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"Interlinking of Rivers"

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ABSTRACT: The interlinking of rivers involving inter basin water transfer has canals, tunnels or water lifts, for water to flow from one river basin to another and making use of excess water. In India rainfall is dependent on the south-west and north-east monsoons or on the shallow cyclonic depressions and disturbances and on violent local storms which form regions where cool humid winds of the sea meet the dry winds from the land and occasionally reach cyclonic dimension. Hence some areas are affected by the droughts while other areas are affected by seasonal floods. There is a general perception that with growing human population and rising standards of living, the available supplies of fresh water on the planet are becoming insufficient to meet demand. It will be scarce, expensive to develop and maintain and valuable in use.

Keywords: Interlinking, Rivers, Global system, Geographical distribution, Monsoon Period, Indian Rainfall.

I. INTRODUCTION

Water is one of the principle elements which not only governs life on earth but also influences economic, industrial and agricultural growth of mankind. There is a general perception that with growing human population and rising standards of living, the available supplies of fresh water on the planet are becoming insufficient to meet the demand. India has a monsoon climate. Except for a small coastal area in the South, almost the entire rainfall occurs during three to four monsoon months. Thus cultivation during non-monsoon months is irrigation dependent. A characteristic of the monsoon climate is variability of rainfall from year to year. India has an average of one in five below-normal rainfall years. India is basically an agricultural country, and all its resources depend on agricultural output. In India, 55% of agricultural output is from irrigated lands. Moreover, average farm incomes have increased from 80-100%as a result of irrigation, while yields have doubled compared with those achieved under the former rain-fed conditions. Water will no longer be cheap and plentiful. It will be scarce, expensive to develop and maintain and valuable in use. At this point interlinking of Indian rivers will open new avenues for developing new supplies. But we are at cross roads, creating new supplies when we face problem leads to bad management of resources. So there is also a need to develop strong policies for efficient use of water resources.

The main aim of present research work is to find out the types research relationship with various physical and cultural features of the regions & to give the management and consevational measurements for the study region.

II. OBJECTIVE

Reducing disparities in different river basins by transferring water from 'surplus' basin to 'dificit' basins.

III. METHODOLOGY

The interlinking of our rivers to transfer the floodwater from the surplus rivers to deficit areas is one of the most effective ways to increase the irrigation potential, for increasing the food grain production, mitigate floodwaters and reduce regional imbalances in the availability of water. Brahmaputra, the northern tributaries of Ganga, Mahanadi, Godavari and west flowing rivers originating from the Western Ghats are found to be surplus in water.
If we could build storage reservoirs in these rivers and connect them to other parts of the country regional imbalances could be removed significantly.

One excellent example before us is the transfer of surplus waters of Rabi-Baes to Rajasthan right up to Jaisalmer and Berme through Indra Gandhi Nahar Pariyojana. The project has eliminated drought conditions, transformed desert waste lands into an agricultural productive areas by bringing irrigation and vegetation to about 2 million

hectare area. Contribution in agricultural production due to implementation of the project is worth 1750 crore rupees annually. Canal water is available for meeting domestic needs and the Indian Military at the western boundary receive water from this canal. The project has miraculously changed the living conditions and the socio-economic conditions of the people.

A . Why Interlinking?

Our Resources: India is a land of many rivers and mountains. Its geographical area of about 329M.ha is criss crossed by a large number of small and big rivers, some of them figuring amongst the mighty rivers of the world.

Table 1: National Water Resources at a Glance.

Sr.No	Items	Quantity(Cu.Km)
1.	Annual Precipitation(including snowfall)	4000
2.	Average Annual Potential flow in Rivers	1869
3.	Per Capita Water Availability(1997)	1967
4.	Estimated utilizable Water Resources	
	i. Surface Water Resources	690
	ii. Ground Water Resources	432

B. Rainfall

The rainfall in India shows great variations, unequal seasonal distributions, still more unequal geographical distribution and the frequent departures from the normal.

C . Rivers

India is blessed with many rivers .as many as 12 rivers are classified as major rivers, whose catchment area is about 252.8 M.Ha.Of the major rivers, the Ganga –Brahmaputra Meghana system is the biggest with a catchment area of about 110 M.Ha, constituting nearly 43% of the catchment area of all rivers in the country. The other major rivers with catchment area more than 10 MHa are Indus (32.1), Godavari (31.3), Krishna (25.9) and Mahanadi (14.2). The catchment area of medium rivers is about 25 M.Ha and Subernarekha with 19Mha catchment area is the largest river among the medium rivers in the country.

D. River Basins in India

India is the richest in terms of water resources. Indus and Bhramaputra are the longest and followed by Ganga. The Ganga basin is the largest in the country, occoupying abut one-fourth of the total land area of the nation. Information about 14 rivers, information such as their origin, length and catchment area are as shown in Table 2.

IV. DISCUSSION

A. Major Rivers and Their Basins

Ganga. The Ganga originates as Bhagirathi from the Gangotri glaciers in the Himalays at an elevation of about 7010 m. above m.s.l., in the Uttar kashi district of Uttarpradesh. The basin lives in china, Nepal, India and Bangladesh. In India its catchment lies in the states of Uttar pradesh, Madhyapradesh, Bihar, Rajasthan, West bengal, Haryana, Himachal pradesh and Delhi.

Bramhaputra–Barak. The Brahmaputra river originates as Tsangpo in Tibet. The Brahmaputra basin lies in Tibet (china), Bhutan, India and Bangladesh. In India its catchment lies in the states of Arunachal pradesh, Assam, Nagaland, Meghalay, West Bengal and Sikkim.

The Barak river rises in the Manipur hills and enters the plains near .The Barak basin lies in India, Myanmar and Bangladesh. In India the basin lies in the states of Meghalaya, Manipur, Mijoram, Assam, Tripura and Nagaland.

Table 2: Details of Major River Basins in India.

River	Length (Km)	Catchments Area of Basin (km^2)
1) Ganga	2,525	8,61,404
2) Brahmaputra-	918	1,94,413
Barak	564	41,723
3) Godavari	1,465	3,12,812
4) Krishna	1,400	2,58,948
5) Mahi	583	84,482
6) Narmada	1,312	98,796,
7) Tapi	724	65,145
8) Brahmani -	799	39,033
Baitarni	355	12,789
9) Sabarmati	371	21,674
10) Pennar	597	55,213
11) Indus	1,114	3,21,289
12) Cauvery	800	87,900
13) Mahanadi	857	1,41,600
14) Subernarekha	395	19,300

Godavari Basin. Godavari river rises near Nasik in Maharashtra at an elevation of 1067 m. above m.s.l. The basin lies in the states of Maharashtra, Andrapradesh, Madhya pradesh, Orissa, Karnataka.

Krishna. Krishna river rises in the western ghats of Maharashtra in Mahableshwar about 64 km. From the Arabian sea and at an elevation of about 1337 m. The basin lies in the states of the Karnataka, Andra pradesh and Maharashtra.

Mahi. Mahi river rises from the northern slopes of vindhyas in Madhya pradesh at an elevation of about 500 m. above m.s.l. The basin lies in the states of Madhyapradesh, Gujarat and Maharashtra.

Narmada. Narmada river rises near Amarkantak in Madhya Pradesh at an elevation of about 900 m above M.S.L. The basin lies in the states of Madhya pradesh, Gujarat and Maharashtra

Tapi. Mahi river rises from the northern slopes of vindhyas in Madhya pradesh at an elevation of about 500 m. above m.s.l. The basin lies in the states of Madhyapradesh, Gujarat, and Maharashtra.

Sabarmati. Sabarmati river rises from the Aravalli hills in Rajasthan at an elevation of about 762 m. above m.s.l. The basin lies in the states of Gujarat state only.

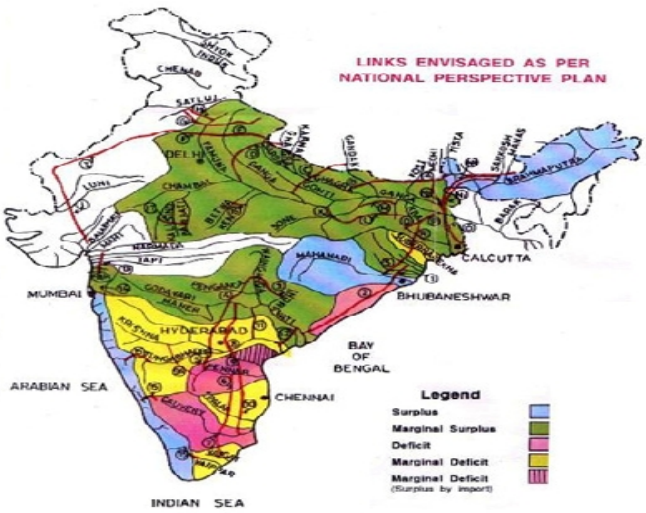
Pennar. Pennar river rises from the Chenna Kesava hills of the Nandi ranges of Karnataka. The basin lies in the states of Andhra pradesh and Karnataka.

Brahmani- Baitarni. Brahmani river rises near Nagri village in Ranchi district of Bihar at an elevation of about 600 m. above m.s.l.The Baitarni river rises in the hill ranges of Keomjhar district of Orissa at an elevation of about 900 m above m.s.l. The basin lies in the states of Orissa, Bihar and Madhya pradesh.

Indus. Indus river rises from Mansarovar in Tibet at an elevation of about 5182 m. above m.s.l. The basin lies in the states of Jammu and Kashmir, Himachal Pradesh, Punjab, Rajasthan, Haryana and union territory of Chandhigarh, also countries like Tibet, Pakisthan and Afganisthan.

Cauvery. Cauvery river rises at Talakaveri on the Brahamagiri range in the western ghats in Karnataka at an elevation of about 1341 m. above m.s.l. The basin lies in the states of Tamilnadu, Karnataka and Kerala.

Subarnarekha. Subarnarekha river rises in Bihar at an elevation of about 600 m. above m.s.l. as boundary between Orissa and west Bengal. The basin lies in the states of Bihar, Orissa and West Bengal.



Historical Perspective

Sir Arthur Cotton, who pioneered the development of water resources in Southern India from 1839 onwards, had proposed a plan for interlinking of Indian rivers for inland navigation. A small portion of the plan was implemented but was abandoned later in favour of railways.

The proposal to link rivers in India was first mooted by Dr. K.L. Rao. then Irrigation Minister Government of India in 1972. His idea was to link Ganga with Cauvery which was about 2640 km. Thereafter Capt. Dastur in 1974 suggested the concept of Garland Canal. Then in1982 NWDA was created to carry out the project, which included carrying out the survey s and preparation of feasibility reports.

Present Scenario

Now the project has again gathered momentum after last years severe drought due to failure of monsoon caused privation in many parts of the country, while there were recurring floods causing misery in the eastern parts of the country. The present government set up a task force to implement the project under the chairmanship of Shri Suresh Prabhu. The river linking scheme, popularly known as the **"GARLAND PROJECT"**, aims to link Indian rivers from the Himalayan ranges in the north with the peninsular river to end the seasonal droughts and floods. The Ministry of Water Resources (then known as Ministry of Irrigation) in the year 1980 formulated a National Perspective Plan for water resources development by transferring water from water surplus basins to water deficit basins/regions by inter-linking of rivers.

The National Perspective Plan has two main components i.e. the Himalayan Rivers Development and Peninsular Rivers Development. The National Water Development Agency (NWDA) was set up as a Society under the Societies Registration Act, 1860 in 1982 to carry out the detailed studies and detailed surveys and investigations and to prepare feasibility reports of the links under the National Perspective Plan. NWDA has, after carrying out detailed studies, identified 30 links for preparation of feasibility reports and has prepared feasibility reports of 6 such links. The various basin States have expressed divergent views about the studies and feasibility reports prepared by NWDA. With a view to bringing about a consensus among the States and provideguidance on norms of appraisal of individual projects and modalities for project funding etc. the Central Government hereby sets up a Task Force. Besides Prabhu, Member of Parliament, Lok Sabha as Chairman, C.C. Patel as Vice-Chairman and Dr. C.D. Thatte as Member-Secretary of the Task Force. Apart from the above members of the Task Force, part-time members are to also be nominated. These part-time members will include a member from water deficit States, a person from water surplus States, an economist, a sociologist and a legal/world wildlife expert. The Task Force is looking into aspects such as providing guidance on norms of appraisal of individual projects in respect of economic viability, socio-economic impacts, environmental impacts and preparation of resettlement plans, devising suitable mechanism for bringing about speedy consensus amongst the states and prioritizes the different project components for preparation of Detailed Project Reports and implementation.

Need For Interlinking the River

With these vast water resources our agriculture is still struggling to get water for irrigation. This is mainly because of the improper planning, impracticable policies and failure of the successive governments to implement the policies effectively. To harness the potential of our water resources it is proposed that we interlink our surface water resources. However sufficient attention should be given to the environmental factors affecting the project.In last 50

years availability of water had been decreased by 1/3 per head and due to which every one out of four persons facing problems of pure water. 'first decade of 21st century will have the problem of scarcity of water' says international institute for sustainable future and also water management institute. According to this institute 4.5 crore peoples from major parts of India along with 29 states are facing serious problems of water now. Not only this much but these institute says up to 2025 worlds 1/3 population will have to fight for water.

In India continental zone main source of water is monsoon. 80% of water in Indian rivers are due to monsoon. There are 851 Millon Litres average percentage of water at national level due to seasonal rainfall. Means nearly about 400 mega hectare meter water is available per year due to monsoon. But at maximum we use only 1/10 of source and 9/10 of its goes to mix salty water of sea with the help of rivers and channels and we thus utilize only 0.62% of water. Mostly rains at time of monsoon are for 100 days but demand of water is for 365 days.Along with these we can have knowledge about important points like droughts, floods and many given in further pages, which gives importance of water. So as to overcome all such problems it is necessary to carryout project like 'interlinking of rivers.

Advantages of Inter-Linking of River

- To solve the problem of water crisis in cosmopolitan cities of India and Inter-state water-disputes.
- To change the course of 173bl,Q,Mt.water flow resulting in the additional irrigation of 35Million Hectare land and the additional production of 34000Megawatt of Hydro-electricity.
- To provide adequate quantity of water to 101 feminine prone provinces of the country and to plugg the big disaster thus to save the annual destruction of India agriculture worth more than 25 thousand crores of rupees.
- The rural areas of the country will get an all out development on modern lines .it will boast the rural economy and the life-style of Indian village.
- Due to interlinking of rivers, the overall economic activities of the country will be enchanced resulting in an annual increase of GDP. The employment opportunities also increase.
- Not only the environment protection and pollution control shall be achieved but this creation of "National Rivers Water Grid" shall also provide extra security to the country as a whole.
- Due to this project the food production will increase from present 200 Million tonne to 500 Million tonne per annum to feed the 1800million population by 2050.
- It will increase navigational efficiency apart from controlling flood & eliminating chances of draught.
- Generate employment in agriculture, power, transport & construction sector.

Strategies Adopted

- Diversion of surplus flood water into deficient basin *i.e.* Girna – Bori, Girna – Titur, Girna – Mhasva, Girna – Anjani.
- 160 villages dependent for drinking water on reservoir were converted under this i.e. Bori dam covers highly draught prone areas of Dhule, Malmatha (Nasik) & Jalgaon District.
- Exsisting canals and other systems were utilized to the maximum capacity with possible modification.
- Exsisting canal system (Jalgaon canals, Titur canals, Lower Girna canals, Hantur canals) with increased capacity and maximum discharge kept on flowing and diverting water to deficient storages.
- Exsisting canal capacity increased by rasing canal banks with earth work and rugosity coefficient was improved by laying PVC paper of low cost at leaky portions.
- Aqueduct and syphons capacity increased by raising wall height with B.B. masonary temporarily & PVC paper laid in the channels to as rogosity coefficient.
- Low cost polythene paper used at canal apexes for reduction percolation losses.
- Short Links – Searched to divert the higher discharge . i.e. Panzan to Bori.
- New links wherever required dug immediately – Jamda to Khandakesium, Jamda to Titur.
- Exsisting deficient storage got filled and every canal water diverted to wells in command. Lower Girna canal to Salwa – Nanded.
- Reservoir capacity was increased to store the maximum possible water by putting gunny bags on top of W.W with calculated risk.. i.e. no encroachment
- beyond high flood level and can easily by pulled down by simply wire rope in flood situation.

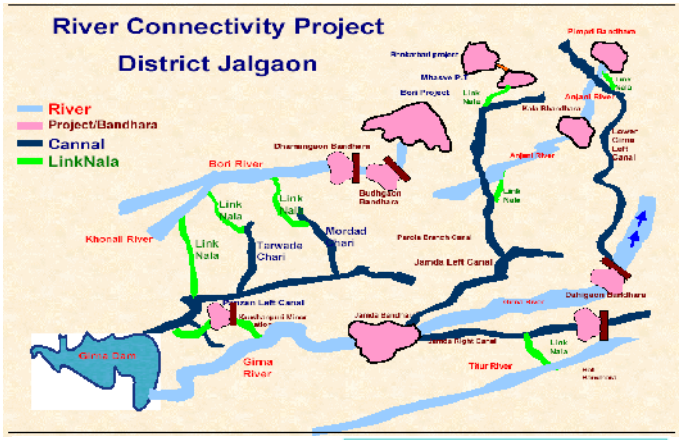
Case Study of Inter-Linking of River in Jalgaon District

A. Jalgaon District: Brief History

- Jalgaon district is located in the north-west region of the state of Maharashtra.
- It is bounded by Satpuda mountain ranges in the north, Ajanta mountain ranges in the south.

- Jalgaon has got pretty diverse climate. It is exceptionally hot & dry during summer with temperature reaching as high as 45 degrees cesius.
- The principal natural feature is the Tapti River- Tapti flows westward from headwaters in eastern Maharashtra to empty into the Arabian Sea.
- The Tapti receives thirteen principal tributaries in its course through Khandesh. Tapti flows in a deep bed which historically made in difficult to use for irrigation.
- Most of Khandesh lies south of the Tapti, & is drained by its tributaries the Boriand Panjhra.

Map showing major Interlinks in Jalgaon District



Situation before Inter-Linking the River.

Situation after Inter-Linking the River.

V. FUTURE SCOPE

1) To study difference in ground water table before & after interlinking for different districts.
2) Flood disaster management.
3) To study socio-economic development of different watersheds.

VI. CONCLUSION

1) This river linking project in Maharashtra, India, is based on innovative methods of linking of natural and artificial water drainage for inter-basin and intra-basin water transfer.
2) This is a unique technique of rain water conservation; utilization of flood water run-off and replenishing natural and artificial water bodies through natural and artificial water drainage channels.
3) The excess water in a river is utilized to recharge the ground water bodies and dry wells in its command areas.
4) The project is designed for the optimum utilization of rainfall-runoff for inter-basin and intra-basin water transfer through innovative technologies of both surface water transfer and ground water recharge.
5) The principle of watershed management within the command area is used not only for agriculture purposes, but also for drinking water and industrial purposes.

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