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Integrating Water Resources Management in a Shared River Basin: Applying a Nexus Tool to Support Water Allocation Reform in the Incomati

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Background

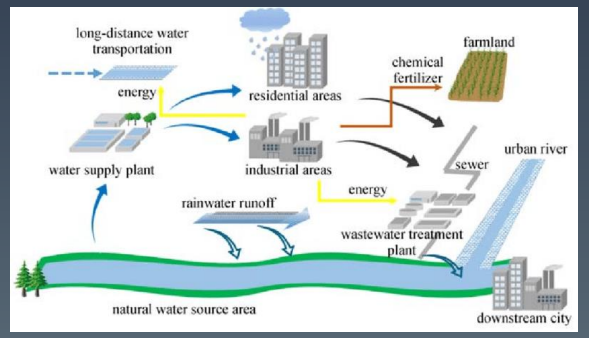
Countries: Eswatini, Mozambique, South Africa

River Basin Commission: INMACOM formed in 2021

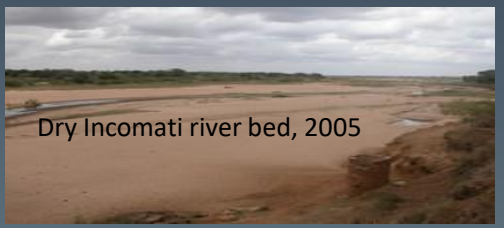
Size: 49,000 km^2
Length of main river: 480 km
Population: 2.3 million

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Amount of the water generated in the basin being withdrawn by human consumption (van der Zaag et al., 2003).

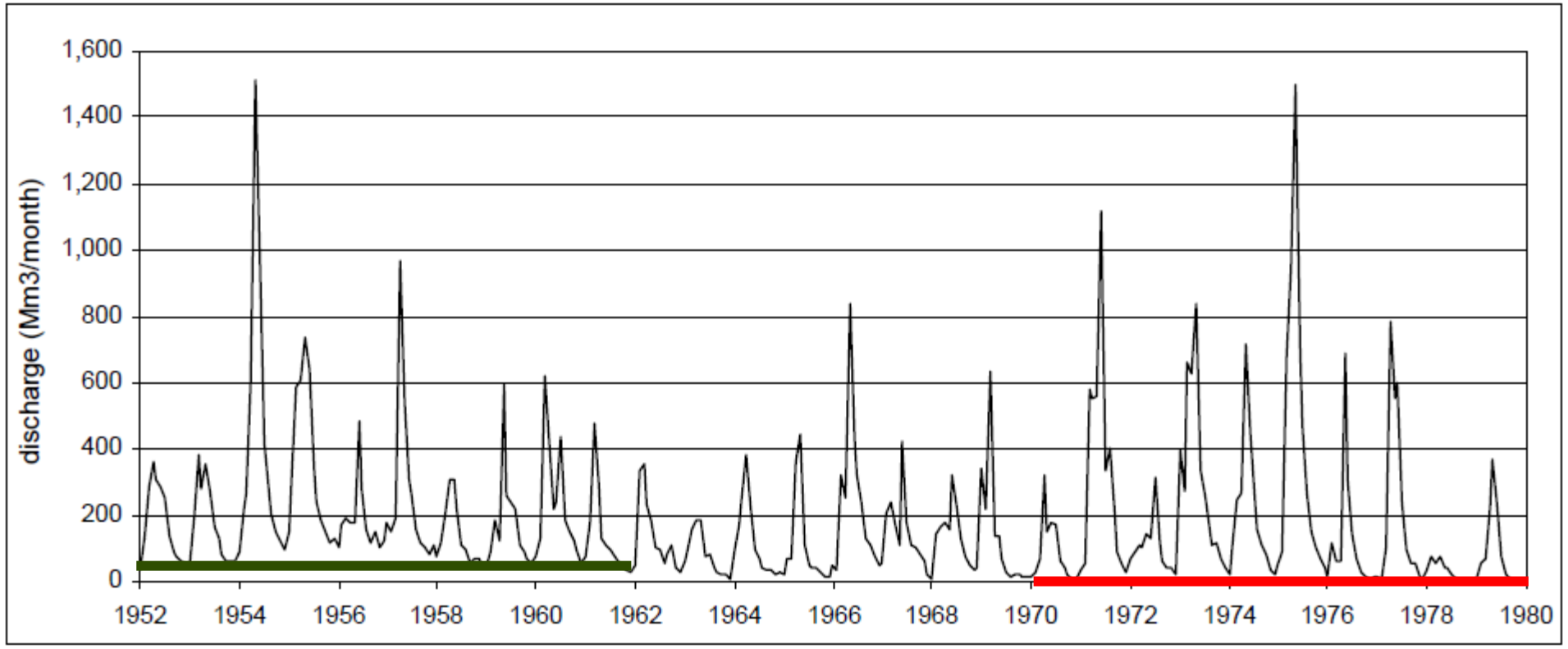


Competition over water is high, with competing water demands and water abstractions are fast approaching the limits of sustainability.



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

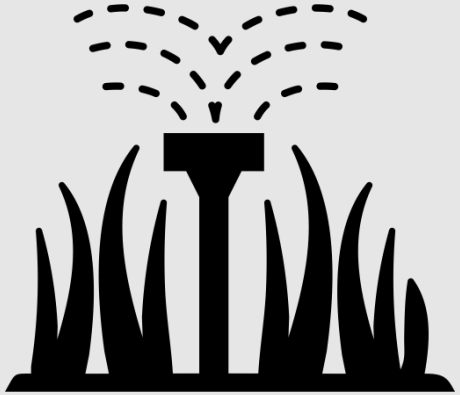
Basin water use acerbating water scarcity in the dry season?



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

1983 TPTC

Drought (and increased use) reduced cross-border flow to nothing, countries accepted to coordinate

1991 Piggs Peak Agreement

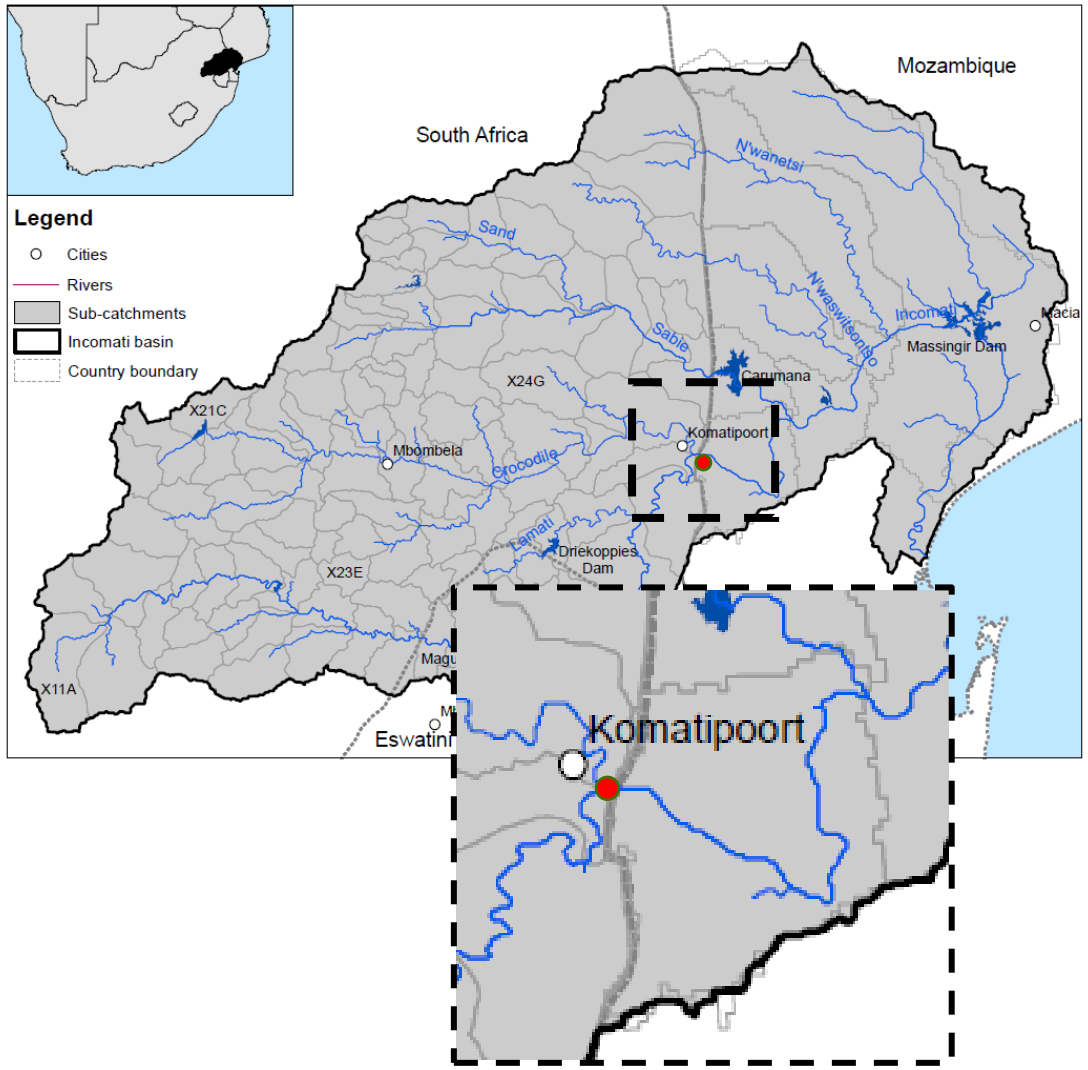
All countries developing water resources, eSwatini needs World bank funding. WB requires no objection from downstream Mozambique. To secure no-objections, SA and eSwatini agree to

2 m3/s to Mozambique 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 m3/s



➢ **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

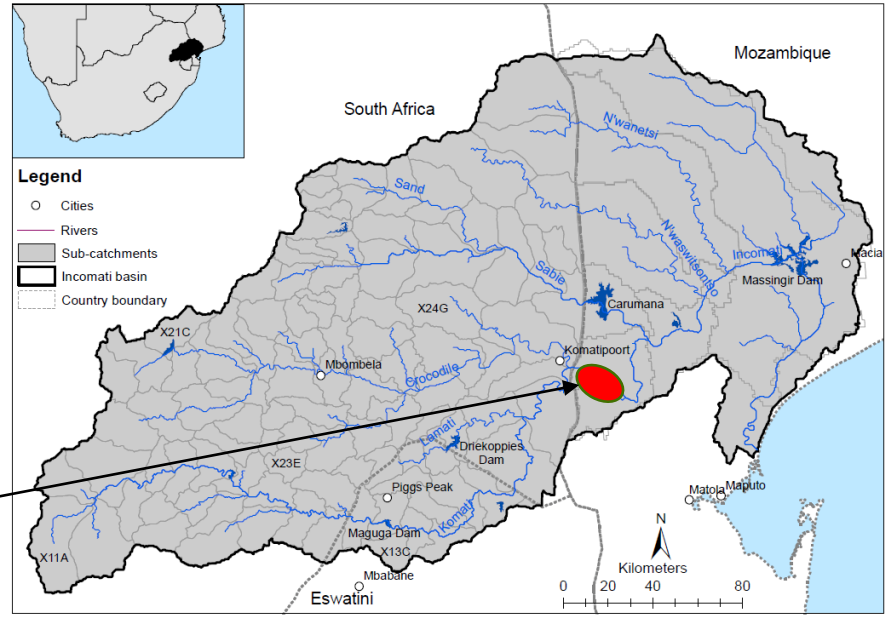
- 18 Participants from 3 countries
- Stock-taked country-level modelling efforts
- Introduced the PyWR model to the member states
- Agreed on YPs and process through which data is to be collected and PyWR model developed for Incomati
- Initiated weekly meetings with YPs

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



PyWR Model background

- PyWR – Python Water Resources is an open source Python simulator that can create a digital support system (DSS) to explain basin water systems in terms of flows, water demands, allocations and infrastructure operations that ac[illegible] the reality.
- Developed by University of M[illegible]chester in 2020
- A Water-Energy Nexus mo[illegible]

pywr/**pywr**

Pywr is a generalised network resource allocation model written in Python.

pywr

METHODS article

Front. Environ. Sci., 07 May 2021
Sec. Water and Wastewater Management
Volume 9 - 2021 | https://doi.org/10.3389/fenvs.2021.596612

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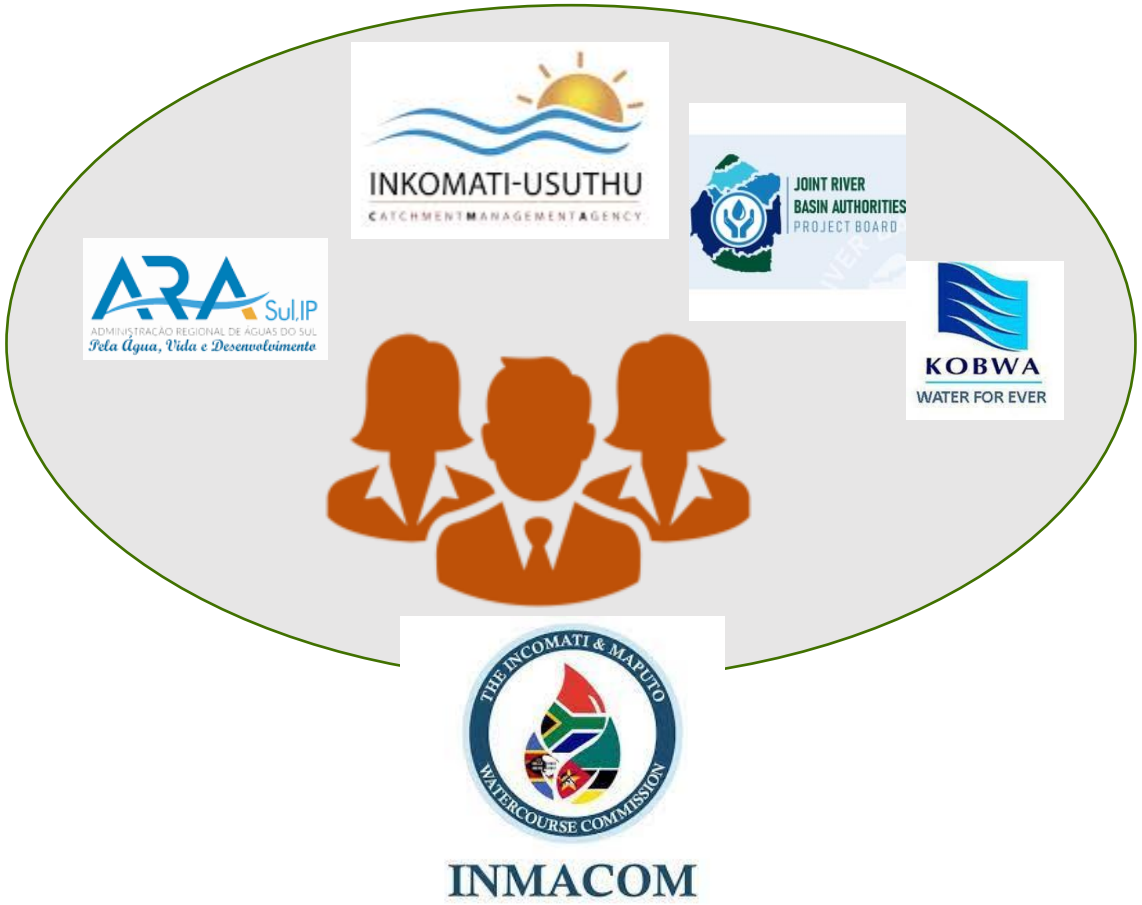
Model Data

Inflow	**Naturalized flows from Pitman and WEAP models**
Water Demands	**Pitman, WEAP, National and river basin organizations**
Observed reservoir levels	**National and river basin organizations**
Reservoirs and dams	**Pitman model, National and river basin organizations**
Irrigation	**National and river basin organizations**

Young Professionals from Incomati basin region



Thank you

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