Accounting Water-Energy-Food nexus trade-offs, Case study-Cauvery Basin

Bhawana Gupta(3), Bob Ferrier(2), Andrew Allan(1) and John S. Rowan(3)
1 UNESCO Centre for Water Law, Policy and Science , University of Dundee, Scotland UK
2 The James Hutton Institute, Invergowrie, Dundee DD2 5DA, Scotland UK
3 University of Dundee, Nethergate, Dundee DD1 4HN, Scotland UK
Email address: B.Gupta@dundee.ac.uk
www.hydronationscholars.scot

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Introduction

· Addressing the scale of the nexus in a large growing economy such as India is a challenge, but this is a country where the nexus problem is very “real”.

· Investment in irrigation technology (when available) is driving a change in crop production to more high value commodities at the expense of staples .

· Subsidised energy and fuel potentially drive over exploitation of groundwater resources.

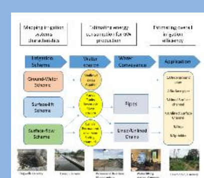
· Urbanisation will significantly impact on the supply markets and chains.

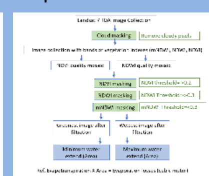
Methods

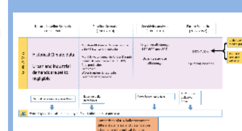
Objective 1: To analyse the intra-basin variabilities in the irrigation regime and estimate the trade-offs between groundwater abstraction and energy consumption in irrigation sector.

Objective 2: To estimate the water losses for energy production and analyse the impact of reservoir dynamics on energy production

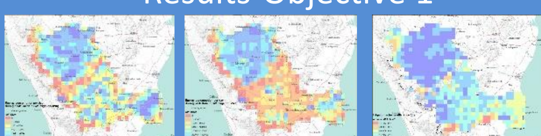
Objective 3: To analyse the impact of social variables, climate variables and policy related to water management on the environmental flows





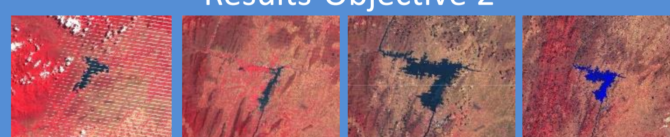


Results-Objective 1



In Cauvery basin 14 GWh per day is consumed in Kharif and 351 GWh per day is consumed in Rabi season and aggregating 21,900 GWh annually which is around 16% of energy consumed in agriculture in India but only constitutes 4% of the net irrigated area in India.
The water use efficiency of the irrigation system in Cauvery region under MI is better than the country average of 44% however the energy use efficiency for irrigation is very low. Moving from GW irrigation to SW irrigation can improve energy use efficiency and decrease water use efficiency.

Results-Objective 2



The results show that the six thermal power stations in the region consume 25-35 MCM water annually. The maximum* evaporation loses from 14 reservoirs used for Hydro power generation between the years 2000-2013, ranges between 112,305,308.2 m^3 and 360,626,464 m^3 . However, some of the major reservoirs such as Harangi, Stanley and Bhavani are multi-purpose dams and assuming that optimistically 20% of the services of these reservoirs are for hydro power generation the maximum evaporation losses for HE generation varies between **39,977,197.1 m^3 and 91,909,004.87 m^3** annually between the years 2000-2013.
*The evaporation losses if the maximum extend of water for that year is observed through out the year.

Future

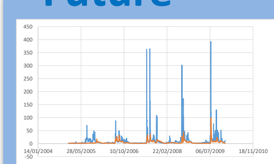
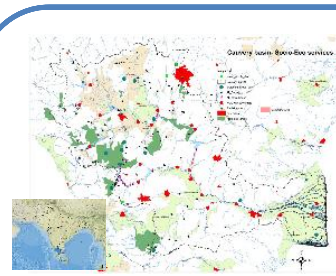
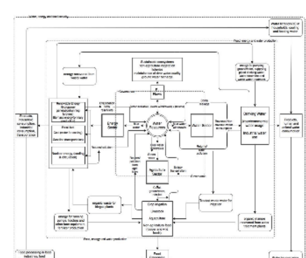


Figure: Observed and Simulated stream flow time series for the gauging station– Thimmanahalli, Upper Cauvery

- Daily time-series of stream flows for each cell in the Cauvery basin for pre-industrial period (Natural), for baseline (change in irrigation efficiencies), and future climate and socio-economic scenarios has been produced using GWAVA model. The work is still in progress.
- The time-series data and water resources indexes will be used to analyse the impact of policy, development and climate on the e-flows and water resource availability in the region.





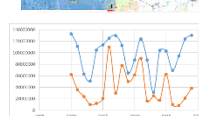


Figure1: Study Area-Cauvery River Basin, India
Figure2:Inter-linkages between water, energy and food sectors at governance, production and resource security levels.
Figure3: Stanley reservoir 20 year mean maximum and minimum water area in meter square

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The James Hutton Institute
University of Dundee