

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.910.372>

Wetlands of Darbhanga District: A Basis of Sustainable Livelihood

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ABSTRACT

Keywords

Wetland,
Biodiversity,
Micro-area
approach, Empirical
assessment,
Sustainable
livelihood

Article Info

Accepted:
24 September 2020
Available Online:
10 October 2020

Darbhanga is known for rivers and their water bodies. The district comprises vast stretches of wetlands, which are not only highly productive but hold significance from the biodiversity point of view. Kusheshwarasthan is an important wetland site in the district. These water bodies are used for fisheries, makhana (*Euryale ferox*) and singhara (*Trapa bispinosa*) cultivation, irrigation etc. and thus provide the basis of livelihood for human beings. The present study aim to study of wet lands as basis of sustainable livelihood in the area. This was a micro-area approach for the assessment of wetland product-based economy and their role in sustaining livelihood. The main objective of the study was to highlight the value of wetland and their products in sustaining livelihood. Different kinds of flying sample survey were conducted on these wetlands in Darbhanga district and pattern of their utilization in terms of wetland products growing therein. The result of empirical assessment and flying sample survey become the basis of this research paper. This paper takes into account some important facets wetland in Darbhanga district in relation to sustainable livelihood.

Introduction

Darbhanga district is a flood prone region of North Bihar, geographically identified as an area of tectonic land depressions. The district comprises vast stretches of wetlands locally called as *chaur*, which are not only highly productive but hold significance from the biodiversity point of view. Kusheshwarasthan is an important wetland site in the district. Apart from these natural wetlands, there are numerous 'Talab' (artificial ponds/tanks) lying dotted all over the district and receiving water from ground water seeps, flooded rivers and monsoon rains. These water bodies are used for fisheries, makhana (*Euryale ferox*)

and singhara (*Trapa bispinosa*) cultivation, irrigation and provide the basis of livelihood for human beings.

Wetlands are critical resources which are very essential for human society. Its importance arises from interaction of the ecological functions that act with human ecosystem. It plays a vital role in sustaining livelihood. It works through a range of ecosystem services, which bring both physical and non-physical benefits to human being.

Ecosystem services are defined by the Millennium Ecosystem Assessment (MEA, 2005) as "the benefits people obtain from

ecosystems". Every wetland performs diverse functions and provides different ecosystem services. Water is the fundamental component that supports the functioning and production of all wetland ecosystem services (MEA, 2005).

Materials and Methods

The researcher himself belongs to the district under investigation and has been observing the nature of wetlands for a long time. Different kinds of flying sample survey were conducted on these wetlands in Darbhanga district and pattern of their utilization in terms of wetland products growing therein. The result of empirical assessment and flying sample survey become the basis of this research paper.

The study was addressed to the study of sustainable livelihood in the area. This was a micro-area approach for the assessment of wetland product-based economy and their role in sustaining livelihood. The main objective of the study was to highlight the value of wetland and their product in sustaining livelihood.

Results and Discussion

Economic functions: As a livelihood support

Though most wetland functions like water storage, ground water recharge, water purification, checking erosion and biological production can be evaluated in economic terms; there are many direct economic benefits in the form of harvestable resources for many of which traditional societies have remained dependent upon wetlands for millennia. These values have already been described above. What need to be stressed here is that an assessment of wetland values cannot be made in purely economic terms

without taking into consideration the needs and dependence on wetlands of the traditional societies and local communities whose perception of an economic values is generally very different from that of an urban or industrial economist. Besides the foregoing quantifiable and conjunctive values, wetlands also have an important non-consumptive value. It lies in their providing aesthetic setting for cultural and recreational activities such as swimming, fishing, bird-watching, meeting place for shared gossips and friendship or just relaxing and marveling at nature's beauty. Wetlands are a social site that connects to the emotional, cultural and religious sentiments of people living in and around.

Darbhanga district of North Bihar plain is known for its water bodies. The area is famous for its ponds, fish varieties and *makhana* (gorgon nut) (Table 1). Besides the natural water bodies of different size, numerous artificial ponds/tanks are located in the region. These wetlands of the region are a repository of aquatic biodiversity and provide a basis of sustainable livelihood to the traditional societies and local communities. These are-

Blue revolution: The river basins of north Bihar plain especially Darbhanga district are replete with a series of shallow water bodies, locally called *chaurs*. These *chaurs* are spread over 29706 ha in Darbhanga district. These biologically sensitive and fragile areas are repository of a variety of fresh water and ornamental fishes. These *chaurs* provide a basis to the capture fishes with a production rate of 40-50 kg/ha/year. Greater colonization of macrophytes and habitat destruction hinders the fisheries. Despite having a vast potential of fish production the state lags behind in meeting the total fish demand. Against an annual requirement of 5.80 lakh metric tonnes the state produces only 4 lakh

metric tonnes of fish. Similarly, the state produces only 350 metric tonnes fish seeds against the demand of 800 metric tonnes fish seeds. However certain managed pockets have shown high fish production to the tune of over 1000kg/ha/year. The existing gap between demand and supply of fish seed provides enormous opportunities for unemployed youth in the area to invest in fish seed production. Darbhanga district attracted the youth to venture in fish seed business because of a high profit margin. The State Fisheries Policy envisages recognizing this unique property regime for cooperative management wherein cultivation is to be integrated with fisheries (Jha *et al.*, 2014).

Ornamental Fishes: Ornamental fishes are characterized by a wide variety of colour, shape and size pattern that are kept in aquarium to overcome pressure from day to day materialistic life. Due to its various colour pattern and natural beauty, these fishes are called as *living jewels*. In Bihar, not much attention has been given to ornamental fishes. Several types of ornamental fishes have not been popular yet. North Bihar has many natural resources in the form of wetlands. There are many rivers, *chaurs* (Land depression), *moins* (Oxbow lakes), tanks, etc. in which many wild ornamental fishes inhabit.

Darbhanga district is rich in large fresh water resource such as rivers, *Chaur*, *moins*, artificial tanks, etc. and is still an untouched sector for exploitation of wild ornamental fishes. Some of important ornamental fishes are given in table 2.

Makhana cultivation

Euryale ferox Salisb, commonly known as Makhana, is an important aquatic plant and

has immense potential to support the livelihood to thousands of poor farmers, particularly fisherman community in North Bihar region, where agriculture is complex, diverse and risk prone. It is also known as Gorgon nut or Fox nut and grown in stagnant perennial water bodies like ponds, *Chaur*s, *Moins* etc. Makhana seeds are known as Black Diamond. Its plant grows in tropical and sub-tropical climatic condition. Makhana requires 20°C-35°C temperature, 50%-90% relative humidity and 100cm-250cm of annual rainfall for its proper growth and development (Mandal *et al.*,2010).

India is the only country on the global level where commercial cultivation of Makhana is done. Within India, Bihar is the leading state in the production of Makhana till date. In North Bihar, there are numerous natural and artificial ponds and tanks, *chaurs* and low lying waterlogged areas. Hence, North Bihar is known as the natural abode of Makhana production.

In North Bihar, commercially, major Makhana producing districts are Darbhanga, Madhubani, Samastipur, Saharsa, Supaul, Araria, Kishanganj, Purnia and Katihar. Approximately, 80% of total production of processed Makhana comes from Darbhanga, Madhubani, Purnia and Katihar district alone.

Area under makhana cultivation is about 13,000 ha. Keeping in view of its commercial importance, a regional research centre was set-up to conduct research on various aspects of Makhana in Darbhanga district under the administrative control of ICAR (Indian Council of Agricultural Research) Research Complex for Eastern Region (Kumar *et al.*, 2011) (Table 3).

Table.1 Important fishes found in wetlands of Darbhanga district

S. No.	Local name	Zoological name
1.	Bulla	<i>Glossogobius giuris</i>
2.	Kanti	<i>M. Seenghala</i>
3.	Mangur	<i>Calaria sbatrachus Linn.</i>
4.	Gainchi	<i>Mastucombelus pancalus</i>
5.	Tengra	<i>Mystus tengla</i>
6.	Kabai	<i>Anabas testudineu</i>
7.	Singhi	<i>Heteropneustes fossilis</i>
8.	Garai	<i>Channa punctatus</i>
9.	Jhinga	<i>Macrobrachium lammeri</i>
10.	Katri	<i>Catla catla</i>
11.	Naini	<i>Cirrhinus mrigala</i>
12.	Rehu	<i>Labeo rohita</i>
13.	Marwa	<i>Oxygaster culpeoides</i>
14.	Saur	<i>Channa matulius</i>

Source: Roy, 2019

Table.2 Important ornamental fishes found in wetlands of Darbhanga district

S. No.	Local name	Scientific Name
1.	Kotri	<i>Colisa spp</i>
2.	Khosti	<i>Colis alalia</i>
3.	Sand loach	<i>Lepido cephalus</i>
4.	Nekti loach	<i>Botia derio</i>
5.	Tiger loach	<i>Botia almorhae</i>
6.	Galpuulani	<i>Eresthistes triangularis</i>
7.	Bulla	<i>Glossogobius giuris</i>
8.	Banspatta	<i>Alia coila</i>
9.	Flying barb	<i>Esomus danivica</i>
10.	Chanari	<i>Chanda nama</i>
11.	Indian glass fish	<i>Chanda ranga</i>
12.	Kawua	<i>Xenantodon cancila</i>
13.	gaichi	<i>Mastacembelus oatesii</i>
14.	Katgaichi	<i>Mastecembelus sp.</i>

Source: Das *et. al.* (2015)

Table.3 Comparison of makhana cultivation in pond ecosystem and in agricultural fields

S. No.	Parameters	Pond ecosystem	Agricultural field
1.	Water requirement	4-6 feet	1 feet
2.	Seed requirement	80-90 kg/ha	20kg/ha
3.	Source of water	Perennial water bodies	Irrigation or rain water
4.	Fertilizers and manure	Not possible due to high depth of standing water	Can be applied very easily
5.	Crop duration	8-10 months	4-5 months
6.	Seed yield	1.8-2.0 ton/ha	2.6-3.0 ton/ha
7.	Intensification of cropping system	Makhana + water chestnut	Makhana + water chestnut Makhana + Barseem Makhana + Rice+wheat
8.	Net income	Low to medium`	High to Very high
9.	Capital investment	High to very high	Medium to low
10.	Scope of horizontal expansion	Limited	Wide

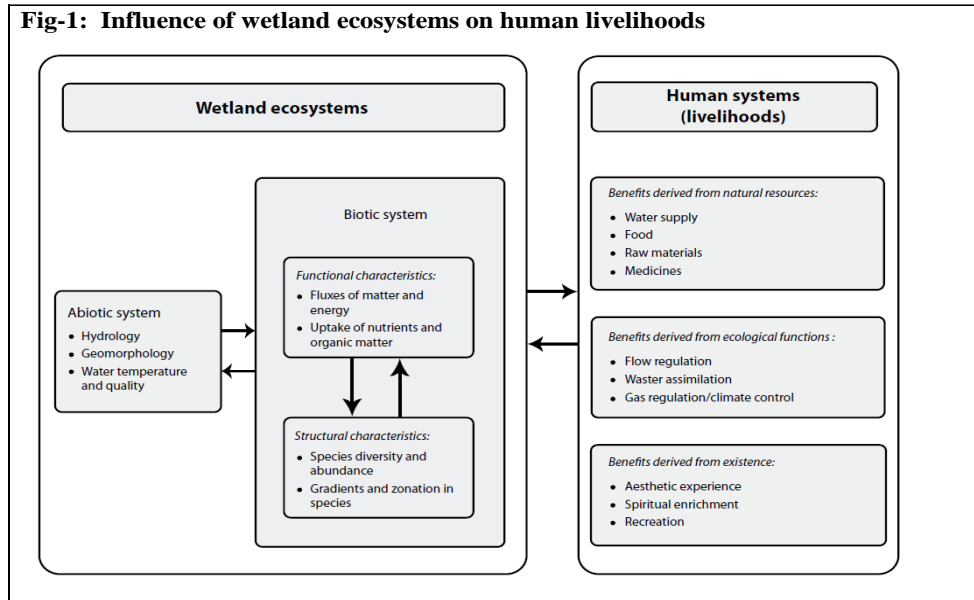
Source: Kumar *et al.*, 2011

Table.4 Aquatic plants as a basis of livelihood around wetlands of Darbhanga district

S. No.	Local Name	Botanical Name	Natural/Habitat	Livelihood Purposes
1.	Tal Makhana	<i>Astercantha longifolia</i> Nees	Wild	Leafy green, Source of drug
2.	Makhana	<i>Euryale forex</i> Salisb	Cultivated	Subsidiary food, Component of integrated aquacultural, pops a ritual items
3.	Singhara	<i>Trapa bispinosa</i> Roxb.	Cultivated	Subsidiary food
4.	Purain(Kamal)	<i>Nelumbo nucifera</i> Gaertn.	Wild	Subsidiary food, flower and seeds as ritual item
5.	Bhent	<i>Nymphaea alba</i> Linn.	Wild	Subsidiary food
6.	Jalkumbhi	<i>Eichhornia crassipes</i> Solms.	Wild	Energy fuel, Fishing shelter belt, Fodder,
7.	Motha	<i>Cyperus rotundus</i> Linn.	Wild	Culms used for making Shitalpaati
8.	Sarahanchi	<i>Alternanthera sessilis</i> DC	Wild	Fodder, Fish shelter Belt
9.	Manager	<i>Sesbania rostrata</i> Bremek.	Wild and Cultivated	
10.	Kataraghas	<i>Vetiveriazizanionides</i> Linn.	Wild	Flood fighter, Sikki handicraft
11.	Khubahi	<i>Scirpus articulatus</i> Linn.	Wild	Subsidiary food
12	Korhila	<i>Aeschynomene indica</i>	wild	Carve items, floating boat

Source: Jha (2012)

Fig.1 Influence of wetland ecosystems on human









Source: Lorenz *et al.*, (1997)

Fig.2 Different stages of makhana cultivation

			
Germination	Matured plant	Hypertrophy	Flowers in bloom
			
Makhana fruit	Internal view of fruit	Fresh seeds	Matured seeds
			
Seed Collection	Pre-heating	Finished product	Packaged product

Source- Compiled by author

Fig.3 Different wetland products and their uses

		
Singhara Plant	Singhara fruit	Khubhi plant
		
Khubhi biscuit	Bhent plants and flower	Bhent fruit

Source- Compiled by author

In general, Makhana is a crop of pond ecosystem. A field based cultivation techniques has been developed in order to enhance the productivity and facilitate the horizontal expansion of Makhana, which is being adopted by the farmers of the region. Makhana based cropping system, *i.e.* Makhana-Water chestnut, Makhana-Barseem, and Makhana-Rice-Wheat has been developed. Makhana with fish and Water-chestnut integrated farming system model have been developed which is gaining popularity among the farmers. Economics of different Makhana based cropping systems have been worked out and net monetary returns have been recorded highest through makhana- Rice-Wheat cropping system (Rs 1,22570/ha), followed by Makhana- Barseem (Rs 98,465/ha) and Makhana- Water chestnut(Rs 88,790/ha). Net monetary returns through Makhana-Fish-Water chestnut was estimated Rs 88,910/ha. (Kumar *et. al.*, 2011).

Other Wetland Products

A survey was done in the study area to know the diversity and utilization of aquatic plants used by the people for their livelihood. About

a dozen aquatic plants have been found to be intimately associated with livelihood practices in this region of North Bihar plain. Of these, Makhana (*Eurale ferox*) and Singhara(*Trapa bispinosa*) are cultivated as commercial crops and constitute subsidiary food items. Other aquatic plants like Khubani (*Scirpus articulatus*) and Bhent (*Nymphaea alba*) are collected from the wild. A number of aquatic plants like Sarhanchi, Tal Makhana etc. are also collected from the wild to be used as leafy greens (Jha *et al.*, 1996).

Singhara (*Trapa bispinosa*): This aquatic plant aregrowing in shallow and slow moving water. Plant bear ornately shaped fruits. The fruit contains a single large starchy seed. These edible seeds are cultivated for subsidiary food. It has much wider distribution as against Makhana whose cultivation is localized around Milkichak wetland. Waterlogged areas alongside of Darbhanga-Lateriasarai rail line are settled to the growers for its cultivation.

Khubahi (*Scirpus articulatus*): It is a densely tufted plant growing in open wet places in

settled lowland areas. Khubani are eaten as granular sweets in India. As dietary plant khubanihas been investigated by Gupta and Saha (1977) for its chemical composition and nutritive values. Its seeds are collected and processed by the people after the rainy season is over to obtain its lightest pops which are available as granular sweets and sold under the name of 'KhubahiRamdana' in the area. (Jha *et al*, 2002).

Bhent (*Nymphaea alba*): This is an aquatic flowering plant. It grows in large lakes and ponds that is 30-150 cm deep. Its seeds are collected, processed and eaten by the people as subsidiary food.

Korhila (*Aeschynomene indica*):This is one of the known lightest woods. It provides a basis of livelihood to the gardening community around the wetland area who carve items like Jhaang, Maurs, etc. from it. Fisherman utilize it as floating boat for moving on the water for throwing their fishing nets(Jha and Jha, 2002).

Cultural value of wetlands

The relationship of people of Darbhanga district with these wetlands has strong reflection in the culture and belief systems. In Mithila region, 'ponds' are treated as daughter. The people had linked their festivals and rituals with the ponds. If there was a marriage or child birth, they would go to the pond and perform their rituals. With onset of Monsoon, the ponds and river channels were cleaned to provide for much needed flood storage. This practice is known as '*joorsital*'. The Sankranti of Baishakh month was a sacred duty of every person to clean all the water sources. The active preparation before flood has a Celebrating name '*jhajhar*'. Some cultural acts which are associated with wetland of the region are Marriage rituals; Shradh and Tarpan; Emersion of goddess

Saraswati, Durga, Kali, etc.; Bathing on Purnimas, Shankranti and Sun and Moon eclipses; Abode of Goddess Kamla (Goddess of water); Sama-Chakewa; Chat Brata etc. (Table 4).

In conclusion the wetlands are essential for human health and prosperity. They provide us fresh water, maintain ground water, ensure our food security, sustain biodiversity, protect against flooding etc. This is a major source of employment globally and also ideally placed to showcase truly sustainable livelihood. Wetlands of Darbhanga District such as *chaur, moin, tal, tank, rivers* etc. provide a basis to capture fishes, shell fishes, crabs etc. it supports thousands of people in securing their food supply and sustaining their livelihood. These wetlands are also a habitat for many aquatic plants and animals. Harvesting and processing of these aquatic plants and their fruits, reeds and grasses also provide a basis of livelihood around the wetlands of Darbhanga district.

Kusheshwarasthan wetland of Darbhanga district in North Bihar is known for wintering ground for migratory birds and is also known for Shiva temple. Therefore, it has the potential of being developed as a place for eco-cum-religious tourism. It could create employment opportunities and hence support local people for their livelihood. Darbhanga district is land of rivers and flood plains. These rivers have potential to play a vital role in transporting goods and services in many parts of the region and support livelihood systems of many communities.

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How to cite this article:

Shailendra Kumar Roy. 2020. Wetlands of Darbhanga District: A Basis of Sustainable Livelihood. *Int.J.Curr.Microbiol.App.Sci.* 9(10): 3097-3105.
doi: <https://doi.org/10.20546/ijcmas.2020.910.372>