Asia Water Forum 2022
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Focus Area: 3 Productive water in agriculture and the economy

Session Title: 3B Water-energy-food nexus

Schedule: [Date | Time] 9 August 2022 (Tue), 3:00 p.m. - 4:30 p.m. (GMT+08)

Water–Food Nexus through the Lens of Virtual Water Flows: The Case of India

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Introduction: need for transition from water scarcity to security

Freshwater scarcity is recognized as a global systemic risk

A specific target of Sustainable Development Goal 6: target 6.4

Need for transition from water scarcity to security

Emerging approach to support the transition: Water –Food Nexus

- Virtual water concept is a measure of freshwater usage in agriculture

Aim

How the virtual water concept can play a role in governing the transition towards water security in water-scarce economies, taking a case of India?

Two main foci of the analysis

Identify the states in India with the highest VW outflows

- Embodied in major agricultural products such as food grains and oilseeds
- Where are these VW- outflows going to

Identify the priorities

- For the water policies of these states.

Methodological steps

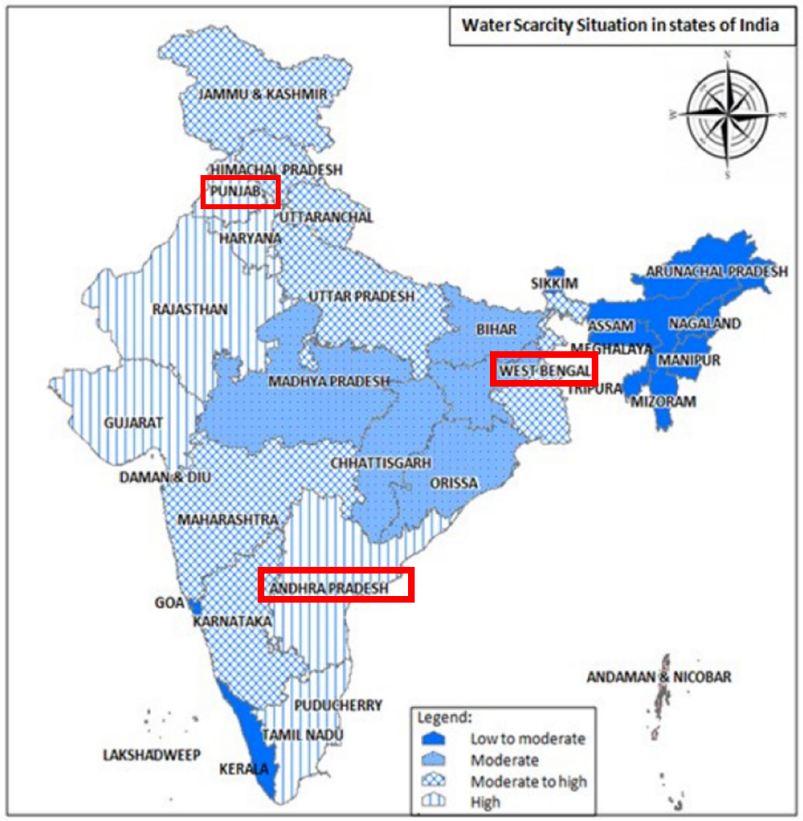
Assessment of the inter-state VW-flows to identify states with highest VW-flows.

- Data collection:
  - inter-state movement of food grains and oilseeds
  - water footprints (1996-2005)
  - yields
- Calculation of the water footprints for 2005-14
- Calculation of the VW-Flows

Analysis of the water policies and climate change action plans of the states

- Content analysis of the policy and planning documents
- Identification of 3 key priorities for enabling transition towards water security.

Key findings:
(1)Water scarcity and (2) states with highest VW-outflows



Katyaini and Barua(2015)

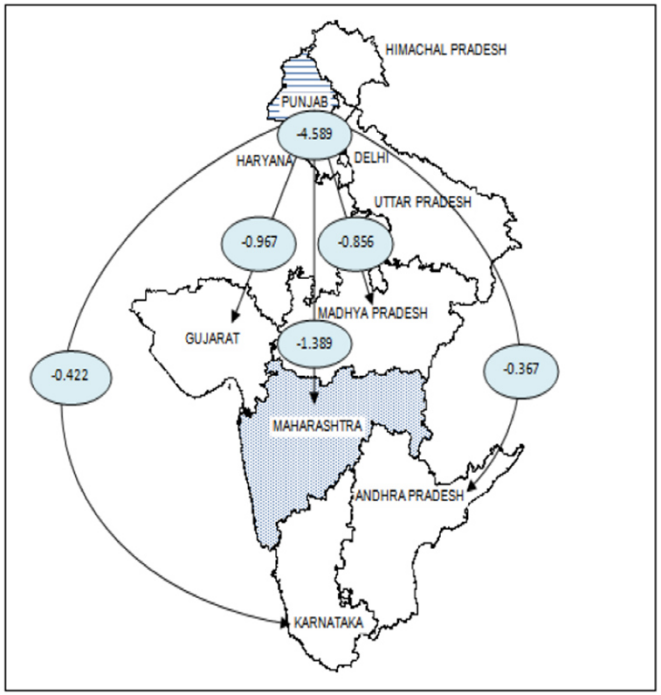
Water scarcity situation in the states of India.

Punjab in the northern zone has the **highest net VW outflows embodied in food grains** in both time periods of 1996-2005 and 2005-2014.

For **oilseeds, Andhra Pradesh from the southern zone and West Bengal from the eastern zone** emerged as the states with the highest net VW outflows in 1996-2005 and 2005-14.

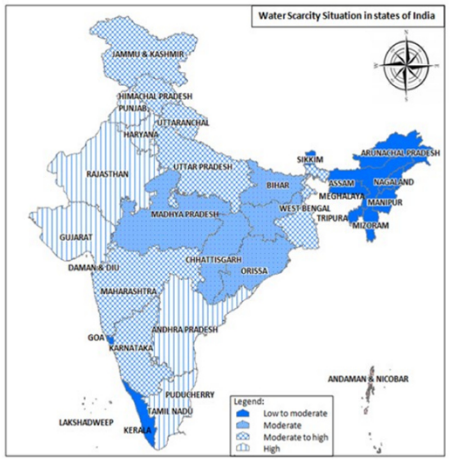
Quantum of VW flows embodied in food grains is much larger than the oilseeds.

Key findings:
Patterns of VW-outflows embodied in food grains (Punjab)



Five major VW outflows from Punjab, the state with highest water losses from 1996–2005 (in TL/year)

Five major VW outflows from Punjab, which had the highest water losses from 2005–2014 (in PL/year)



- **Increase in the VW-outflows** despite high water scarcity: from 4.589TL/year (1996-2005) to 5.928 PL/year (2005-2014; equivalent to 5928TL/year)
- These major flows are to other highly water-scarce, moderate to highly water-scarce, and moderately water-scarce state. VW outflows of Punjab that **water scarcity is not being distributed**.

Key findings:
Key concerns for governance of water-food nexus in Punjab

1. Intensive rice-wheat cropping systems

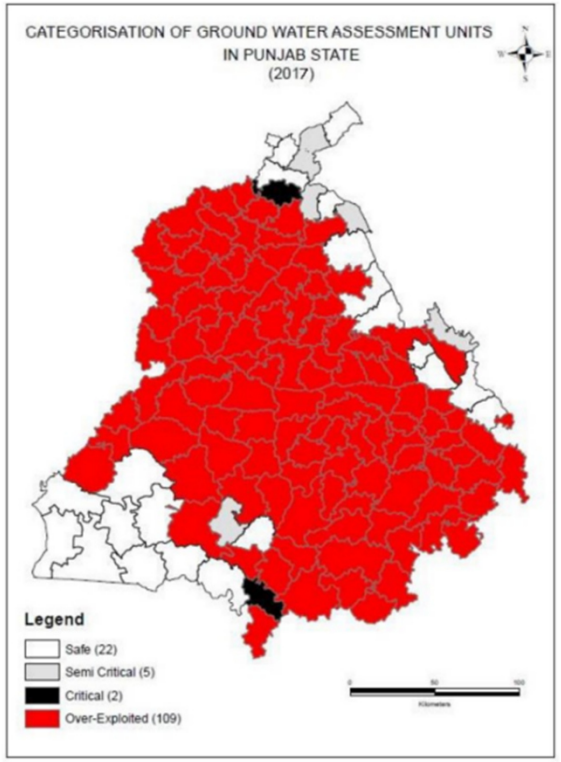
- Since 2000-2001 , 75% of the total cropped area
  - Supported by subsidies on water, electricity, and fertilizers
  - 63% of small farmers rely heavily on subsidies for maximizing profits

2. Over-exploitation of groundwater resources

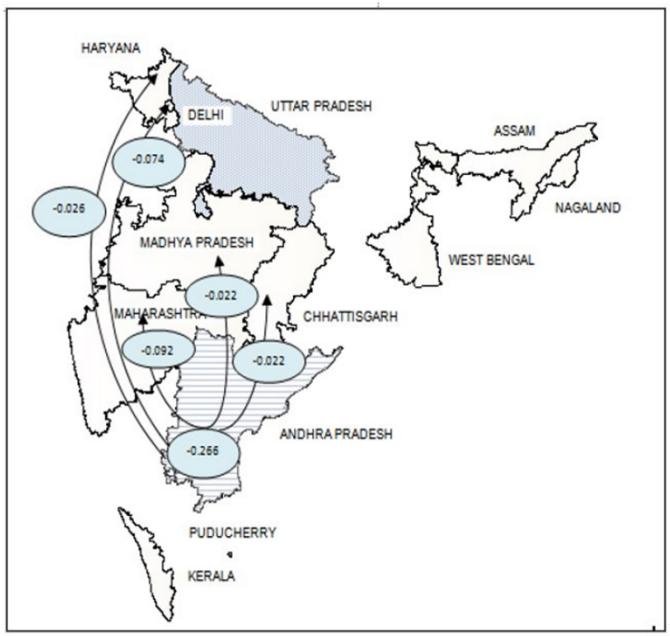
- 98% of the cultivable area is under groundwater-dependent assured irrigation.

3. Water pollution due to high cropping intensity

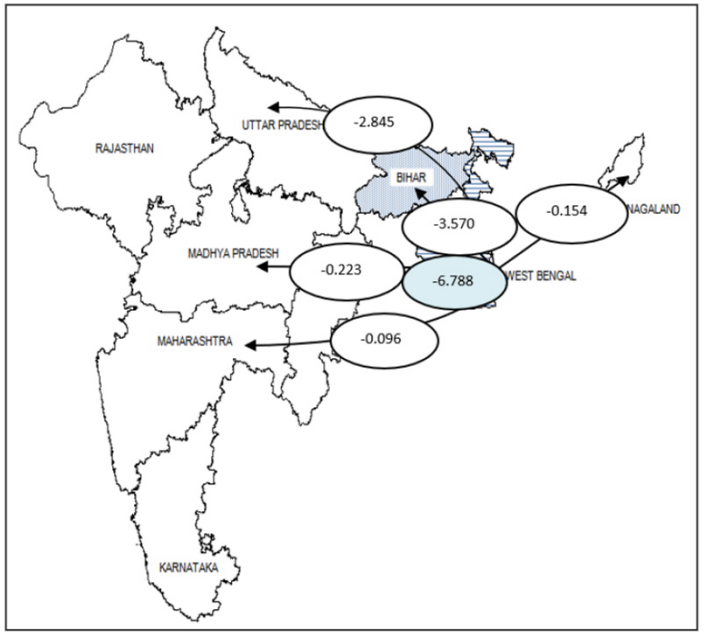
- High cropping intensity (189%)
- Excessive use of nitrogenous fertilizers and pesticides resulting in residual toxicity of soil and water.



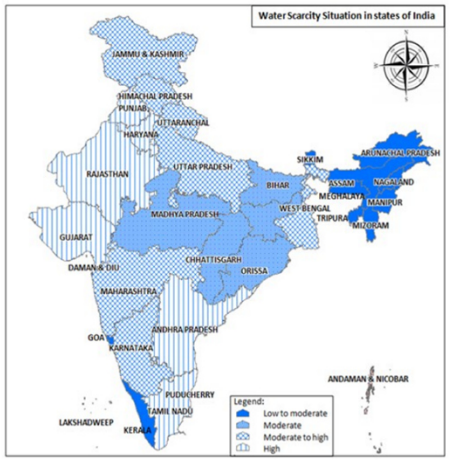
Key findings:
Patterns of VW-outflows embodied in Oilseeds (Andhra Pradesh and West Bengal)



Five major VW outflows from Andhra Pradesh, which had the highest water losses from 1996–2005 (in TL/year)



Five major VW outflows from West Bengal which had the highest water losses from 2005–2014 (in TL/year).



- A significantly large proportion of these VW outflows from
  - Andhra Pradesh- **cotton and groundnut**
  - West Bengal- **mustard and groundnut**
- These major flows are to other highly water-scarce, moderate to highly water-scarce, and moderately water-scarce state. VW outflows of Punjab that **water scarcity is not being distributed**

Key findings:
Key Concerns for governance of water-food nexus in Andhra Pradesh and West Bengal

Andhra Pradesh

1. High **dependence on rainfed agriculture-** 60% of the total agriculture- **increases vulnerability** to uncertain rainfall patterns

2. High exposure to **water-mediated disasters** like cyclones and floods , long history of droughts- makes the state vulnerable.

3. **High crop intensity (126%)** since 2009-10 led to **soil nutrient deficiency**.

West Bengal

1. **Extreme rainfall events** – 77% rain is experienced during the monsoon months of June-Sept, **associated with 42% area being prone to floods , and water logging**.

2. **Groundwater overexploitation and quality issues-** irrigation is largely based on groundwater, issues of **high salinity, high concentrations of arsenic and fluoride**

3. **High cropping intensities-** 185%; 4 of 6 agro-climatic zones are **stressed zones**

Key Conclusions

Planning and implementation of **sustainable intensification of agriculture production** is important in **highly water-scarce contexts.**

Pressure on the freshwater resources of the highly water –scarce states can be reduced by **diversifying the production areas . VW flows analysis can support interventions in low - moderately water scarce areas with suitable agro-climatic conditions.**

These measures **call for joint decision making at multiple levels of governance** and the involvement of crucial stakeholders such as farmers, CSOs and concerned govt. dept **for water ,agriculture and food security**.

In this process, the **states can learn from each other** about the possible pressures on the freshwater resources due to certain agricultural production decisions.

There is a need for **deeper policy engagement** with the **water-food nexus** for the **sustainable future** of developing and emerging economies grappling with the challenges **of water scarcity and fragmented environmental governance systems**.

ADB

Thank you

Looking forward to future interactions

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Full version of research article (open access)

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