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Surface Water Resources (A Geographical Appraisals in Luni Basin)

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ABSTRACT: Luni river basin, characterized by extremely high aridity and very low rainfall in most parts, is one of the most water scarce river basins in India. Yet agriculture is an important economic activity. The paper discusses the methodology for a water accounting study specific to the basin and presents the result from an exercise carried out for 1 year. It involved estimation of virgin runoff, and consumptive water use in various sectors including agriculture. The analysis shows that a major chunk of the renewable water in the basin is in the aquifers due to high transmission loss of runoff. While the internal renewable water resources is 2606 MCM per annum, the high levels of water use (2704 MCM) is sustained through groundwater mining and water imports (240 MCM per annum) as most of the available runoff also stands utilized. Irrigation (2404 MCM per annum) accounts for a major share of the total consumptive use. The basin discharges a fraction of the runoff into the desert, due to the constraints induced by topography in capturing this water.

KEYWORDS: Luni basin, water resources, geographical appraisals, agriculture, runoff, irrigation, topography

I.INTRODUCTION

Luni is the only river basin of any significance in Western Rajasthan, which form the bulk of arid zone. Luni originates from western slopes of the Aravalli ranges at an elevation of 772 m above m.s.l. near Ajmer flowing in South West direction and traversing a course of 511 km in Rajasthan, it finally flow into the Rann of Kachchh. Most of its tributaries drain the steep north west of Aravalli hills and join it on left side. Its total catchment area falls in Rajasthan. Luni basin is situated in between 24^0 11' to 26^0 43' North latitude and 70^0 37' to 74^0 39' East longitude approximately. The peculiarity of this river is that it tends to increase its width rather than deepening the bed because the banks are of soils, which are easily erodible whereas beds are of sand. [1,2]The floods develop and disappear so rapidly that they have no time to scour the bed. The Aravalli ranges form its East boundary whereas main course of river in Barmer district itself forms North boundary and mostly Banas and initial reach of Chambal River form its Southern boundary.

Description of river system

Luni receive alol the main tributaries on its left bank except one i.e. Jojari (Mithri) on the right bank. Luni receives ten tributaries namely Lilari, Guhiya, Bandi (Hemawas), Sukri (Hemawas), Sukri, Mithri, Jawai, Khari Bani Sukri Bandi and Sugi. Hence the drainage on the left bank of Luni is, therefore, more extensive than on right bank. The Luni drains an area of 32879 sq.km. in Rajasthan state only.[3,4]

The catchment area of the basin upto Chittalwana is 32661 sq.km. The remaining catchment area of the Luni basin below Chittalwana and upto Rann of Kachchh is only 218 sq.km. which is delta where the water spreads out and does not contribute any runoff. The total available runoff from entire Luni basin is 788 Mcum, out of which Guhiya, Jojari(Mithri), Bandi(Hemawas) and Jawai tributaries contribute runoff of 116 Mcum, 64 Mcum, 64 Mucm, 120 Mcum and 125 Mcum respectively. [5,6]The catchment area, length and elevation of source of important tributaries are shown below:

S.No	Name of river	Bank	Elevation of Source above m.s.l. (m)	Length (km)	Catchment are (sq.km)
1	Luni	Main	737	511	32879
2	Jojari (mithri)	Right	312	83	1060
3	Guhiya & Sukri (Hemavas)	Left	237	125	4126
4	Lolari	Left	731	60	1611

S.No	Name of river	Bank	Elevation of Source above m.s.l. (m)	Length (km)	Catchment are (sq.km)
5	Bandi(Hemavas)	Left	935	135	3016
6	Sukri	Left	955	140	3280
7	Mithri	Left	459	71	2637
8	Jawai	Left	1099	145	2701
9	Khari Bandi	Left	701	84	2671
10	Sukri Bandi	Left	588	85	1161
11	Sugi	Left	688	80	1370

The important irrigation schemes in Luni Basin are Jawai Dam, Jaswant Sagar dam, Hemawas, Sardar Samand. CWC is maintaining two H.O sites namely Gandhav (GD) and Balotra (GD)

The Luni is the largest river in the Thar Desert of northwest India.[1] It originates in the Pushkar valley of the Aravalli Range, near Ajmer, passes through the southeastern portion of the Thar Desert, and ends in the marshy lands of Rann of Kutch in Gujarat, after travelling a distance of 495 km (308 mi). It is first known as Sagarmati, then after passing Govindgarh, it meets its tributary Sarasvati, which originates from Pushkar Lake and from then on it is called Luni.[2]

In 1892, Maharaja Jaswant Singh II of Jodhpur constructed Jaswant Sagar in Pichiyak village between Bilara and Bhawi of Jodhpur district. It is one of the largest artificial lakes in India and irrigates more than 12,000 acres (49 km^2).[2] It is one of the internal drainage rivers in India; it does not meet with Arabian Sea. It is drained before it reaches the Arabian Sea.[7,8]

The Luni River basin is 37,363 km², which includes all or part of the Ajmer, Barmer, Jalore, Jodhpur, Nagaur, Pali and Sirohi districts of Rajasthan and the Banaskantha and Patan districts of northern Gujarat. Its major tributaries are the Sukri, Mithri, Bandi, Khari, Jawai, Guhiya and Sagi from the left and the Jojari from the right.[1]

The Luni River begins near Ajmer in the Pushkar valley of the western Aravalli Range at an elevation of about 550m. At this point, the river is also known as the Sagarmati. The river then flows in the southwest direction through the hills and plains of the Marwar region in Rajasthan. The river flows south-west and enters the Thar Desert before dissipating into the Rann of Kutch, traversing a total of 495 km. In spite of the high salinity, it is a major river in the region and serves as a primary source of irrigation. The Luni is not saline until it reaches Balotra,[3] where high salt content in the soil impacts the river.[1]

The Luni may have been the southern portion of the historic Ghaggar-Hakra river channel.[1]

II.DISCUSSION

The Jawai, Sukri, Guhiya, Bandi and Jojari rivers are the main tributaries of Luni river.[9,10] The Jojari is the only tributary that merges to the right-bank of the river while other 10 tributaries reach its left bank. All the tributaries except Jojari originates from the Aravalli hill.[4][5][6] The dams in Luni river are:[4]

- Sipu dam
- Jaswant Sagar Dam - built in 1892 by Maharaja Jaswant Singh.It is one of the largest artificial lakes in India.

The two major irrigation projects on Luni river are SardarSamand and Jawai dam.[4] Sardar Samand dam was constructed in 1905.[11,12]

Flash floods

Flash floods have occurred in the Luni river as the river flows on a shallow bed and the riverbank soil is easily flattened by the rain water.[4]

The worst flood happened in 2006, when the desert region received heavy rain. The water levels rose to 15–25 feet submerging the surrounding region. The 2006 flash floods caused water levels to rise to as high as 15–25 feet submerging many parts along the river in the Barmer district. A large number of people and animals died in the flood.[4]

In 2010, another flood occurred but there were less casualties.[4]

Fish diversity

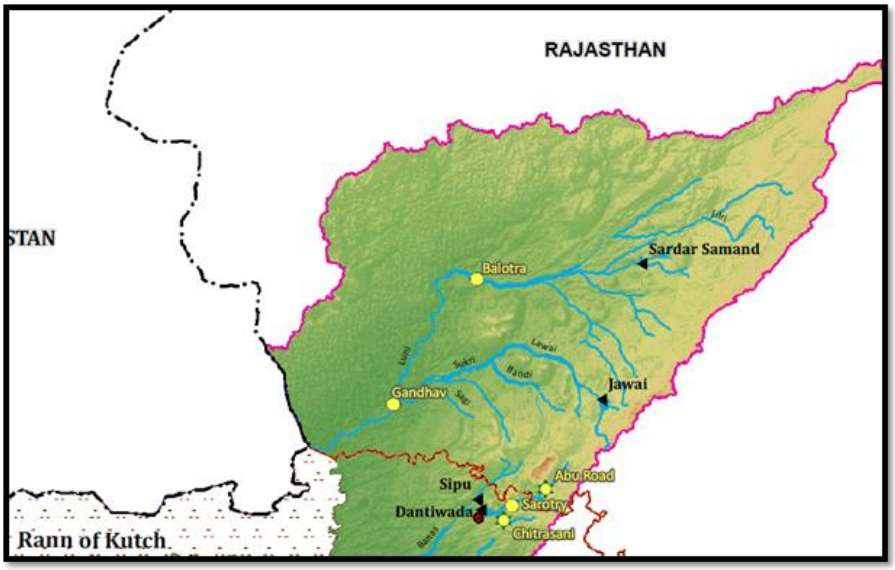
The fish diversity assessment of Luni river led by ICAR-National Bureau of Fish Genetic Resources, Lucknow from October, 2015 - November, 2014 reported the occurrence of 27 species belonging to 22 genera, dominated by Cyprinids.[13,14] The highest fish diversity of 12 species was reported in Samdhari and Gandhav. In this study, the wide distribution of Invasive Fish Species such as African Catfish (*Clarias gariepinus*) and *Mozambique tilapia (Oreochromis mossambicus*) were also reported from the river Luni.[7]

III.RESULTS

Luni River is the only saline river in India. The word "Luni" is taken from the Sanskrit word "lavanavari," which signifies salt water. The high salinity of the river is the reason behind its name. For the initial hundred kilometres, the freshwater in Luni is fresh, but as it gets closer to Balotra in Barmer, it starts to get salty from the high amount of salt of the land it flows on.[15,16]

The Luni River rises 772 metres above sea level in Rajasthan's Ajmer district from the Naga hills of the Aravalli Range. The river Luni, locally known as Sagarmati, flows through the Rajasthani districts of Nagaur, Pali, Jodhpur, Barmer, and Jalore as it travels 495 kilometres in a south-western direction towards Gujarat. The river gradually runs out in Gujarat's Barine, close to the Rann of Kutch. The astounding feature is that the river's stream sinks across a shallow bank before coming to an end and not entering any other bodies of water.[27,28]

The river Luni, while being saline, is a major irrigation supplier for Rajasthan's parched regions, and as a result, the residents consider it to be sacred. Maharaja Jaswant Singh of Jodhpur constructed the Jaswant Sagar Dam close to Pichiyak hamlet in the Jodhpur area in 1892 to harness the water from Luni.[17,18]



The Luni basin is bordered to the east by the Aravalli range and Gujarat plains, on the north by the Rajasthan sand, and on the south and west by the Arabian Sea. The Luni basin has a total area of 32,879 square kilometres and contains a number of locations in the Ajmer region, from Nagaur to Pali, then proceeding on to Jodhpur and Barmer and finally entering the Jalore district.[19,20]

The major rivers that flow into Luni include the Jawai, Sukri, Guhiya, Bandi (Hemawas), and Jojari rivers. Jojari serves as the only tributary on the right bank; there are eight on the left side. Additionally, it is the only branch of the Luni River which does not come from the Aravalli Mountains.[29,30,31]

Wild creatures including the wolf, Indian fox, desert fox, and Indian porcupine are significant species in the area, in addition to large mammals like the Indian gazelle, blackbuck, and nilgai or blue bull.[21,22]

IV.CONCLUSIONS

The Luni river basin has been evolved as a result of typical hydrogeomorphic processes of arid zone, operating under the influence of active tectonic lineaments. A detailed analysis of stream morphology in relation to geology and lineaments carried out on selected windows indicated the morphological control of the streams while flowing over the

lineaments from the eastern to the western part of the basin.[25,26] Typical valley fills indicated by dark green tone on digitally processed images and the pediments showing greenish white tone appear in sharp contrast and indicate respectively the graben and horst structures. A detailed identification of lineaments for the georesources and geological evaluation has been carried out. Earlier analysis carried out on Bouguer anomalies correlate with graben and horst structures in the subsurface. Quaternary sequences have been dated from 80 ka to 3 ka indicating a range of fluvial to aeolian deposits reflecting prevailing climatic conditions. However, the changes in sediment type from coarse and mixed of all size grades to fine in a vertical litho-column warrant further studies on fine resolution stratigraphy and high resolution stratigraphy for understanding climatic variations in the region[23,24]

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