Concerns with Interlinking of Rivers

Why in news?

India's river interlinking projects, aimed at addressing droughts and floods, may worsen water stress and disrupt monsoon patterns, according to a study in Nature.

Interlinking of rivers

• **Inter-basin water transfers**- It tracks with mathematical concepts of surplus and deficit. Excess water is routed from “donor river basins” (to “recipient” dry regions.
• **Conventional assumption-** The river basins operate in silos without affecting the land or the atmosphere
• **Mandate-** National Water Development Agency, Ministry of Jal Shakti.
• **Components-**
• Himalayan component- Kosi-Ghagra, Kosi-Mechi etc.,
• Peninsular component- Ken- Betwa, Par-Tapi-Narmada etc.,
• **Himalayan component**- It aims to construct storage reservoirs on the Ganga and Brahmaputra rivers, as well as their tributaries in India and Nepal.
• **Peninsular component**- It propose to connect the rivers of South India. It envisages linking the Mahanadi and Godavari to feed the Krishna, Pennar, Cauvery, and Vaigai rivers.
• **National Perspective Plan (NPP)-** The NPP for inter-basin transfer has identified 16 links under the peninsular rivers component and 14 links under the Himalayan component, charged with transporting 174 billion cubic metres of water each year using some 15,000 km of canals and 3,000 reservoirs.
• **Benefit**- Increase the irrigated areas across the country by 30 million hectares
• 34,000 MW of hydropower generation,
• employment generation,
• Salinity control,
• Pollution abatement, among other aspects

What are the key highlights of the study?

- **Research team-** Indian Institute of Technology, Bombay and the Indian Institute of Tropical Meteorology, Pune.
- **Analysis-** It analysed major river basins— namely Ganga, Godavari, Mahanadi, Krishna, Cauvery and Narmada-Tapi— between 1991 and 2012, observing the summer rainfall patterns between May and October each year.
- **Methodologies-** They used climate regional models, reanalysis datasets and delineation techniques to see how inter-basin water transfers impact the water cycle and different atmospheric variables, such as the El Niño-Southern Oscillation, which controls soil moisture across basins.

- **Land atmosphere feedback**-The water transfer could have an effect on nearby

basins through land-atmosphere feedback, especially given how strongly the land interacts with the atmosphere in the Indian region.

Land atmosphere feedback refers to the energy exchange between land surface and atmosphere.

- The research debunked the idea that river basins act as independent entities as they are connected to one another through feedback loops between the land and atmosphere, links that are formed when water evaporates from one basin or when winds transport water across basins.
- **Alter moisture content-** The study showed that since land-atmosphere feedback connects basins, changes in water levels in one can travel to neighbouring basins, altering the moisture content of the air and patterns of wind.
    - They impact summer monsoons and create a feedback loop, impacting water availability and climate patterns.
    - Thus, over time, moisture from the Ganga basin might play a role in how clouds are formed across Chhattisgarh and Odisha around the Mahanadi basin.
- Land-atmosphere feedbacks produce causal pathways between river basins in India using causal delineation techniques, a coupled regional climate model, and multiple reanalysis datasets.
    - The analysis disproves the conventional assumption of independence when planning hydrological projects by showing how river basins are connected through feedback between the land and atmosphere
- **Hydro-meteorological effects**- There is no proper study about hydro-meteorological effects in the interlinking of rivers projects that involve the transfer of water through reservoirs and canals from river basins that are in surplus to those that are in deficit.
- **Impact on monsoon**- Interlinking of rivers will have impact on the Indian summer monsoon, potentially reducing September rainfall in arid regions and escalating water stress.
- **Increase water stress-** Increased irrigation from the transferred water reduces mean rainfall in September by up to 12% in already water-stressed regions of India.
    - India is among the most water-stressed countries in the world, as climate change increases the frequency of floods and droughts, groundwater quality and levels decline, and urbanisation and encroachment ail water body health.
    - The current per capita availability of water in India is around 1400 cubic meters, slated to reduce to about 1200 cubic meters by 2050, according to the Central Water Commission
- **Excess irrigation**- Excess irrigation (using transferred water) caused soil moisture to dry up, which corresponded with a decline in rainfall and increased temperatures across the entire central Indian belt (from Rajasthan to east coast), more visible during the La Niña years (which last between one to three years).
- **Atmospheric variables**- It highlights the significance of taking atmospheric variables into account in large-scale hydrological projects and offers a ground-breaking scientific assessment of the interconnectedness of river basins.

- **Delicate balance**-The results provide understanding of potential effects of river interlinking, emphasising the need for a careful balance between ecological sustainability and meeting water needs.
- **Reduction in precipitation**- This can dry rivers post monsoon, augmenting water stress across the country and rendering interlinking dysfunctional.
- **Alteration of river flow**- The environmental experts and activists have advocated for policymakers to evaluate the impact how groundwater, land atmosphere feedback, local ecosystem, monsoon patterns respond to inter-basin water transfers or other projects that alter the natural flow of rivers.
- **Earlier studies**-
    - 2017 study warned that "moving even slightly away from the natural flow regime (the recorded historical pattern of floods and droughts) can lead to a collapse in the structure of ecological networks."
    - In 2011 researchers also found any interlinking project could cause lasting changes in the aquatic system and fish diversity.

What lies ahead?

- Inter-basin water transfer was pushed to be resilient solutions present conflicting dual objectives of meeting water demands and balancing ecological sustainability.
- The present study finds it of "utmost importance" to understand complex hydro-meteorological systems when planning and implementing infrastructure projects and to "carefully consider the potential consequences of river interlinking on the nation's water security and climate resilience".

Idea of Interlinking of Rivers
• **History-**Interlinking of rivers was conceived more than 125 years ago by Sir Arthur Cotton, mainly to facilitate trade but it was not implemented then. • **National Water Grid**- In 1970 revived the plan of linking the Brahmaputra and Ganga basins (the water surplus areas) to the central and southern parts of the country (the water deficit areas). • **National Perspectives for Water Development**- It was formulated by Ministry of Irrigation (now the Ministry of Water Resources, River Development and Ganga Rejuvenation) and Central Water Commission in 1980. • **National Water Development Agency (NWDA)-** It was constituted in 1982 to study basin-wide surpluses and deficits and look into the feasibility of storing, linking and transferring water. • It was during this time that the outline to divide the project in two components of Himalayan and Peninsular was planned but the plan was again abandoned. • **Interlinking plan-** It was revived again by the commission for Integrated Water Resources Development in 1999. • **The National River Linking Project (NRLP)-** It was formally known as the National Perspective Plan, envisages the transfer of water from water 'surplus' basins where there is flooding to water 'deficit' basins where there is drought/scarcity, through inter-basin water transfer projects.

References

1. The Hindu- Climate blindspot in interlinking of rivers.
2. Economic Times- River interlinking projects may worsen water stress.

3. Nature- River interlinking alters land atmosphere feedback

