Arth Ganga Project: District Saran

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Submitted to

National Mission for Clean Ganga (NMCG)

Submitted by:

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EXECUTIVE SUMMARY

1 DISTRICT OVERVIEW

1.1 INTRODUCTION

Saran district is one of the thirty-eight districts of Bihar state, India.[1] The district, part of Saran Division, is also known as Chhapra district after the headquarters of the district, Chhapra. Saran district is located on global map between 25°36' and 26°13' North latitude and 84°24' and 85°15' East longitude. The district occupies an area of 2,641 square kilometers. The rank of the district in comparison to other districts of Bihar in terms of area is 16th. The Gandak river along with Muzaffarpur and Vaishali districts forms the eastern side, the Ganges and the Ghaghra alongwith Bhojpur and Patna districts forms the southern side, whereas the boundaries of Balia district of U.P. and Siwan and Gopalganj districts of Bihar and north western form the western side of the triangular Saran district. The districts's 2.24% area is covered under the forests out of the total geographical area. Administration wise, district has 3 sub-divisions namely, Chhapra, Marhawrah and Sonepur which are further divided into 21 developmental blocks. There are 2 Lok Sabha seats and 10 Assembly constituencies in the district. The district has 6 towns and 1764 villages.

According to 2011 census, the district has a population of 3951862 including 2022821 are males and 1929041 are females. The district has sex ratio of 944 females for 1000 males and a literacy rate of 68.57%. The work participation rate (WPR) in the district is 13.80 percent for main workers and 12.52 percent for marginal workers. Proportion of non-workers in the district is 73.68 percent. The economic activity in the rural areas of the district is supported by the fact that the cultivators (23.75 %) and agricultural labourers (50.10%) together constitute 73.85 percent of the total workers of the district. The agriculture sector has absorbed around 3/4th of the total workers. The cultivators constitute 7.25 percent and agricultural labourers constitute 19.52 percent of the total workers in urban areas of the district.

Agriculture is the main occupation of the people of the district and also the main source of livelihood of the people. Some of its chief agricultural products are paddy, wheat, sugarcane, pulses, oil seeds, potato, maize, etc. Almost all people of the district are engaged in agriculture since it is scantily industrialized. Only a few sugar factories are found in it which as well help in its economy to some extent.

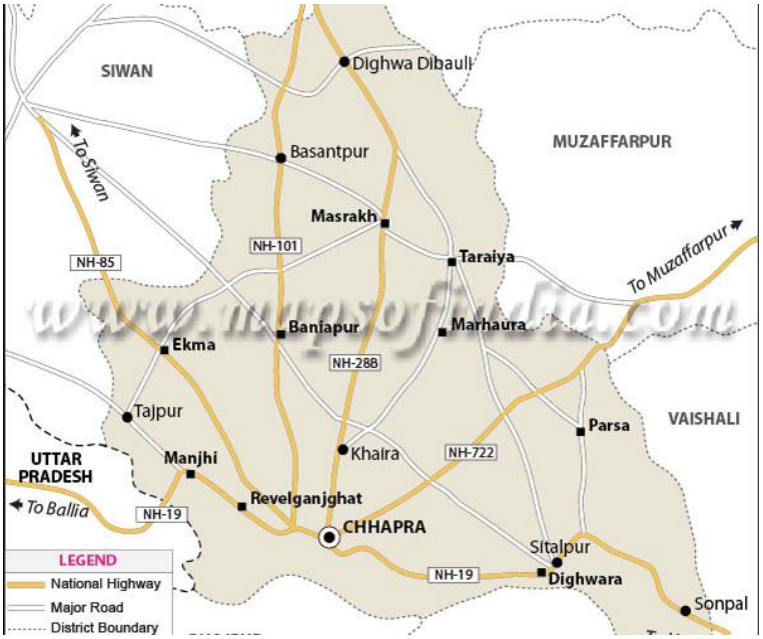


Figure 1 Map of the district

1.2 DEMOGRAPHIC PROFILE OF SARAN

Geographic area: 2641 Km^2
Altitude: 64 m
Rainfall: 486.8 mm (2018-19)
Forest area: 59.13 Km^2
Rivers: Ganga

Administrative Divisions:

District Headquarter	Chhapra
No. of subdivision	3
No. of Blocks	20
No. of Villages	1764

Demographic and Socio-economic Parameters:

Population	39,51,862
Population Density	1496 / Km^2
Sex Ratio	944
Literacy	65.96%
Occupation/Livelihood	Agriculture

1.3 AGRO CLIMATIC PROFILE OF THE DISTRICT

1.4 ECONOMIC PROFILE OF SARAN

The economy of the district is solely dependent on agriculture. Some of its chief agricultural products are paddy, wheat, sugarcane, pulses, oil seeds, potato, maize, etc. The adaptability of its farmer to the new agricultural technologies and ideas help to increase the production level of the agricultural items. Every year a huge chunk of revenue comes from these agricultural products. Almost all people of the district are engaged in the agriculture since it is scantily industrialized. Only a few sugar factories are found in it which as well helps in its economy to some extent. It is one of the 36 most backward districts in Bihar and currently receiving funds from the Backward Regions Grant Fund Programme. In the year 2011-12 the gross domestic product in the district was Rs. 6,54,333 lakh at current price and Rs. 4,01,151 lakh at constant prices in the year 2004-05. In the year 2011-12 net domestic product in the district was Rs. 5,87,569 lakh at current price and Rs 3,55,513 lakh at constant prices in the year 2004-05. (IndiaStat).

2 QUANTITATIVE DATA ANALYSIS

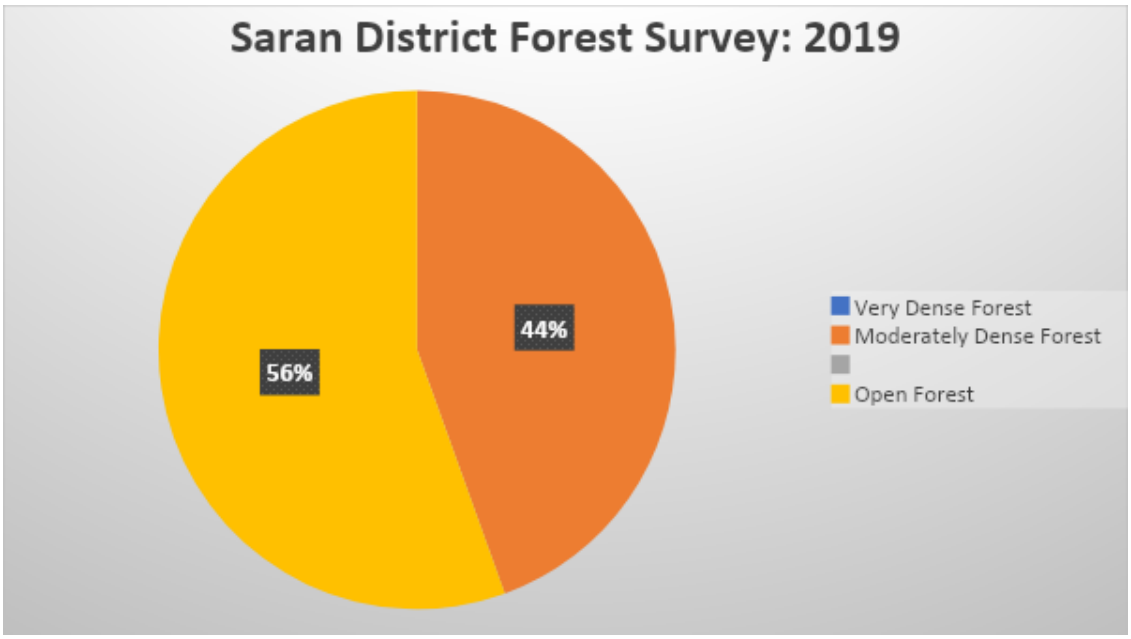
2.1 Agriculture and Allied Activities

2.2 Trends in Livestock

2.3 Forestry

District of Saran has 2641 Km^2 total geographic area. Forest cover area as per 2019 forest survey assessment is 59.13 Km^2. This is barely 2.24% to the total area which makes district forest deficient area. The state has total 7305.99 Km^2 forest area which is 7.76% of total geographic area of the state.

Saran district does not have forest under the category of Very Dense Forest (VDF), 26.3 Km^2 of area comes under the category of Moderately Dense Forest (MDF) and 32.83 Km^2 is open forest (OF) as per 2019 assessment.



Forest Survey of India 2019 Bihar State vs Vaishali Comparative Assessment						
Area	Geographical Area	Very Dense Forest	Moderately Dense Forest	Open Forest	Total	%of Geographical Area
Saran	2641	0	26.3	32.83	59.13	2.24
Bihar	94163	333.13	3280.32	3692.54	7305.99	7.76

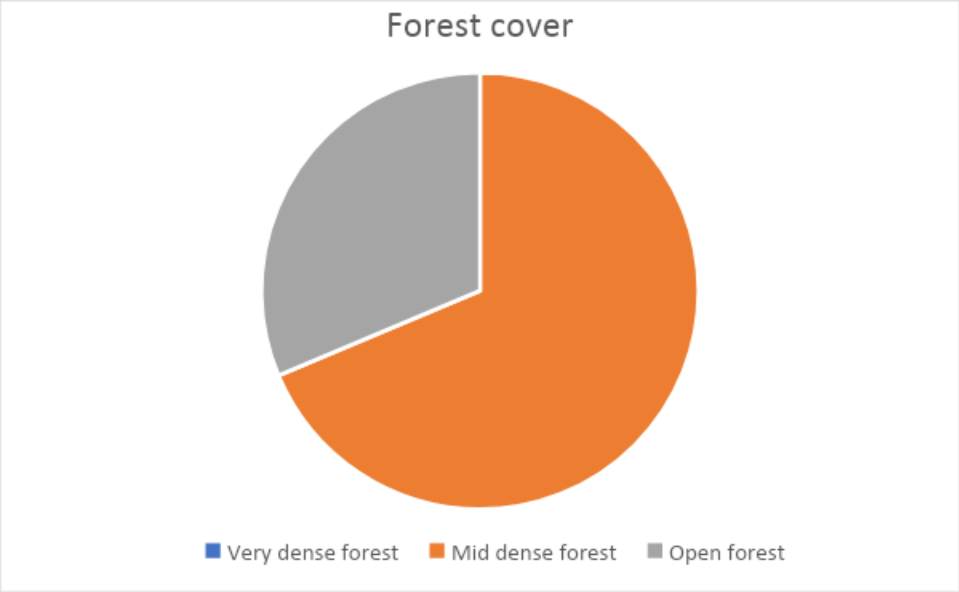
2.3.1. Biodiversity: The district's biodiversity data includes livestock population, bird species, and forest cover. Saran is located in the southern portion of the Saran division, North Bihar, between 25 -36 degrees and 26 to 13 degrees north latitude and 84 to 24 and 85 to 15 degrees East longitude. Saran district has an important place in Bihar for ethnobotanical biodiversity. The district has a forest area of 59.13 square km, in which 44% area is mid-dense forest, and 56% area is open forest.

Table 1 Bird species recorded in the district.

Number of species	341
Number of rare/accidental species	9
https://avibase.bsceoc.org/checklist.jsp?lang=EN&p2=1&list=clements&synlang=&region=INwhukut&version=text&lifelist=&highlight=0	

Forest cover (in sq. km.)

Geographical area	**Very dense forest**	**Mid dense forest**	**Open forest**	**Total**	**% of Geographical area `**	**Change with respect to 2017 assessment**	**Scrub**
2641	0	26.30	32.83	59.13	2.24	2.13	0



2.4 Tourism

2.5 Wetlands

The district consist of large number of wetlands. Table 1 shows the number of wetlands and their area representation in the district. There are around 113 wetlands sized greater than 2.25 Ha and 430 less than 2.25 Ha areas. The region consists of small wetlands, generally less than 200 Ha in the area but 5 are greater than 200 Ha.

Table 1: Wetland Data of Saran District

	Total Number of												
	Wetlands:			Area (ha)									Aquatic Vegetation
Natural Wetlands	**NRCD**	**NWIA**	**Diff.**	**<2.25**	**<5**	**<10**	**<20**	**<50**	**<200**	**<500**	**<1000**	**>1000**	
Lake/ponds	21	26	5	0	1	4	8	3	5	0	0	0	19
Ox-bow lakes/cut off meanders	10	10	0	0	6	1	1	2	0	0	0	0	8
High altitude Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0
Riverine Wetlands	9	10	1	0	1	3	4	1	0	0	0	0	9
Waterlogged	29	30	1	0	2	7	2	6	7	4	1	0	24
River/Stream	0	27	27	0	0	0	0	0	0	0	0	0	0
Man-made Wetlands	**NRCD**	**NWIA**	**Diff.**	**<2.25**	**<5**	**<10**	**<20**	**<50**	**<200**	**<500**	**<1000**	**>1000**	**AV**
Reservoirs/Barrages	0	0	0	0	0	0	0	0	0	0	0	0	0
Tanks/ponds	9	10	1	0	7	0	1	0	1	0	0	0	8
Waterlogged	0	0	0	0	0	0	0	0	0	0	0	0	0
Salt pans	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (543)	78	113	35	430	17	15	16	12	13	4	1	0	68

Source: (National River Conservation Directorate, 2008), (Space Application Centre-ISRO, 2007)

- The district comprises 543 wetlands; most are waterlogged and lake/ponds/tanks.
- The wetland size is small and medium-sized in general.
- The number of natural wetlands is more than man-made.
- Half of the wetlands (>2.25 ha) have aquatic vegetation.

2.6 Energy

2.6.1. Solar Energy

BREDA i.e. Bihar Renewable Energy Development Agency, has been established to promote development of schemes on non- conventional energy sources. BREDA aims to work as a Catalyst for Change by utilizing the Best Renewable Energy Technology to cater to the ever growing Growth Potential of Bihar.
The data from the 2011 census depictsin figure that majority of households in the district Saran, use kerosene as the main source of lightning. They account to 83.96, followed by them are 14.77% households using electricity and only 0.58% households use solar as the main source of lightning.

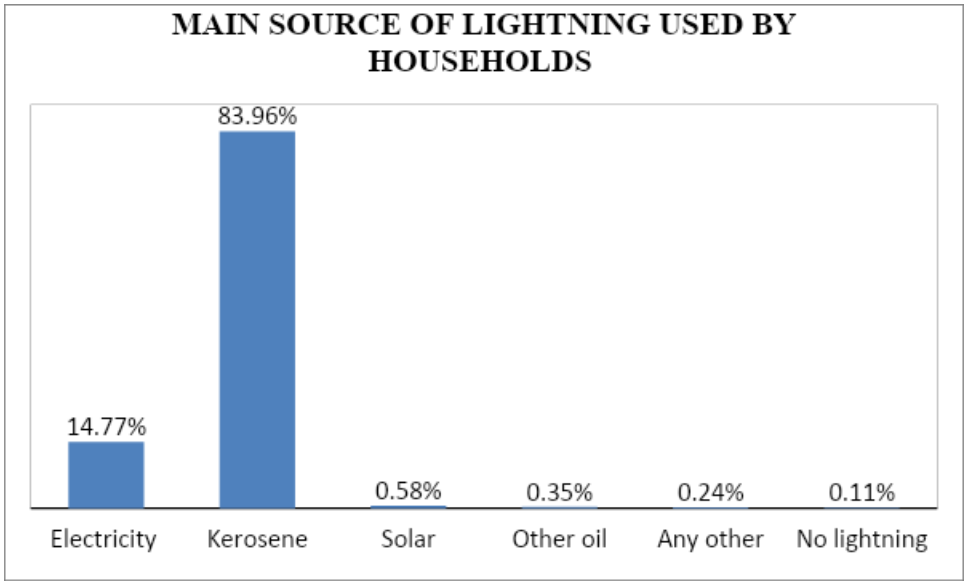


Fig. 1

The district has a good potential of solar potential. According to Pugazenthi et. al. (2016), the total solar power potential available in the district Saran is 0.1554.
There is not sufficient data available giving the account of the solar power units in the district.

2.6.2.Biomass Energy

BREDA i.e. Bihar Renewable Energy Development Agency, has been established to promote development of schemes on non- conventional energy sources. BREDA aims to work as a Catalyst for Change by utilizing the Best Renewable Energy Technology to cater to the ever growing Growth Potential of Bihar.
The main activity of the district Saran is agriculture. The gross cropped area of the district Saran is 348300 ha with a total net sown area of the district is 199300 ha. Out of the total net sown area 74500 ha area is sown more than once in the area with the cropping intensity of 174.7%.

The major field crops in the district are rice, maize, pulses, wheat and oilseeds. Table 1, gives an account of productivity of these crops.

CROP	PRODUCTIVITY (kg/ha)
Rice	1730
Maize	1830
Pulses	1960
Wheat	1432
Oilseeds	2010

The pie chart in figure 1, depicts the type of fuel used by households for cooking. A majority of 53% households use firewood for cooking , followed by 26% using crop residue, 12% using cowdung cake and only 8% using LPG/PNG.

The district has a good potential of biomass potential. According to Pugazenthi et. al. (2016), the total biomass power potential available in the district Saran is 0.4027.

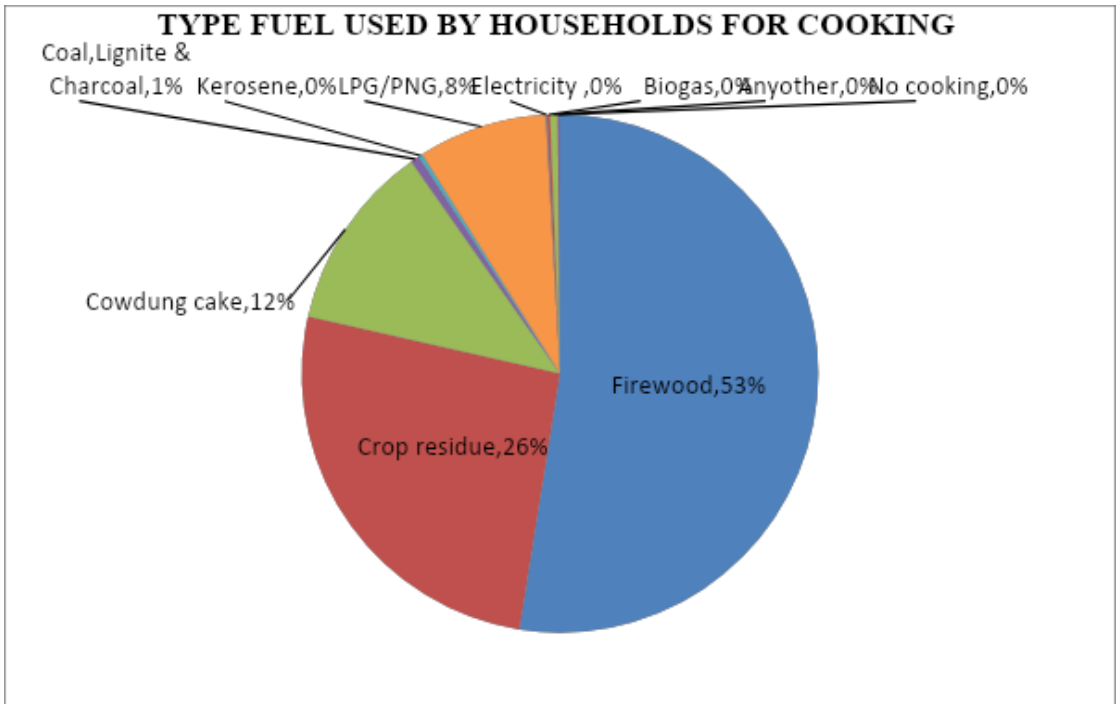


Fig. 1

2.6.3.Biogas Energy

No biogas plants are installed in the district. Biogas potential has been evaluated by average livestock and agricultural waste production. Biogas potential from animal waste is calculated approximately as one crore m^3/year and twenty crores m^3/year from agricultural waste. This amount of biogas generation can efficiently complete the energy demand of the district.

2.6.4.Hydropower Energy

Saran is located in the southern part of the Saran Division in North Bihar, between 25°36' and 26°13' north latitude and 84°24' and 85°15' east longitude. The district is bordered on the south by the Ganges and on the north by the districts of Bhojpur and Patna. The districts of Siwan and Gopalganj are located to the north of Saran. The Gandak river separates the districts of Vaishali and Muzaffarpur in the east. To the west of Saran are the Uttar Pradesh districts of Siwan and Balia. The Ghaghra river runs through Saran and Ballia, forming a natural border. No hydropower plants exist in the district. However, two sites have been identified for future projects.

Name of project	Category of project	Name of river/canal	Capacity in kW	Head in meter	Discharge in m^3/sec	Remarks
Saran- I	Canal	Gandak	1850	1	-	Site identified
Saran- II	Canal	Gandak	1230	1	-	Site identified

3 QUALITATIVE DATA ANALYSIS

3.1 AGRICULTURE, ALLIED ACTIVITIES,

3.2 FORESTRY

Forest Survey 2019 assessment reported variety of native trees in rural and urban areas across the state. These common species are Mangifera indica, Bombax ceiba, Psidium guyava, Dalbergia sissoo (FSI, 2019). Currently, State government forest department runs 'Krishi Vaniki Yojana', a scheme which primarily focuses on to motivate farmers to plant trees and other crops on a large scale along with traditional crops on their land. This scheme is aimed to improve the income of farmers in the event of crop loss and to contribute towards agricultural produce by growing popular trees such as Heesham, Guava, Gambhar, Amla, Mahogany, Teak, Peepal, Jamun, Kachnar, Gulmohar, Mango, Eucalyptus, Neem, Kadam, Bahera, Palas, etc. Farmers are provided seedlings of the trees in government nursery at the rate of Rs 10 / seedling. If farmers maintain 50 percent of the plants purchased from the forest department in their lands for 3 years, then for this, the

farmers will be given an incentive of Rs 60 per plant. Moreover, the Rs 10 they spent for purchasing the seedling is also given back to the farmers (Krishi Yojana).

Recently, The United States Agency for International Development and Bihar's Department of Environment, Forest and Climate Change jointly launched forest monitoring tool. which will use satellite images and geo-analytics to improve forest monitoring, planning, and management in the state. This will help forests to pull more carbon out of the air, enhance water yields, and improve livelihoods for indigenous and tribal communities (Outlook, 2021).

3.2.1. Biodiversity : Gobardhan Das pond, as a fresh-water resource, supports a diverse fish species. According to the finding of Prabhat Ranjan, 17 fish species from six families and nine genera were reported (August 2017 to January 2018) on Gobardhan Das pond[1].

[1] The Biodiversity of Fish Fauna in GobardhanDas Pond (Saran District), North Bihar. International Journal on Orange Technologies, 2(9),22-25.

https://doi.org/10.31149/ijot.v2i9.754Pdf Url: https://journals.researchparks.org/index.php/IJOT/article/view/754/726

3.3 ENERGY

5.5.1. Solar

This district of Bihar has not done very well in the solar energy sector. There have been very less sources talking about the solar energy in the district Saran. An article in a local daily, Dainik Bhaskar reads 18 schools of Saran will be illuminated with solar energy. According to the article- The higher secondary and middle schools of the district will soon get rid of the obligation of electricity connection and the problem of payment of electricity bill coming every month. Grid connected roof top (solar power plant) will be installed in all the higher secondary and middle schools of the district under Jal-Jeevan Hariyali Abhiyan of the state government. The state government has authorized Bihar Renewal Energy Development Agency (BREDA) to install solar plants.

Another article in The Times of India with the heading ‘Take up pisciculture, go for solar energy: Nitish Kumar to farmers’, reads- Chief minister Nitish Kumar on Sunday asked the officials of Saran district to promote the trend of ‘Niche Machchli Upar Bijli’ in ‘chour’ (wetland) areas to increase production of fish along with solar power. Addressing a meeting to review the development works under the ‘Jal-Jivan-Hariyali Abhiyan’ at the Saran collectorate in Chhapra, the CM said maximum number of farmers should be motivated to construct ponds in such a way that fisheries could be done in the pond and solar energy can be generated from the makeshift top of the solar panels.

5.5.2. Biomass

This district of Bihar has not done very well in the biomass energy sector. A quite old news article in The Economic Times with the heading-'Saran renewable energy is bringing power to the people in Bihar' is about the young entrepreneur Vivek Gupta. According to the article - Teenagers in Saran district of Bihar have found a new idol. Their elders may still want them to become an engineer or a civil servant, but they would rather turn entrepreneur and do something for their villages, just the way 32-year old Vivek Gupta did. Gupta, who grew up spending several nights without electricity at home in Chhapra district, the aim has been to "electrify" the villages around Saran, and those little pockets in the country where the state's grid-power is yet to reach. "Since I know what they face, I feel it is my resposibility to provide electricity in those villages where kids light the midnight lamp to finish their studies," says Gupta, who founded Saran Renewable Energy, a small firm which generates electricity from renewable raw materials such as agricultural waste biomass--rice and wheat husk, plant stalks, juliflora, waste wood and corn cobs, among others.

Another article in The Times Of India, with the heading 'SIPB approves setting up of biomass power plants' reads- The State Investment Promotion Board (SIPB) has given consent for establishment of a number of biomass power plants and also a solar power plant in the state to private enterprises from outside and also to some local entrepreneurs. An agriculture powerhouse having plenty of natural and agriculture resources, Bihar has a rich potential for establishment of biomass-based power plants to produce electricity which can be easily termed as "green energy" in environmental parlance.

With the likely arrival of outside private enterprises with technology for establishing biomass-based power plants, there is a possibility they would supplement the energy (electricity) supply badly needed in the power-starved Bihar. The SIPB has given consent to M/S Saran Renewable Energy Pvt Ltd, Chhapra (Bihar), to set up biomass gasification system for producing 240 kW electricity at Garkha in Saran district.

An article with the heading 'Benefits of schemes will not be available for burning crop residues: DM' in Jagran is about stubble burning in the district Saran. According to this article - A meeting of the district level inter-departmental working group on crop residue management was held on behalf of the Agriculture Department in the Saran Collectorate Auditorium. District Magistrate Rajesh Meena said that burning of crop residues in the fields is causing damage. For this, farmers should be made aware through training and Choupal. They should be informed about proper adjustment of crop residues. A case was registered against the farmers who did not do so. They should be deprived of the schemes of the department.

5.5.3. Biogas

Power generation from biomass is the most cost-effective and environmentally friendly approach to produce renewable electricity in biomass potential locations with abundant biomass supplies and processing activities. Furthermore, using this resource contributes to greater energy independence, and using a locally-sourced fuel gives employment and direct economic benefit to

local communities. No data has been presented in the district and states website for biogas plants of household or industrial level.

5.5.4. Hydropower

The district is surrounded by rivers Ganga, Gandhak, and Ghaghra. These rivers can serve electricity and irrigation purposes. As per the MNRE data, two small hydropower projects, namely Saran I and Saran II, have been investigated on the Gandak river of 1.85 and 1.23 MW capacity.

3.4 TOURISM

3.5 WETLAND

The wetlands are the source of many ecosystems and habitats for various species. The wetlands create a unique ecosystem that supports many species simultaneously like aquatic, terrestrial, and human beings. Local stakeholders directly or indirectly depend on the wetland for their income and small-scale business. These businesses can be a great opportunity can be turned into a large-scale production hub using the right approach. The district derive it's name from Sarangaranya which means forest of deers. The data collected and analyzed shows the region's production and possible product that can be derived from the raw product. The list of sources and the possible products are mentioned below:

- Agriculture is the main activity of Saran district. Agricultural products include paddy, wheat, sugar cane, potato and maize
- The sugar factories in the region contribute the most to the industrial scenario of Saran
- Animal Husbandry is coming up as new enterprises in the district followed by fishery and poultry
- The district consist of several depressions and marshes create three broad natural divisions:
    - The alluvial plains along the big rivers, which are subject to periodic inundation
    - The uplands away from the rivers, not subject to floods
    - The riverbed diara areas

4 ACTION PLAN DEVELOPMENT

4.1 AGRICULTURE

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4.2 FORESTRY

Saran district is a forest deficient area. The major occupation in the district is agriculture and small-scale businesses. That is why the Government of Bihar had drafted an Agroforestry policy in 2018. The district lies under the agriculture category III. This categorisation had been developed on the basis of climatic condition, the geography of the region, soil condition and water availability. Major crops in the district are Rice, Wheat, Lentils, and Gram pulse. The study has suggested a variety of trees in this zone. Eucalyptus, Arjun, Jamun, Kadam, Semal etc are the suggested tree species in the flood-prone zone; whereas Shisham, Gamhar, Melia, Teak etc for the non-flood zone. Litchi, Mango, Jamun, Kathal, Guava can be the most profitable money yielding tress as part of agro-horticulture. Medicinal plants like Kalmegh, Aswagandha, Sarpgandh, Satawar, Lemongrass, Safedmusli etc are viable options in agroforestry (Govt of Bihar, 2018). Below are the important species which can be included under agroforestry:

Fruits	Vegetables	Spices	Flowers	Aromatic Plants
Mango, Guava, Litchi, Banana, Pineapple	Solanaceous, Cucurbits, Onion, Okra, Beans	Turmeric, Ginger, Garlic, Coriander	Marigold, Rose, Tuberose, Gladiolus, Jasmin	Japanese Mint, Lemongrass, Pamaroja, Citronella

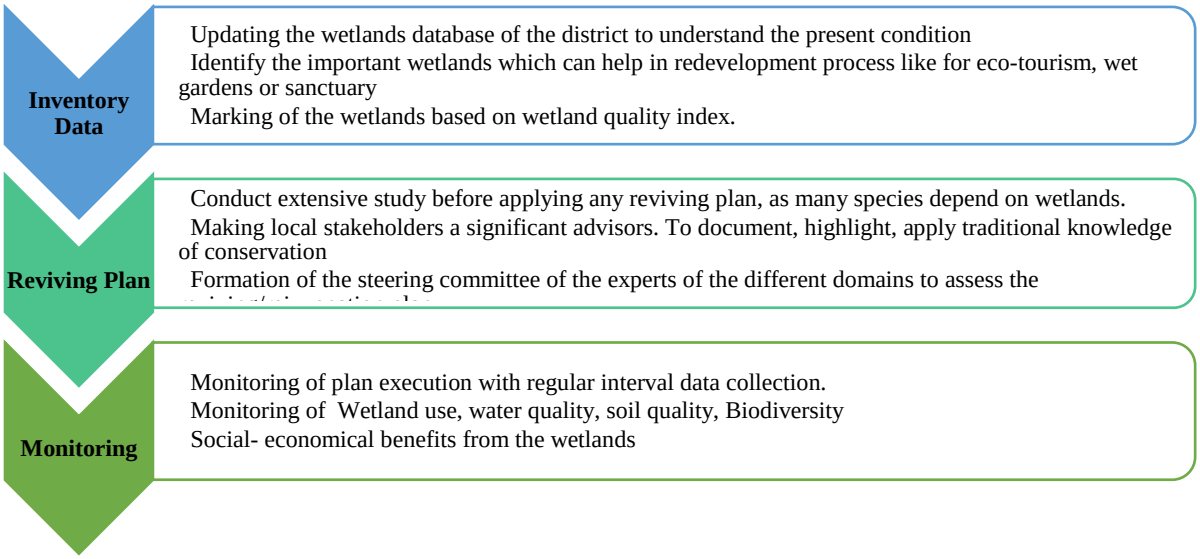
Afforestation on the riverbanks and open public spaces is another option that suits the saran district. Miyawaki afforestation method has been adopted by many urban authorities in the world. This technique helps to build dense, native forests. This method ensures that plant growth is 10 times faster and the resulting plantation is 30 times denser than usual. It involves planting native species in the available area and becomes maintenance-free after the first three years. The most important aspect of this method is it requires as minimum as 20 square feet of area. This can enable the native citizens of Saran to grow profitable fruit plants in the community. The combination of a small forest and home garden is known as homestead forest. With the combination of the Miyawaki method of afforestation and trading platform for these products, this combination can be beneficial for the local economy (Miyawaki Afforestation, 2019). Some of the major Indian cities like Mumbai, Chennai have also adopted this technique for afforestation (Indian Express, 2021). Afforestt is the firm that works in the development of Miyawaki Forest.

4.2.1. Biodiversity : Saran is derived from Saranga- aranya, or the deer forest, the territory being famed in prehistoric times for its vast areas of forests and animals. Present data show that the district has no dense forest. The state or district government should conduct afforestation programs and strict laws at the village level.

4.3 TOURISM

4.4 WETLANDS

The district is comprised of some of the healthy and wealthy wetland ecosystems. They directly or indirectly support millions of people and provide goods and services to them. They support all life forms through extensive food webs. They are habitat to aquatic flora and fauna and numerous species of birds, including migratory species. They mitigate floods and recharge the groundwater. They need to be taken care of, and action on different fronts must be taken. The action plan below gives a glimpse of the action and development required to protect, conserve, rejuvenate the wetlands existing and extinct.



4.5 ENERGY

4.5.1 Solar

In the district Saran solar energy has not been much developed. Not many people in the district are aware about the solar energy, or probably they do not have knowledge about the policies that have been made to promote solar energy. People should be made aware about the solar energy in the panchayats, chaupals, etc. The district mainly depends on the agriculture hence; giving agriculture the power of solar energy would definitely be beneficial for the farmers. Providing solar irrigation pumps under the Kusum Yojana can be one of the ways to increase solar energy penetration in the district. With better irrigation, farmers will be encouraged to earn more profit by planting improved varieties of crops, which does not pollute the environment in any way. It will be available to the people of Saran. Attention should also be paid on improving the infrastructure so that grid connected solar rooftop panels under the National Solar Mission are easily installed. Also the facilities that should be provided by the electricity department in getting the net metering facility, should be improved. This will incline more and more people towards solar energy. Also the net metering facility should be provided to the industrial sector as well. In remote areas, where there

are no power lines, off grid installations should also be provided with financial aid by the government.

PROJECTION AND MONITORING MATRIX

Firstly, people should be made aware about the solar energy and the policies that government has made for them. This can be done through different awareness campaigns arranged by the local governments.
Secondly, Kusum Yojana should be popularized among the farmers, so that they could take its benefit. Farmers should be given the knowledge about the different components in the Yojana.
Thirdly, infrastructure should be strengthened so that solar roof top panels under the National Solar Mission are easily installed. The services that are to be provided by the concerned departments, should be made customer friendly.
Fourthly, some provisions should be made for the industries as well, so that they are able to take the benefit of solar energy.
Lastly, areas where there are no power lines. There should be provision of some subsidy for the off grid connections. Solar power units should also be installed in the public places by the government.

4.5.2 Biomass

The district first needs to spread awareness about the biomass energy in the district Saran. This should be done on an extensive level in both urban and rural areas. The awareness should not be only about the biomass energy but also about the policies and the schemes related to it. The district mainly depends on agriculture for its income and hence produces a lot of agricultural waste. The district deals with the problem of stubble burning as well. So to overcome this problem and to push the development in a sustainable manner it is important that the biomass energy is encouraged and popularized in the district. A district oriented survey should be conducted in order to pick and choose the land available for the biomass plants. These lands should be chosen in such a way that they are easily approachable to all the stakeholders producing biomass wastes. Also a well-connected transport system dedicated to the collection of biomass wastes should be developed. Along with transportation, provisions for the storage should also be made. Rice mills should be encouraged to have their own biomass plants. The native entrepreneurs should be encouraged more. This will increase the employment in the district. Biomass based gasifier power project and Biomass based Co-Generation Power Project are best suited for the district.

PROJECTION AND MONITORING MATRIX

Firstly, the people of the district should be made aware of the biomass energy and how it can be utilized in the district. This can be done by organizing panchayats, chaupals, etc.
Secondly, a district wide survey should be conducted to figure out the lands available where the biomass plants could be established. Also an account of biomass waste production should be conducted, such as the type of wastes available, time during which they are available, etc. This

information will help the district authorities to accordingly work on the biomass energy production.
Thirdly a well-connected transport system along with the storage centres should be planned and constructed in the district.
Fourthly the native entrepreneurs should be encouraged more, this will directly benefit the residents of the district.

4.5.3 Biogas

At present data is not available, or plants are not installed in the district. Government should make data available for the public about biogas plants on state or district websites. Organic waste is present in enough amount to generate bioenergy for local people. Government should construct biogas plants in cities and rural areas to manage solid waste as well as to generate electricity.

4.5.4 Hydropower

Government should make dams on flood-prone areas of the district. These dams created reservoirs that can be used for hydroelectric plants. The local population benefits from the building of these facilities in the form of increased job opportunities and the fulfillment of their electricity needs. As a result, building small hydropower projects is a crucial step toward meeting the state's energy needs and promoting economic development.

5 RECOMMENDATIONS

5.1. Agriculture and allied sectors

The Saran district has ample scope to develop agricultural and allied activities due to its favorable land, soil and geographical condition. Therefore, there is a need for some proper management and strategy to promote the agricultural and allied activities for more outcomes of the farmers.

- The major Kharif crops grown in the district are paddy, maize and rapeseeds. The alluvial plains along the river is comes under flood-prone areas. The district has been frequently suffered from floods in the monsoon season and damages the crops. Therefore, there is a need for awareness and implementation of the PMFBY scheme (Pradhan Mantri Fasal Bima Yojana) to reduce the losses of the farmers.
- This district has higher scope for Mushroom cultivation and their processing unit could generate more livelihood for the rural people.
- The district is the witness of regular meteorological drought, mainly due to delayed monsoon. Hence, the farmers should follow the proper instructions and guidelines from the

KVK. The agronomic measures like direct seeding of rice, use of organic and bio-fertilizer to increase the water-holding capacity of the soil, implementation of life-saving irrigation, mulching could be adopted by the farmers in drought conditions to minimize the yield reduction.

- High levels of arsenic, fluoride, and saline groundwater have been observed in some parts of the district.
- Flood irrigation is commonly practiced by the farmers, but there is a need to bring more area under micro-irrigation.
- The expansion of new technologies like the implementation of zero tillage, mulching and pressurize irrigation are highly recommended at the drought-prone and heat wave areas.
- The district has shown an increasing trend in fruits and vegetable cultivation, but there is a need for food processing and storage units.
- Sugar mills are one major contributor to the industry sectors, but the productivity of the sugarcane is low. Therefore, there is a scope to scale up the cultivation of sugar cane as a cash crop and increase productivity, which would able to generate more livelihood to the rural people.
- The upland area of the district is highly recommendable for the cultivation of Dragon fruit as a cash crop with the proper irrigation and drainage facilities.
- There is a scope to increase the poly houses to farming horticultural crops, flowers and orchids, those have high market value.
- Most of the farmers of the district follow the KVKs instructions.
- There is a large scope for organic farming, though the government giving monetary help to the farmer, ostensibly there is a need to engage and involve a large number of farmers for training and awareness and benefits of organic farming.
- There is a scope to enhance flower farming.
- Beekeeping would be become a more profitable venture to the farmers, abreast there is need of more training and engagement of the farmers.
- Expansion of the fisheries and applying the latest technology (bioflock) could generate more income for the farmers.

5.2. Forestry

- Saran District is forest deficient area with only 2.24% of forest area.
- The district has some popular tourist places. These places can be focused for afforestation drives.
- The trees in the afforestation drive should be fruit yielding or medicinal and aromatic plants. In this way the locals can earn and increase their livelihood options,
- District has 0% very dense category of forest. These forests are important for carbon sequestration and ecological balance in the local area. Local government should focus on dense groves of native trees to balance the flora and fauna. Agro-forestry and afforestation on barren

and unused government lands, and land adoption to the local people to increase income and to provide the incentives to the guards and government can be the better option.

5.2.1. Biodiversity.

- It is recommended to increase plantation in the district as it has a very low percentage of forest area.

5.3. Tourism

5.4. Wetlands

The wetlands need to be intact, but at the same time, they need to be planned wisely to support the district economically, socially and environmentally, which will lead to indirectly relieving of stress from the Ganga River to a large extent. It will also lower the local people's dependence on the Ganga River for their small-scale industry or basic daily needs. The following recommendation and interventions are required to get valuable products and solve the issues/ challenges faced by the local people of that region.

- Introduction of improved cultivars and production technologies for fishery and poultry
- Diversification through introducing vegetable, mushroom, beekeeping, fruits, medicinal plants, dairy etc for nutritional security
- It is recommended to rejuvenate and restore the water bodies.
- It is recommended develop with flower gardens around the wetlands area and biodiversity by creating a market for selling handicrafts nearby.
- It is recommendation to develop eco-tourism (forest, wetlands and deer)

5.5. Energy

5.5.1. Solar

- Awareness about the policies is the key to have a well-developed solar energy sector in the district.
- Since the district is agriculture dependent, Kusum Yojana best suits the district and should be promoted among the people.
- To achieve the targets under the National Solar Mission, it is important to improve the infrastructure and facilities related to it.

5.5.2. Biomass

- Awareness about the biomass energy is very important. People should be told about the demerits of stubble burning and how can they utilize the agricultural wastes.
- Biomass based gasifier power project and Biomass based Co-Generation Power Project should be popularized in the district.

- The native entrepreneurs should be encouraged of setting up of biomass plants and for this, a well- connected transportation system along with storage centres is important to be constructed.

5.5.3. Biogas

- It is recommended to connect five gaushalas present in the district with the biogas plant.

5.5.4. Hydropower

- It is recommended to identify new small hydropower plants in Gandak river near In blocks Amnour, Dariyapur, Garkha, Isuapur, Maker, Marhaura, Mashrak, Panapur, Parsa and Taraiya.

6. Discussion during the Report Presentation

- Recently a Natural Farming Training has been organized in all the three districts.
- Buxar is adjoined with Patna and hence has a great market for Fruit and Vegetables (Horticulture)
- Organic Farming is being promoted in all the districts and Natural Farming is being taken up.
- The points suggested by Advisor, NMCG about the utilization of the Ashrams was appreciated by the DMs and the opportunity will be explored. The IIML Report for Arth Ganga should be a regular Agenda item for next 6-8 DGC meetings.

- Hon'ble PM during the post-Budget webinar on Tourism had spoken about market potential of destination weddings. It was suggested that suitable Ashrams in Ganga Basin may be identified for such purpose to promote blissful experience, cost reduction, livelihood opportunities and better upkeep.
- Allocate separate space for Namami Gange Awareness and Jalaj Marketing kiosk in Melas/Congregatios/Fairs for providing better marketing opportunities to the Jalaj products.
- As Dilli Haat Centre – Namami Gange Awareness and Marketing Centre – is being launched soon, it was requested that every district to identify niche products with a creative story and link it with Jalaj in their area.
- To identify Arth Ganga Tourist Trails and organize Ganga Guide training
- Promotion of Natural Farming in Ganga Basin and training workshops should be organized on a regular basis. NMCG is supporting this initiative in coordination with MoA& FW and NCOF.
- Make plans for reuse of treated waste water for agriculture, industrial etc. purpose and also the sludge.
- Training of volunteers for Ganga awareness & Aarti workshops to promote regular aartis on Ghats.

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8 APPENDICES

Table 2 Biogas potential from animal waste.

Livestock	Residue type	Total population as of 2012	Manure yield* (kg/day)	Total manure generation annually (kg)	Average collection (75%)	Dry manure after removing	Manure required for	Biogas potential (m^3/yr)

						Moisture content	biogas* (kg/m^3)	
Cattle	Manure	321448	10	1,17,32,85,200	879963900	175992780	25	7039711.2
Buffalo	Manure	187462	15	1,02,63,54,450	769765837.5	153953167.5	25	6158126.7
Sheep	Manure	5001	1	18,25,365	1369023.75	273804.75	25	10952.19
Goat	Manure	187674	1	6,85,01,010	51375757.5	10275151.5	25	411006.06
Pig	Manure	8421	2.5	76,84,163	5763121.875	1152624.375	25	46104.975
Poultry	manure	1,17,480	0.1	42,88,020	3216015	643203	25	25728.12
Total		**8,27,486**						**13691629.25**

Table 3 Biogas potential from agricultural waste.

Crop	**residue type**	**Total crop production (tons) (2017-18)**	**Residue production ratio**	**Residue amount (tons)**	**Average collection (70%)**	**Moisture content**	**Residue amount after removing moisture (tons)**	**Biogas potential [m3/(tons of dry matter)]**	**Overall biogas potential (m3)**
Maize	straw	69934	1.5	104901	73430.7	15	62416.095	800	49932876
Wheat	straw	254663	1.5	381994.5	267396.15	30	187177.305	800	149741844
sugarcane	bagasse	15676	0.33	5173.08	3621.156	80	724.2312	750	543173.4
Total		**340273**							**200217893.4**