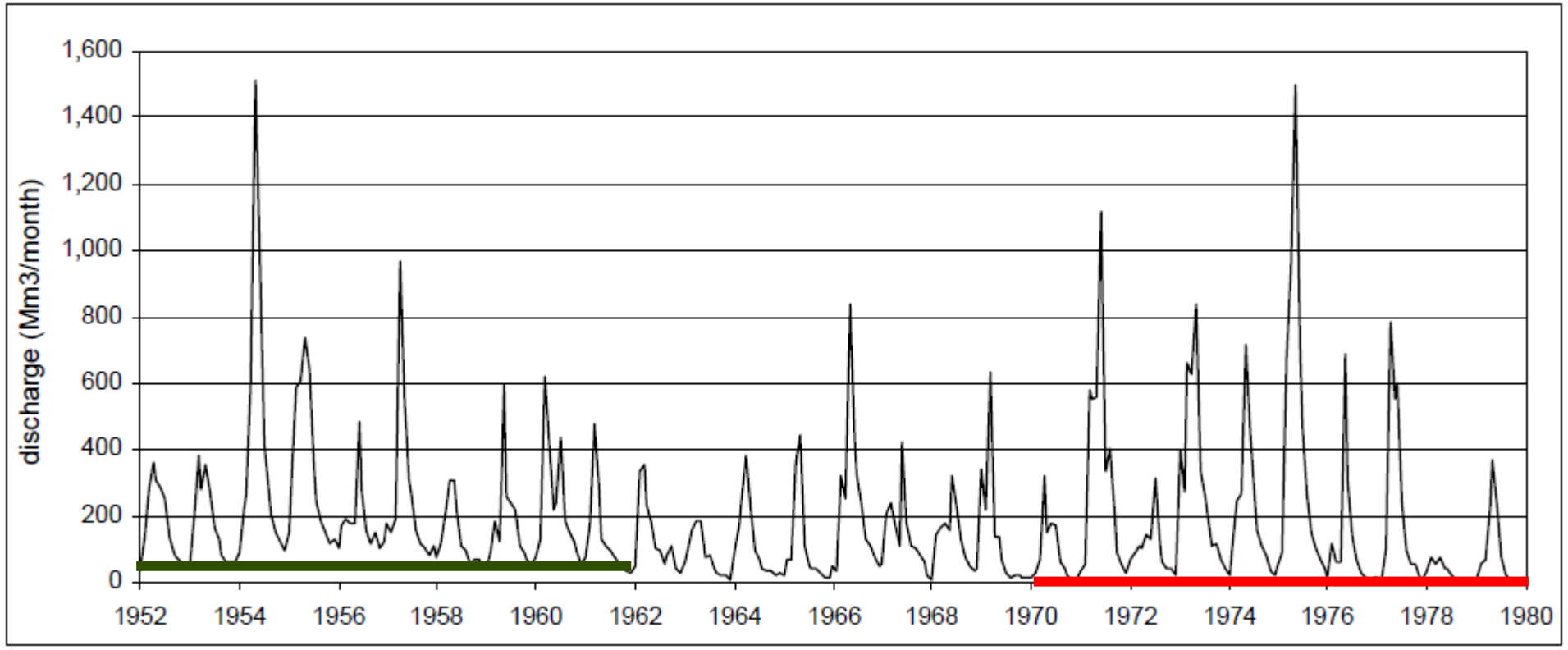


Competition over water is high, with competing water demands and water abstractions are fast approaching the limits of sustainability.



The effects of extreme events such as droughts and floods, are very common with significant losses recorded each year.

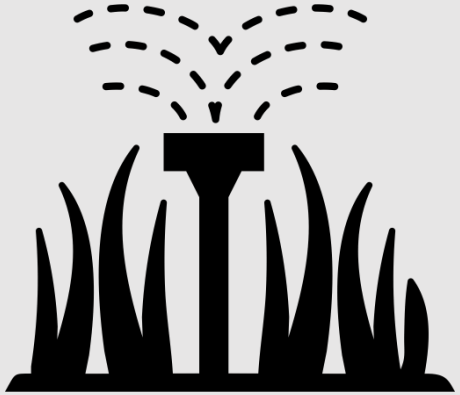
Basin water use exacerbating water scarcity in the dry season?



Monthly discharge at Ressano Garcia (1952-1980)

Impact of competing demands from multiple sectors is not clearly understood

Agriculture



Area under irrigated sugarcane expanded by significantly in the basin

Reservoir storage

Member states have increased storage capacity by building new dams since 1980s and more dams are underway

Industry

One of the biggest economic zones in South Africa relies on Incomati waters

Domestic water supply

Domestic water supply for Maputo city is also dependent on Incomati waters

Transboundary Basin Governance

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1983 TPTC

Drought (and increased use) reduces cross-border flow to nothing, countries accept need to coordinate

1991 Piggs Peak Agreement

All countries developing water resources, eSwatini needs World bank funding. WB requires no objection from downstream Mozambique. To secure no-objections, SA and eSwatini agree to 2 m3/s to Moz at border (Komatipoort/Ressano Garcia)

2002 IIMA

Better relations between states, SADC Water sharing Protocols; Need for a more comprehensive approach, belief that more water can be found if a more collective approach are used

- Minimum transboundary flow increased to 2.6

➢ **New Transboundary Flow allocation under development**

Activity Objectives

1. Develop a model that can be used by INMACOM to support basin wide decision making
2. Explore simulation and optimization that can enhance cross sector WEFE benefits
   - Understand the impact of competing basin demands and optimize water allocation in the basin
   - Understand the water resources impact of potential dams (Moamba Major) on basin hydrology
   - Understand the water resources impact of increased irrigation (both upstream and downstream)
   - Quantify the changes in the basin outflow under different scenarios of irrigation development

Activity Progress: Developing a process for model development

First meeting held in Aug, 2022

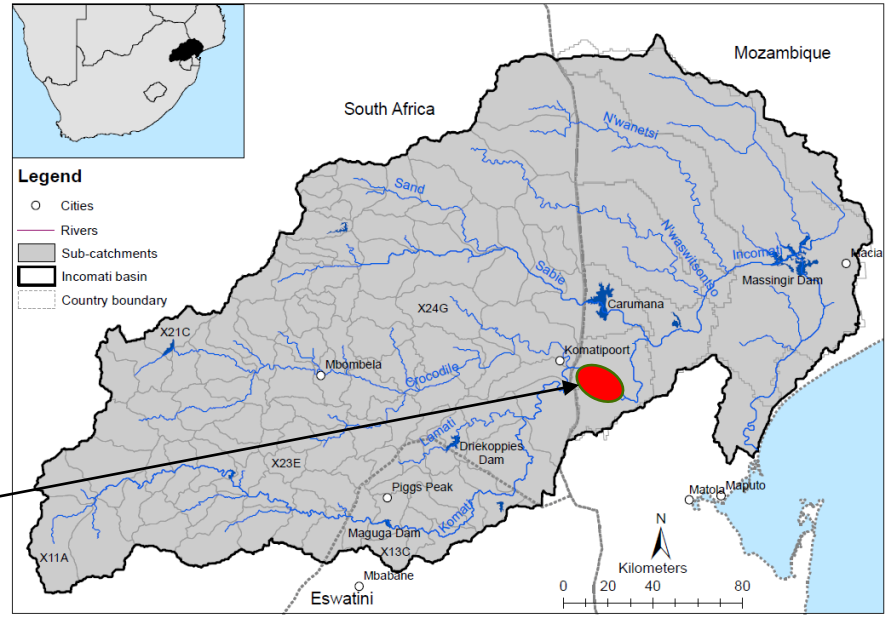
- 18 Participants from 3 countries
- Stock-taked country-level modelling efforts
- Introduced the PyWR model to the member states
- Agreed on YPs and process through which data is to be collected and PyWR model developed for Incomati
- Initiated weekly meetings with YPs

Activity Progress: Co-developing the model and testing

- 18 Participants from 3 countries
- Presented Incomati river basin PyWR model
- Capacity building and training
- Identified key questions to answer using the PyWR model
  - Impact of ensuring flows into Moamba dam on upstream water abstraction
  - Potential benefits that could be derived from increasing transboundary minimum flow requirement

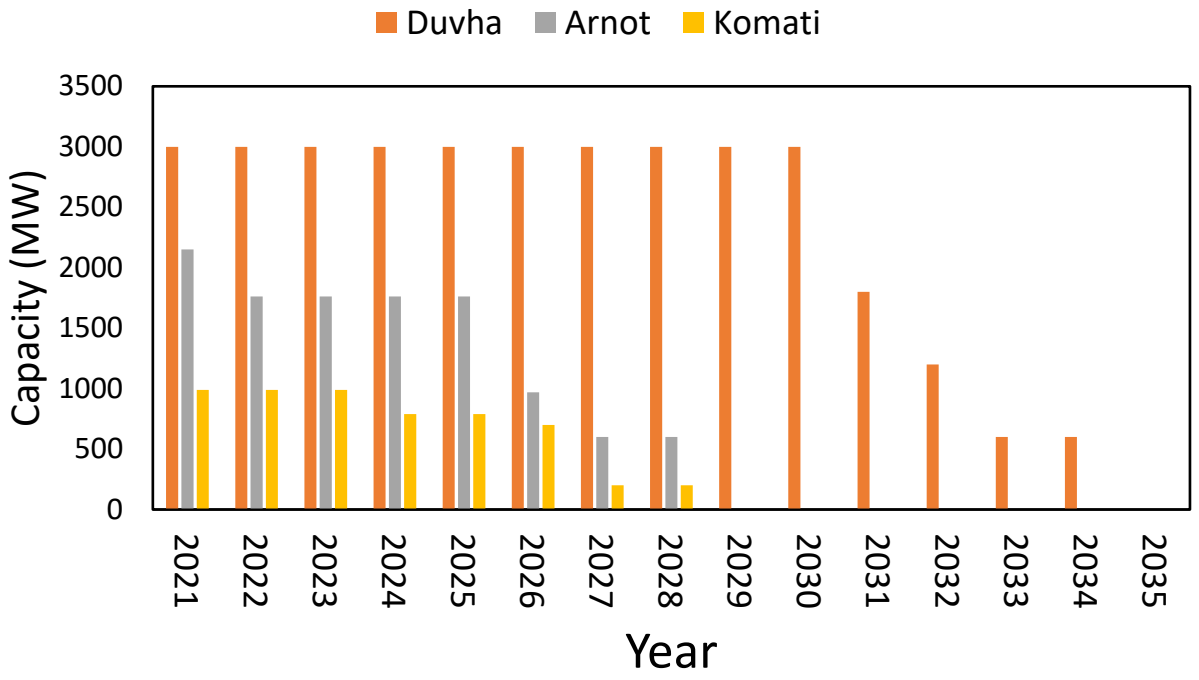
Second meeting held in March, 2023 (at Driekoppies dam)

Moamba major



Application of PyWR model

Understanding the impact of energy and agricultural sector water usage on the transboundary Incomati River



Phased decommissioning plan for ESKOM thermal power plants that withdraw water from the Incomati River

Scenario	Scenario Name	Scenario description
Scenario 1	Business as usual	Current infrastructure with increased domestic demand, irrigation development, and demand for thermal power plant cooling. Assumes a 2% increase in annual water abstraction.
Scenario 2	Decommission	Scenario 1 with a progressive decommissioning of the thermal power plants in line with South Africa's low-carbon transition.
Scenario 3	Decommission with efficient irrigation	Scenario 2 with a 20% increase in irrigation efficiency where current efficiency is below 80%.

Hydrologic impact of decommissioning of Thermal Power Plants

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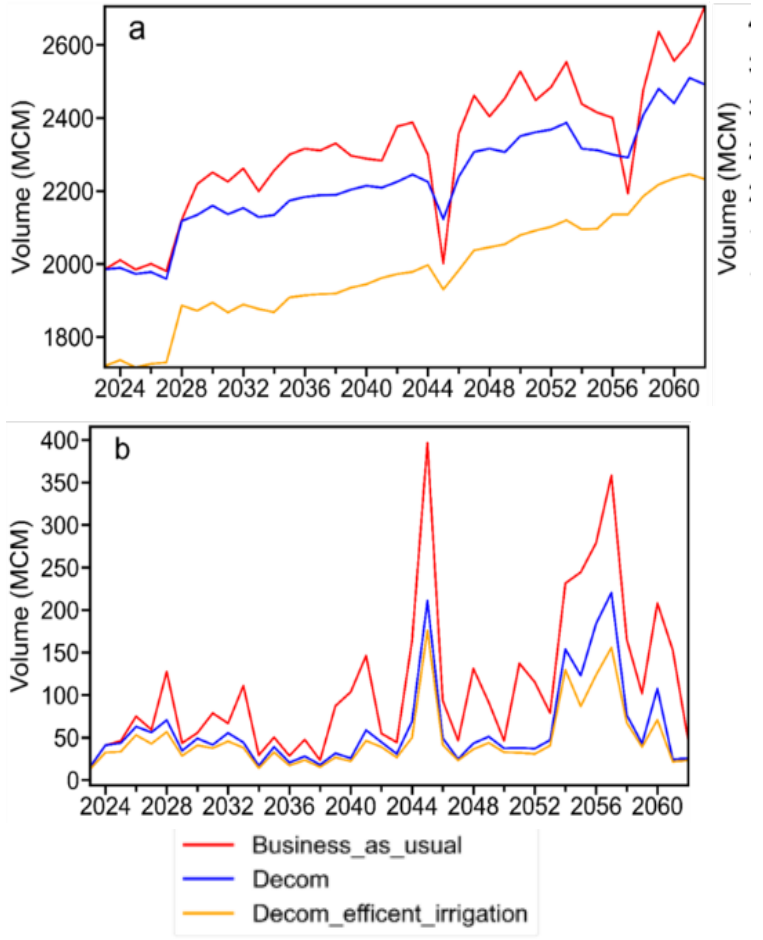
- Decommissioning of power plants and efficient irrigation reduces water abstraction after 2030:
  - 3.8% reduction from power plant decommissioning
  - 14% reduction when combined with efficient irrigation
- Decommissioning can reduce shortages by up to 175 MCM/year and combining decommissioning with efficient irrigation can increase savings to 220 MCM/year.
- Improve environmental flow at Ressano Garcia by 5%.
- Cumulative hydropower generation in Mozambique increased by 266 GWh in the ”Decommission with efficient irrigation” scenario.

More water in the river

Reduced impact of droughts

Increased hydropower in Mozambique



Incomati River Basin annual and riparian countries aggregated water abstraction and deficit under a hydrological sequence resulting in the highest deficit.

Next Steps

- Future research will assess:
  - New regulations and management approaches to address future water scarcity.
  - Examine the impact of forthcoming storage and irrigation projects in South Africa and Eswatini.
  - Explore coordinated reservoir operation rules.
  - Evaluate transboundary water agreements in light of changing demands and future projects.
  - Assess the effects of climate change uncertainties on future water availability and use.

Thank you

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