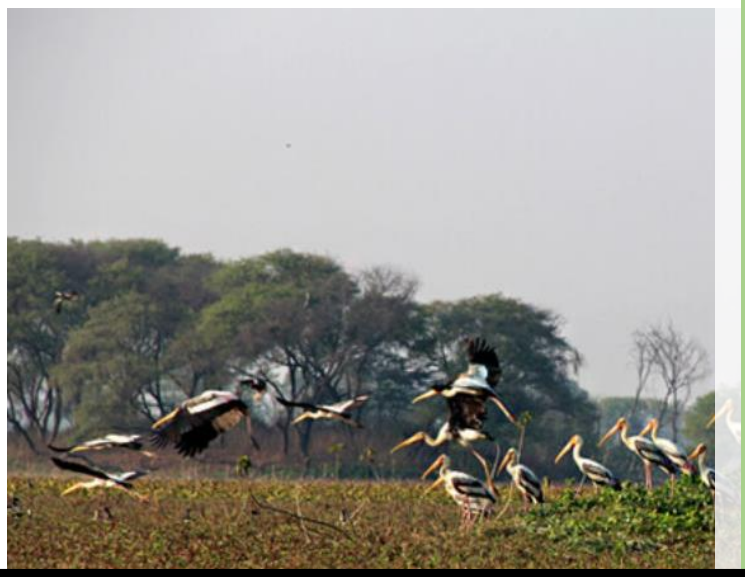

Arth Ganga Project: District Bijnor

Submitted to:

National Mission for Clean Ganga (NMCG)

Submitted by:

IIM Lucknow

IIT Roorkee

JUNE-2022

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EXECUTIVE SUMMARY

Bijnor, in the state of Uttar Pradesh, is a district of spiritual and religious significance that is diverse in the religions but united by humanity. The city well known for mango cultivation is flourished by the rivers Ganga, Baha & Krishna.

The total geographical area of the district is 2249 km^2. The district is dominated by the secondary sector economy with a share of 40.01% in 2018-19. The sector grew with an average annual growth rate of 7.90%. The primary sector grew with an annual growth rate of 4.67% during the study period. The tertiary sector had a growth rate of 7.71% with a share increase to 34.58% in 2018-19.

The total irrigated area stands out to be 28931 ha. The cropping intensity of the district is 154.91%. The net sown increased from 79.21% in 2010-11 to 80.73% in 2017-18. The area for non-agricultural use increased steadily over the period from 8.04% to 8.49%. The share of cultivable wasteland and barren and uncultivable land decreased from 0.41% in 2010-11 to 0.08% in 2017-18, and 0.53% in 2010-11 to 0.19% in 2017-18 respectively. The major crop types are sugarcane, rice, wheat, potato, mustard, urd, oilseed, etc. The total food grains along with pulses account for the production of 390729 MT. Along with these Rabi, vegetables acquire a significant proportion of the area. In 2018-19, the net sown area and pure irrigated were rea were 29781 and 172040 hectares, respectively. The net sown area has slightly increased from 79.21% in 2010-11 to 80.73% in 2017-18. The area for non-agricultural use also increased from 8.04% in 2010-11 to 8.94% in 2017-18. The district's net and gross irrigated areas increased over the years with an average of 94.64% and 88.28%, respectively. Use of the chemical fertilizers has been prominent with the use of nitrogen higher and phosphorus and potassium used in lesser amounts than the prescribed ratio. In 2017-18, the nitrogen share, after declining, became 66.23%, while the phosphorus share increased to 25%, and the potassium share rose to 8.76%. The overall use of chemical fertilizers has reduced in the district from 321.91 kg/ ha GSA in 2010-11 to 220.30 kg/ ha GSA in 2017-18.

The livestock consists of cattle, buffalos, pigs, and sheep; along with poultry and fisheries. The share of livestock increased from 15.16% to 32.79% from 2011-12 to 2018-19. The fishery & aquaculture subsector share grew with a significant average annual growth rate of 94.25% from 2011-12 to 2018-19. Mines and quarrying also recorded a remarkable average annual growth rate of 17.07%.

The total forest cover of the district is 86 km^2. There is no major forest cover in the district. Out of total forest cover, the maximum area is covered by Open Forest (60%) followed by Moderately dense forest (25%). The district has increased forest cover and contribution to GDP up to 2019 with an annual average growth rate of about 20.37%. The share of area under trees and gardens decreased from 0.10% in 2010-11 to 0.05% in 2017-18. The share of forestry and logging is around 2.08% in 2018-19 with a negative average annual growth rate of 3.61%. Bijnor is known for its spiritual significance and is home to some Islamic shrines. In the year 2019, Bijnor received a total of 979353 tourists which has been increasing since 2016 but decreased drastically in 2020 due to COVID-19. There are a variety of places to visit in the district such as Dargah Bhure Shah, Majaar Shah Vilayat Sahib, Vasudev Tirtha temple, etc. The district also holds melas and festival celebrations but the connectivity is mainly through the road.

The main source of lightning is Kerosene (61.13%) followed by electricity (36.82%) whereas the major power source for cooking is cowdung(40.02%) followed by firewood(36.72%). Only 0.99% of households are using solar energy. According to Pugazenthi et. al. 2016, the total solar power potential available in the district is 0.2143. There have been a few installations of solar energy units in the district. A 2 MW biomass energy plant (Industrial waste) at Vam organic, Gajraula, and a biomass gasifier at Insilco Limited, Gajaraula are installed in the district. Electricity consumption in agriculture has increased significantly from 276.72 kWh in 2014-15 to 527.23 kWh in 2019-20, a net increase of approximately 90.53%. The percentage share of the agriculture sector in the total electricity consumption is about 46.37%. The total number of wetlands existing in the district is 542 consisting of both Man-made and Natural. Most of them are small and tanks/lakes/ponds and waterlogged. The district's biodiversity data includes various crop production, livestock population, bird species, and forest cover with 401 bird species and 49 threatened/rare species of bird in the district. Biogas potential from animal waste and agricultural waste was calculated approximately as 2 crores m^3/year and 41 crores m^3/year. No hydropower present or plans exist.

There have been many active measures taken to support and promote sustainable development which shows the government's strenuous efforts to comply with green and clean strategies along with economic development yet lack of monitoring, local participation, expansion of practices, etc. are some of the barriers that are needed to be overcome. The government should maintain historical structures like temples, etc., organize and advertise the festivities like mango festivals, fairs, art and culture, hygienic and well-kept restrooms, and safe drinking water. Thus, practices like agroforestry, drip and sprinkler irrigation, cluster farming, greenhouse farming, organic farming; adopting modern technologies, increasing aromatic and medicinal plantations, enhancing animal husbandry productions, etc. should be taken into consideration. A subsidized crop insurance system must be adopted to protect farmers' livelihood and income. Use of high-yielding seeds, micro-irrigation, constructing and maintaining harvesting structures, and encouraging farmers for adapting different crop cultivation and various irrigation methods. Also, adapting to advanced technologies, proper monitoring, MIS, Geo-tagging, monthly physical and financial reports, maintenance of places and forests, shifting cultivation, promoting bee keeping, floriculture, etc., are a few measures that might be adopted in the district.

1 DISTRICT OVERVIEW

1.1 INTRODUCTION

Bijnor (Jyotibha Phule Nagar) district was created on 15th April, 1997. Before becoming a separate district, it was part of Moradabad district. It is situated between 28º20' and 29º 16' north latitude and 78º4' and 79º6' east longitude. The district has 03 tahsils namely Dhanaura, Bijnor and Hasanpur. Total area of the district is 2249.0 Sq. Km. There are 484 Gram Sabhas and 1123 Revenue villages out of which 959 inhabited villages and 164 uninhabited villages in the district. In urban area there are 8 statutory Towns and 1 Census Towns. River Ganga separates this district from districts Meerut, Ghaziabad and Bulandshahr in the west.

According to 2011 census, total population of the district is 1840221 in which 1381508 live in rural and rest 458713 in urban parts of the district. Out of the total population of the district Bijnor 32.56 percent are workers and rest of 67.44 percent are non-worker. Among workers 24.65 percent are main workers and 7.91 percent are marginal workers of total population. In the district among workers 36.33 percent are cultivators and 36.38 percent are other workers.

The economy of the district is predominantly agricultural as greater part of the working force is engaged as cultivators and agricultural laboures. Kharif and Rabi are the two main harvests grown in the district. Wheat occupies the predominant place followed by paddy both in terms of area and production. Sugarcane is the most important commercial crop in

the district grown. Other main Kharif crops of the district are Arhar, Urd, Moong. After the Kharif harvest, in the middle of September, the fields are prepared for the Rabi crop of which wheat is the most important. It is grown in all tahsils of the district. It is cultivated separately as well as mixed with other crops like barley, Gram, pea and mustard. The harvesting commences in the latter half of March and continues throughout April. The main non-food crops of the district are sugar-cane, oil- seeds, ground- nut, potato, onion, garlic and other vegetables and fruits, sun-hemp and tobacco.

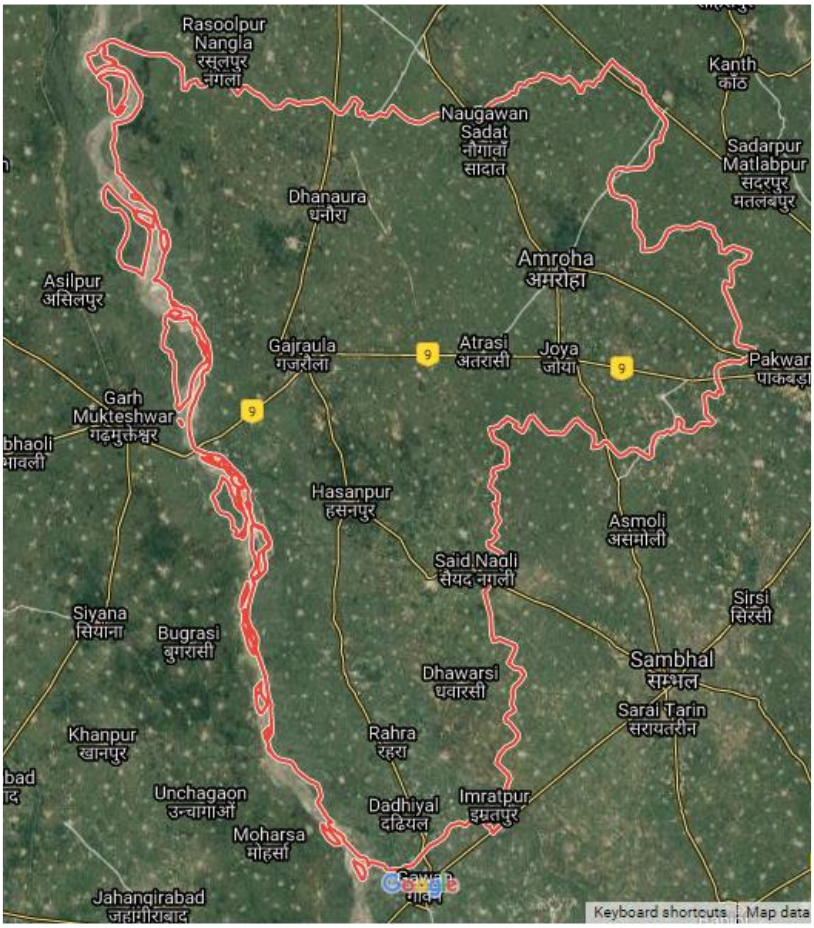


Figure 1 Map of the district

1.2 DEMOGRAPHIC PROFILE OF BIJNOR

1. Economy and Livelihoods

- Geographical Area: 2249 Sq. Km.
- Administrative Divisions:[1]

District Headquarters: Bijnor

[1] https://Bijnor.nic.in/

No of Nagar Palika/Panchayat: 5/4

No of Tehsil: 4

No of Blocks: 6

No. Of Villages: 1133

No. of Gram Panchayat: 601

- Demographic and socio-economic indicators:[2]

  Population: 18,40,221 (Census 2011)

  Population density (Total persons per sq. km): 818

  Sex ratio: 910

  Literacy: 63.8%

- Occupation/ other Livelihood source: Production of Mango, Cotton & Textiles
- Major Rivers: Ganga, Baha & Krishna
- Forest Area: 86 Sq. Km. (ISFR 2019, No major forest

[2] https://www.censusindia.gov.in/2011census/dchb/DCHB_A/09/0906_PART_A_DCHB_JYOTIBA%20PHULE%20NAGAR.pdf

1.3 ECONOMIC PROFILE OF BIJNOR

The primary sector has a significant impact on the district economy because it contributes, on average, 27.15% share to the district GDP. This sector's average annual growth rate from 2011-12 to 2018-19 has been fairly high at 4.67%. However, its share decreased from 29.81% in 2011-12 to 24.85% in 2018-19 because of faster growth of other sectors during the same period. The share of the secondary sector increased from 37.29% in 2011-12 to 40.01% in 2018-19. The sector grew with a significant average annual growth rate of 7.90%. The tertiary sector occupies, on average, 34.58% share of the district economy. Moreover, the sector grew with a remarkable average annual growth rate of 7.71%, with its share increasing from 32.90% in 2011-12 to 35.14% in 2018-19.

Overall, the district economy grew with an average annual growth rate of 6.83%. Although the District. Steps should be taken to further increase the productivity of the primary sector so that it can grow at a higher rate. It will improve the growth rate of the overall district economy and the primary sector. The secondary and tertiary sectors have performed relatively well during the study period.

Table 1: Trends in Gross District Domestic product in Bijnor at Constant Prices (base 2011-12) in Rs Crore

Year	Sector-wise GDDP (Rs, Crore)				Annual Growth Rates			
	Primary	Secondary	Tertiary	Total GDDP	Primary	Secondary	Tertiary	Total
2011-12	2737.80	3424.52	3020.94	9183.26	-	-	-	-
	(29.81)	(37.29)	(32.90)	(100)				
2012-13	2544.24	3565.83	3192.62	9302.69	-7.07	4.13	5.68	1.30
	(27.35)	(38.33)	(34.32)	(100)				
2013-14	2902.15	3740.02	3373.70	10015.87	14.07	4.88	5.67	7.67
	(28.98)	(37.34)	(33.68)	(100)				
2014-15	2544.66	3757.86	3566.65	9869.17	-12.32	0.48	5.72	-1.46
	(25.78)	(38.08)	(36.14)	(100)				
2015-16	3205.18	4249.45	4017.44	11472.07	25.96	13.08	12.64	16.24
	(27.94)	(37.04)	(35.02)	(100)				
2016-17	3214.90	4669.17	4350.93	12235.00	0.30	9.88	8.30	6.65
	(26.28)	(38.16)	(35.56)	(100)				
2017-18	3622.32	5501.82	4684.50	13808.65	12.67	17.83	7.67	12.86
	(26.23)	(39.84)	(33.92)	(100)				
2018-19	3588.15	5776.76	5072.87	14437.78	-0.94	5.00	8.29	4.56
	(24.85)	(40.01)	(35.14)	(100)				
Average Growth Rate					4.67	7.90	7.71	6.83

Source: http://updes.up.nic.in/
Note: Figures in Parentheses are percentage share in the total GDDP

We further break down the primary sector GDP to know which subsector is lagging and which one is driving the primary sector growth. Table 2 shows that agriculture with the horticulture sector grew at a low average annual growth rate of 3.67% from 2011-12 to 2018-19. Moreover, its share decreased from 67.19% in 2011-12 to 64.76% in 2018-19. On the other hand, the share of the livestock

subsector increased from 15.16% to 32.79% in the same period as it grew, with a remarkable average annual growth rate of 18.66%. It shows the importance of livestock in Bijnor District and the increased dependency of citizens on livestock products. The share of forestry and logging in the total agriculture and allied sector is small, around 2.08% in 2018-19, as it grew with a negative average annual growth rate of 3.61%. The fishery & aquaculture subsector share is very minimal, around 0.37% in 2018-19, but it grew with a significant average annual growth rate of 94.25% from 2011-12 to 2018-19. Mines and quarrying also recorded a remarkable average annual growth rate of 17.07%. This high growth in this subsector can have serious environmental issues like deforestation, soil erosion, etc., with long-term effects on the health of local citizens. Overall, the crop sub-sector grew at the lower rate than the livestock, fishery and mining sub-sectors. More work can be done on improving the agriculture, including horticulture sub-sector as it has the vital impact on the rural economy.

Table 2: Gross District Domestic Product Trends from Agriculture and allied activities in Bijnor at Constant Prices (base 2011-12) in Rs. Crore

Year	Agriculture	Livestock	Forestry and Logging	Fishery and Aquaculture	Total Agriculture and allied	Mining and Quarrying	PRIMARY SECTOR
2011-12	1817.87	410.28	476.27	1.27	2705.69	32.11	2737.80
	(67.19)	(15.16)	(17.60)	(0.05)	(100)		
	-	-	-	-	-	-	-
2012-13	1856.83	465.04	184.24	1.32	2507.44	36.80	2544.24
	(74.05)	(18.55)	(7.35)	(0.05)	(100)		
	[2.14]	[13.35]	[-61.32]	[4.45]	[-7.33]	[14.64]	[-7.07]
2013-14	1986.29	486.42	379.23	1.36	2853.30	48.85	2902.15
	(69.61)	(17.05)	(13.29)	(0.05)	(100)		
	[6.97]	[4.60]	[105.84]	[2.94]	[13.79]	[32.74]	[14.07]
2014-15	1897.05	508.03	91.10	1.45	2497.63	47.03	2544.66
	(75.95)	(20.34)	(3.65)	(0.06)	(100)		
	[-4.49]	[4.44]	[-75.98]	[6.86]	[-12.47]	[-3.73]	[-12.32]
2015-16	2118.98	946.49	83.25	1.49	3150.21	54.97	3205.18
	(67.26)	(30.05)	(2.64)	(0.05)	(100)		
	[11.70]	[86.31]	[-8.61]	[2.17]	[26.13]	[16.89]	[25.96]
2016-17	1967.93	1079.84	82.27	1.82	3131.85	83.05	3214.90
	(62.84)	(34.48)	(2.63)	(0.06)	(100)		
	[-7.13]	[14.09]	[-1.18]	[22.25]	[-0.58]	[51.07]	[0.30]
2017-18	2311.59	1035.27	131.91	1.84	3480.60	141.73	3622.32
	(66.41)	(29.74)	(3.79)	(0.05)	(100)		
	[17.46]	[-4.13]	[60.33]	[1.31]	[11.14]	[70.66]	[12.67]
2018-19	2289.66	1159.09	73.37	13.24	3535.36	52.79	3588.15
	(64.76)	(32.79)	(2.08)	(0.37)	(100)		
	[-0.95]	[11.96]	[-44.38]	[619.79]	[1.57]	[-62.75]	[-0.94]
Average Growth Rate	3.67	18.66	-3.61	94.25	4.61	17.07	4.67

Source: Compile from UPDES
Note: 1. Figures in () are percentage share in the total agriculture & allied GDDP
2. Figures in [] are annual growth rates.

Table 3 shows the percentage share of subsectors in secondary and tertiary sectors. Within the secondary sector, the manufacturing sector had a share of approximately 44.94% in 2018-19. The share has decreased over the years as the average annual growth in this sector (7.54%) is less as compared to the growth in other subsectors of the secondary sector. The share of the electricity, gas, and water supplies subsector has increased from 1.92% in 2011-12 to 2.81% in 2018-19. Moreover, this subsector grew with a remarkable average annual growth rate of 14.38%. The share of the construction sub-sector increased from 50.43% to 52.26% in the same period, and the average annual growth rate is significant (8.35%). It indicates that the secondary sector in Bijnor is heavily dependent on the Manufacturing and construction sub-sector, but the electricity subsector is also growing at a faster rate.

Within the tertiary sector, Trade & hotel made up the highest share (31.62%) in 2018-19, followed by the Real estates (24.67%), transport, storage, and communication (13.50%), and financial services (8.85%). Average annual growth is observed highest in transport, storage, and communication (12.24%), followed by Financial services (9.74%), trade & hotel (6.63%), Real Estates 5.92%), and lastly lowest in public administration (3.24%). All the subsectors in the tertiary sector have performed well during the study period. More work needs to be done to improve real estate and public administration subsectors. Trend and hotels, Transport and Communication, and Financial services sub-sectors are the major contributors to the Tertiary sector's growth.

Table 3: Trends in percentage share of non-agriculture sub-sectors in DGDP in Bijnor at Constant Prices (base 2011-12) in Rs Crore

Year	Manufacturing	Electricity, Gas, Water Supply	Construction	SECONDARY SECTOR	Transport, Storage & Communication	Trade and Hotel & Restaurant	Financial Services	Real Estate and Professional Services	Public Administration	Other Services	TERTIARY SECTOR
2011-12	47.65	1.92	50.43	100	10.32	34.55	7.93	27.71	12.39	7.10	100
2012-13	46.22	1.98	51.81	100	10.54	31.00	8.95	28.14	13.72	7.66	100
2013-14	46.41	2.25	51.34	100	10.91	33.84	8.60	27.94	10.47	8.24	100
2014-15	40.28	3.14	56.58	100	12.72	31.53	8.59	28.00	10.19	8.98	100
2015-16	43.17	2.81	54.02	100	13.15	33.35	9.20	25.86	9.33	9.12	100
2016-17	45.58	2.91	51.51	100	15.19	32.38	8.52	24.96	7.60	11.36	100
2017-18	47.37	2.83	49.81	100	14.70	31.75	8.08	25.13	8.28	12.06	100
2018-19	44.94	2.81	52.26	100	13.50	31.62	8.85	24.67	8.68	12.68	100
Average Growth Rate	7.54	14.38	8.35	7.90	12.24	6.63	9.74	5.92	3.24	17.20	7.71

Source: Estimated from statistical handbooks

2. QUANTITATIVE DATA ANALYSIS

2.1 Agriculture and Allied Activities

2.1.1 Trend in Land Use Pattern

The total declared area of the district is 2168.79 sq. km². Forest area represents 9.68% of the total reported area. The share of cultivable wasteland decreased from 0.41% in 2010-11 to 0.08% in 2017-18, which is a good development indicator. Barren and uncultivable land share decreased from 0.53% in 2010-11 to 0.19% in 2017-18. The share of area under trees and gardens decreased from 0.10% in 2010-11 to 0.05% in 2017-18. The current and other fallow land has also decreased over the years, which is good for the district economy. The net sown area (NSA) has slightly increased from 79.21% in 2010-11 to 80.73% in 2017-18. The area for non-agricultural use also increased from 8.04% in 2010-11 to 8.94% in 2017-18 (Table 4). Overall, the land use pattern shows that the fallow and uncultivable land area has decreased while the NSA has increased over the years.

Table 4: Trends in Land-use Pattern in Bijnor (as % of total reported area)

Year	Total Reported Area (ha)	Area under forest	Cultivable wasteland	Current Fallow	Other Fallow	Barren and uncultivable land	Land other than agriculture	Pastureland	Area under trees and gardens	Net Sown Area
1	2	3	4	5	6	7	8	9	10	11
2010-11	216879	9.63	0.41	1.47	0.52	0.53	8.04	0.09	0.10	79.21
2011-12	216879	9.63	0.29	1.08	0.71	0.58	8.28	0.09	0.13	79.22
2012-13	216879	9.68	0.41	1.41	0.52	0.49	8.10	0.09	0.10	79.19
2013-14	216879	9.68	0.33	1.27	0.48	0.49	8.28	0.09	0.09	79.28
2014-15	216879	9.68	0.33	1.25	0.44	0.49	8.49	0.09	0.14	79.09
2015-16	216879	9.68	0.06	0.23	0.11	0.24	8.82	0.09	0.05	80.72
2016-17	216879	9.68	0.08	0.15	0.10	0.19	8.94	0.09	0.05	80.73
2017-18	216879	9.68	0.08	0.15	0.10	0.19	8.94	0.09	0.05	80.73

Source: Compiled from http://updes.up.nic.in/spiderreports/intialisePage.action

2.1.2 Trends in Operational Land Holdings

In Bijnor district, the total number of operational farms increased from 194 thousand in 2010-11 to 205 thousand in 2015-16, a net increase of 5.67%. While in the state, their numbers increased from 23,325 thousand in 2010-11 to 23822 thousand in 2015-16, a net increase of 2.13%. Most land positions in the district are marginal and small. in the state was These two size categories represented around 90.12% in the district in 2015-16, while the corresponding proportion 92.81% (Table 5). The two agricultural censuses of 2010-11 and 2015-16 report no significant change in the percentage share across the various categories of landholdings. Marginal land holdings increased in 2015-16.

Table 5: Distribution of Operational Holdings by Size-categories of farms (in %) in Bijnor							
	Agri, Census	Marginal Holdings (0-1 ha)	Small Holdings (1-2 ha)	Semi-Medium Holdings (2-4 ha)	Medium Holdings (4-10 ha)	Large Holdings (10 & above, ha)	Total Holdings ('000 No.)
Bijnor	2010-11	74.29	15.45	7.83	2.37	0.07	194
	2015-16	75.49	14.63	7.55	2.26	0.06	205
							[5.67]
Uttar Pradesh	2010-11	79.45	13.01	5.72	1.71	0.11	23325
	2015-16	80.18	12.63	5.51	1.58	0.10	23822
							[2.13]
Source: Compiled from Statistical Diary 2018-19, UPDES. Figures in [] are percentage increase/decrease in 2015-16 over 2010-11.							

2.1.3 Trends in Area, Production, and Yield of Principal Crops

2.1.3.1 The Trend in Cropping Patterns

Rice, Wheat, and Sugarcane dominate the agriculture of the district. Table 6 shows the area under various crops over the last eight years. In 2017-18, wheat made up the highest share of GCA (33.44%), followed by Rice (8.63%). These two crops constitute around 42.08% of the GCA. The area shared by the total cereals has decreased from 48.84% in 2010-11 to 44.10% in 2017-18. The main pulse produced is Urad, while the rest of the pulses are not significantly produced. The total pulse acreage has decreased from 1.40% in 2010-11 to 1.24% in 2017-18. Thus, the food grains cover a majority (average, 47.58%) of the GCA. Mustard is the only major oilseeds crop produced, and the total oilseed acreage has increased from 1.04% in 2010-11 to 1.05% in 2017-18. The area under Sugarcane has decreased slightly over the years, but at the same time, the area under Potato has increased. Three water guzzling crops—Sugarcane, Rice and Wheat together constituted about 70% of GCA. In general, there is no significant change in cropping pattern, except that the NSA decreased from 65.80% in 2010-11 to 62.50% in 2017-18. The average cropping intensity is 154.91.

Table 6: Trends in Cropping Pattern (as % GSA) and Cropping Intensity in Bijnor								
Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	10.75	9.51	10.25	8.98	9.22	8.64	8.63	8.63
Wheat	36.05	36.17	35.05	35.27	35.70	33.47	33.44	33.44
Bajara	1.22	1.56	1.26	1.56	1.54	1.44	1.44	1.44
Other Cereals	0.82	0.62	0.86	0.64	0.62	0.59	0.59	0.59
Total Cereals	48.84	47.86	47.42	46.45	47.08	44.14	44.10	44.10
Urad	1.19	1.26	1.11	1.23	1.19	1.12	1.12	1.12
Other Pulses	0.21	0.16	0.25	0.18	0.13	0.12	0.12	0.12
Total Pulses	1.40	1.43	1.36	1.41	1.32	1.24	1.24	1.24
Total Foodgrains	50.24	49.29	48.79	47.86	48.40	45.37	45.34	45.34
Mustard	1.03	1.04	1.15	1.19	1.08	1.01	1.01	1.01
Total Oilseeds	1.04	1.05	1.15	1.19	1.12	1.05	1.05	1.05

Sugarcane	28.15	29.57	28.91	29.74	29.64	27.79	27.76	27.76
Potato	1.15	1.19	1.21	1.17	1.23	1.16	1.16	1.16
Net Sown Area	65.80	66.30	65.36	66.40	65.36	62.54	62.50	62.50
Gross Sown Area (in 1000 Ha)	261.07	259.16	262.76	258.98	262.43	279.92	280.14	280.14
Cropping Intensity	151.98	150.83	152.99	150.61	153.00	159.90	160.0	160.0
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

2.1.3.2 Trends in Per Hectare Yield of Principal Crops

Table 7 shows that the yield per hectare of most crops varies across years. However, the yield for most of the major crops has increased in the latter years of the study. It can be due to improved irrigation facilities and the availability of better infrastructure. Wheat and Rice are the major crops in the district, and their per hectare yield (35.62 qtls and 19.61 qtls respectively, in 2017-18) are also high. Per hectare yield of total cereals has increased from 28.10 qtls in 2010-11 to 31.44 qtls in 2017-18. On the other hand, per hectare yield of total pulses decreased from 8.41 qtls in 2010-11 to 6.74 qtls in 2017-18.

The yield of total oilseeds has increased from 11.02 qtls in 2010-11 to 14.95 qtls in 2017-18. It can be due to the availability of hybrid seeds in the district. However, the rise in the yield of most of the crops is not uniform. In some years, it has decreased as well, but on average, the yield has increased in the latter years of the study. The per hectare yield of Sugarcane is, on average, 698.11qtls/ha. Similarly, the yield of Potato is also very high, average, 219.56. Since both Sugarcane and Potato are high-value crops, they can help in doubling the income of farmers if proper marketing and infrastructure support is provided to the farmers. In summary, all crop yields show year-over-year fluctuations, with the lowest in 2014-15. The lack of homogeneity of yields makes farmers' income riskier and more unstable, requiring a solid insurance protection measure.

Table 7: Trends in Per Hectare Yield of Principal Crops in Bijnor District (Qtls.)

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	18.95	20.46	18.37	21.35	22.62	22.16	22.70	19.61
Wheat	31.90	31.70	32.40	32.67	21.04	29.23	34.74	35.62
bajara	7.74	8.35	6.83	6.78	10.36	13.00	7.92	7.30
Maize	10.94	14.64	9.59	13.02	14.87	20.75	29.81	25.49
Total Cereal	28.10	28.49	28.28	29.34	20.92	27.20	31.46	31.44
Urad	8.53	7.62	8.92	8.00	8.39	6.57	8.38	5.62
Total Pulses	8.41	7.74	8.91	8.21	8.20	6.86	9.82	6.74
Total Food Grains	27.55	27.89	27.74	28.72	20.57	26.64	30.87	30.76
Mustard	11.06	8.31	11.50	11.76	10.41	14.88	11.01	15.52
Total Oilseeds	11.02	8.28	11.50	11.75	10.10	14.43	10.61	14.95
Sugarcane	630.00	609.36	642.48	696.76	705.36	696.79	739.00	865.14
Potato	173.55	190.00	148.80	220.24	174.30	248.15	291.21	310.23
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

2.1.3.3 Trends in Production of Principal Crops

Table 8 shows the trends in the production of the main crops over the years. Rice, Wheat, Sugarcane, and Potato dominate the production. In 2017-18, Rice (47.42 thousand tons) and Wheat (333.76

thousand tons) formed a major part of the total cereal production (388.40 thousand tons). Coming to pulses, Urad occupied the highest production (1.76 thousand tons) in 2017-18. Although there has been a significant variation in its production across years, it still represents around 75% of the total pulse production. Pulses production in the district was relatively low, indicating that pulses are not an essential part of the district's agriculture.

Mustard production was 4.40 thousand tons, representing around 100% of the total oilseed production in 2017-18. Sugarcane is another essential crop whose production has been significant in the district (6729.12 thousand tons in 2017-18). Potato production has also been significant over the years (100.54 thousand tons in 2017-18). Looking at the annual production data of various crops, we find that their production has increased, on average, during the period, but at the same time fluctuates year to year, partly due to weather changes and partly due to market conditions. Proper insurance arrangements are the need of the hour to get assured income and take more risk and diversify their production.

Table 8: Trends in Production of Principal Crops in Bijnor District (in 1000 Tons)

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	53.19	50.45	49.47	49.65	54.70	53.59	54.90	47.42
Wheat	300.24	297.15	298.36	298.42	197.10	273.87	325.48	333.76
Bajara	2.46	3.38	2.27	2.74	4.18	5.25	3.20	2.94
Other Cereals	2.37	2.38	2.25	2.22	2.48	3.34	5.11	4.27
Total Cereals	358.26	353.36	352.34	353.02	258.46	336.04	388.69	388.40
Urad	2.65	2.50	2.61	2.55	2.62	2.05	2.62	1.76
Other Pulses	0.43	0.36	0.58	0.44	0.22	0.32	0.78	0.58
Total Pulses	3.08	2.86	3.19	2.99	2.84	2.37	3.40	2.33
Total Foodgrains	361.34	356.22	355.54	356.01	261.30	338.42	392.09	390.73
Mustard	2.98	2.25	3.47	3.63	2.95	4.22	3.12	4.40
Total Oilseeds	2.99	2.26	3.47	3.63	2.97	4.25	3.12	4.40
Sugarcane	4629.11	4669.40	4880.02	5367.21	5486.36	5419.67	5748.04	6729.12
Potato	52.01	58.67	47.45	66.91	56.49	80.43	94.38	100.54

Source: http://updes.up.nic.in/spiderreports/intialisePage.action

2.1.3.4 Variability assessment in the area, production, and yield

To understand the variability across the years (Table 9), we calculated the mean, standard deviation (SD), and coefficient of variation (COV) in the area, production, and yield of the main crops. Among different crops, the lowest variability in the area is observed in Wheat (1.05%), followed by Sugarcane (1.95%) and Urad (3.11%), and the highest in Bajra (9.57%). The variability in the area under total pulses (2.89%) is more than the variability in the area under total cereals (1.58%). Since Rice and Wheat dominate the production, the variability in the area under total food grains is, therefore, also relatively low (1.55%).

Table 9: Variability in Area, Production, and Yield of Principal Crops (2010-11 to 2017-18)									
Crop/Year	Area (1000 Ha)			Production (1000 Ha)			Yield (Qty. /Ha)		
	Average	SD	COV	Average	SD	COV	Average	SD	COV
Rice	24.96	1.65	6.60	51.67	2.78	5.38	20.78	1.69	8.12
Wheat	93.26	0.98	1.05	290.55	42.02	14.46	31.16	4.53	14.53
bajara	3.84	0.37	9.57	3.30	0.99	29.83	8.54	2.13	25.00
Total Cereal	123.83	1.96	1.58	348.57	40.75	11.69	28.15	3.31	11.74
Urad	3.12	0.10	3.11	2.42	0.33	13.71	7.75	1.12	14.48
Total Pulses	3.55	0.10	2.89	2.88	0.37	12.95	8.11	1.02	12.55
Total Food Grains	127.38	1.98	1.55	351.45	40.80	11.61	27.59	3.22	11.65
Mustard	2.85	0.14	4.78	3.38	0.71	20.95	11.81	2.35	19.91
Total Oilseeds	2.91	0.13	4.51	3.39	0.71	20.91	11.58	2.20	19.00
Sugarcane	76.78	1.50	1.95	5366.12	685.13	12.77	698.11	80.39	11.52
Potato	3.16	0.10	3.25	69.61	19.95	28.67	219.56	58.82	26.79
Source: http://updes.up.nic.in/spiderreports/intialisePage.action									

The variability of production depends on the variability of the cultivated area and the variability of the yield. Therefore, the variability in the production of different crops is greater than in the cultivated area of all crops. The highest variability in production is observed in Bajra (29.83%), followed by Potato (28.67%), Mustard (20.95%), Wheat (14.46%), and Urad (13.71%). High variation in the production of pulses and oilseeds is partly due to variation in the land area under them and partly due to non-availability of hybrid seeds. Improvement in crop insurance conditions and better market accessibility can lower this variation. Variability is lowest in Rice (5.38%), followed by Sugarcane (12.77%) and Urad (13.71%).

In the case of yield, the greatest variability is estimated in Potato (26.01%), Bajra (24.67%), and Mustard (19.73%). Yield variability in total cereals (11.74%) and total food grains (11.65%) is lower as compared the total pulses (12.62%). Rice, Wheat, and Sugarcane are the most consistent crops over the years. Several factors, such as climate change, market prices, rainfall patterns, etc., influence the variability in agricultural production.

2.1.4 Trends in Value of Product of Major Crops

Table 10 compares the share of the main crops in the total GCA and their share in the total value of agricultural output (VOP). It is significant to note that total cereals, total foodgrains, and total oilseeds, on average, have a relatively larger share in GCA than their share in VOP. In contrast, Potato and Sugarcane have, on average, a greater share in VOP than GCA. Bijnor is mainly a food grain production district; therefore, food grains account for around 47.58% of the gross area of the crops. Similarly, total foodgrains account for nearly 29.91% of the total value of the agricultural product. Three crops - Wheat, Rice, and Sugarcane together accounted for, on average, around 73% of GCA and 94% of the total VOP. Overall, the total agricultural GCA has increased in the latter years of the study (average, 268.07 thousand hectares), and the total value of the product has also increased significantly, that is, 1501.38 Cr. Rs. in 2010-11 to 3091.69 Cr. Rs in 2017-18.

Table 10: Share of Principal crops Total GCA and Total Value of agriculture products in Bijnor									
Crop	**% Share in**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
Wheat	GCA	36.05	36.17	35.05	35.27	35.70	33.47	33.44	33.44
	VOP	23.00	26.41	21.32	21.39	15.62	21.76	23.67	20.08
Paddy	GCA	10.75	9.51	10.25	8.98	9.22	8.64	8.63	8.63
	VOP	7.08	7.83	8.15	5.64	6.31	7.27	6.79	5.38
Total Cereals	GCA	48.84	47.86	47.42	46.45	47.08	44.14	44.10	44.10
	VOP	30.51	34.77	29.82	27.36	22.47	29.87	31.03	25.91
Total Pulses	GCA	1.40	1.43	1.36	1.41	1.32	1.24	1.24	1.24
	VOP	1.20	1.05	0.99	0.91	1.21	0.82	0.80	0.52
Total Food Grains	GCA	50.24	49.29	48.79	47.86	48.40	45.37	45.34	45.34
	VOP	31.71	35.82	30.81	28.27	23.68	30.68	31.84	26.43
Total Oilseeds	GCA	1.04	1.05	1.15	1.19	1.12	1.05	1.05	1.05
	VOP	0.60	0.46	0.61	0.55	0.50	0.69	0.96	1.32
Potato	GCA	1.15	1.19	1.21	1.17	1.23	1.16	1.16	1.16
	VOP	2.94	3.33	3.18	4.89	2.03	3.23	2.40	4.75
Sugarcane	GCA	28.15	29.57	28.91	29.74	29.64	27.79	27.76	27.76
	VOP	64.75	60.39	65.40	66.28	73.78	65.39	64.80	67.47
Paddy + wheat + sugarcane	GCA	74.95	75.25	74.21	73.99	74.56	69.9	69.83	69.83
	VOP	94.83	94.63	94.87	93.31	95.71	94.43	89.15	92.93
Total Agriculture	GCA (1000 Ha)	261.07	259.16	262.76	258.98	262.43	279.92	280.14	280.14
	VOP (in Cr Rs)	1501.38	1623.64	2014.80	2348.28	2081.98	2486.29	2749.97	3091.69
Per Worker VOP (Rs.1000 at current prices) in **Bijnor**		-	65.52	80.21	86.51	72.73	90.48	97.78	114.33
Per Worker VOP (Rs.1000 at current prices) in **UP**		-	40.66	48.69	52.5	52.11	56.48	61.97	69.69
Source: http://updes.up.nic.in/spiderreports/intialisePage.action And District-wise Indicator reports									

Table 10 shows that the total value of agricultural produce per agricultural worker in Bijnor district increased from Rs.65.52 thousand in 2011-12 to Rs.114.33 thousand in 2017-18, a net increase of 74.50% at current prices, while in UP it increases from Rs. 40.66 thousand to Rs.69.69 thousand, a net increase of 71.40%. Thus, the total value of agricultural output per worker is much higher in the district than in the state. The growth rate per worker value of output in the district is more than in the state. The ratio of per worker value of the district's output to the state average has increased from 1.6113 in 2011-12 to 1.6405 in 2017-18.

2.1.5 Consumption of Chemical Fertilizers

Table 11 shows the trends in the use of chemical fertilizers in agriculture. The recommended nitrogen to phosphorus and potassium ratio is 4:2:1, which is not maintained in the district. For example, in 2010-11, nitrogen represented 77.93% of the total fertilizers used, while the Sproportions of phosphorus and potassium were 15.84% and 6.23%, respectively. In 2017-18, however, the nitrogen share increased to 78.13%, while the phosphorus share increased to 17.35%, and the potassium share decreased to 4.52%. The use of nitrogen is more than the recommended ratio, while the phosphorous and potassium ratio is less than the recommended ratio. The table also shows that fertilizer consumption varies across years, which can be due to several factors, including rainfall patterns and cultivation patterns, etc. The overall use of chemical fertilizers has decreased in the district from 251.64 kg/ ha GSA in 2010-11 to 146.78 kg/ ha GSA in 2017-18, which is a good sign. However, the authorities still need to take steps to reduce their consumption further as the chemicalization of agriculture degrades soils and water resources, requiring the use of organic fertilizers and biofertilizers.

Table 11: Trends in Use of Chemical Fertilizers in Agriculture (Kgs/per ha GSA) in Bijnor

Fertilizer/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Nitrogen	196.10	161.70	157.25	148.04	127.67	108.61	109.11	114.67
Phosphorous	39.85	36.07	41.22	40.71	37.14	40.75	43.29	25.47
Potassium	15.69	6.24	5.48	14.58	7.67	7.65	8.86	6.64
Total	251.64	204.01	203.95	203.33	172.49	157.01	161.27	146.78
Gross Sown Area (Ha)	261068	259156	262758	258977	262432	279920	280143	280143

Source: http://updes.up.nic.in/spiderreports/intialisePage.action

2.1.6 Irrigation Structure and Status

2.1.6.1 Types of Irrigation systems

The types of irrigation systems and the percentage of the net and gross irrigated area to the net and gross cropped area, respectively, are described in Table 12. The length of the canal has remained constant (53 km) over the years. Government tube wells increased from 288 in 2010-11 to 308 in 2018-19. Shallow, medium, and deep tube wells increased by 1.06%, 121.62%, and 34.29%, respectively, in 2018-19 compared to 2010-11. The district's percentage of the net and gross irrigated areas have increased over the years with an average of 94.64% and 88.28%, respectively.

Table 12: Types of Irrigation Systems and percentage of the net and gross Irrigated Area

Name/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Length of Canal (KM)	53	53	53	53	53	53	53	53	53
No. of Govt. Tube wells	288	294	294	136	136	136	136	134	308
Shallow Tube well	71497	71712	71949	72107	72171	72171	72236	72256	72256
Medium Tube well	370	488	591	641	725	725	725	820	820
Deep Tube well	277	321	349	357	364	364	371	372	372
% Of NIA	65.12	99.29	99.33	99.32	99.24	98.27	98.27	98.27	-
% Of GIA	88.32	88.69	88.47	89.40	89.38	87.31	87.33	87.33	-

Source: http://updes.up.nic.in/spiderreports/intialisePage.action

2.1.6.2 Source-wise Area under Irrigation

Groundwater is the main source of irrigation in the district. The share of wells and tube wells (GW) in NIA (average, 99.98%) has increased over the years. This shows the increased dependency of the district on the groundwater for irrigation purposes, and it can have serious environmental issues if such a pattern continues in the long run.

Table 13: Source-wise Area under Irrigation in Bijnor (in %)

Source/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Wells And Tube-wells (GW Irri.)	99.98	100	100	100	100	99.94	99.96	99.96
NIA (1000 ha)	111.86	170.59	170.60	170.78	170.22	172.04	172.07	172.07

Source: http://updes.up.nic.in/spiderreports/intialisePage.action

2.1.6.3 Crop wise irrigated area

Table 14 shows that a majority area under Rice (average, 99.95%), wheat (average, 100%), total oilseeds (average, 98.34%), Potato (average, 100%), and Sugarcane (average, 100%) is irrigated. Percentage of the irrigated area under pulses (average, 34.46%) are relatively less

Table 14: Trends in Crop-wise Irrigated Area in Bijnor (as % of the cropped area)

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	100	100	99.63	100	100	100	100	100
Wheat	100	100	100	100	100	100	100	100
Total Cereal	97.54	96.95	97.25	96.85	96.94	96.94	96.94	96.94
Total Pulses	29.92	34.43	32.92	33.19	36.30	36.30	36.30	36.30
Total Foodgrains	95.65	95.14	95.45	94.98	95.28	95.28	95.28	95.28
Total Oilseeds	99.74	99.49	100	99.94	98.44	96.36	96.36	96.36
Sugarcane	100	100	100	100	100	100	100	100
Potato	100	100	100	100	100	100	100	100

Source: Compiled from Statistical Abstract, Uttar Pradesh

2.1.7 Electricity consumption in Agriculture

Electricity is one of the main energy sources used in agriculture. Table 15 shows that per capita electricity consumption in agriculture has increased significantly from 276.72 KWH in 2014-15 to 527.23 KWH in 2019-20, a net increase of approximately 90.53%. This is a cause of concern as this can result in an increased burden on non-renewable resources and create waste disposal problems. The percentage share of the agriculture sector (average, 46.37%) in the total electricity consumption in the district is quite significant. It indicates the heavy usage of electricity by agricultural farmers. Since electricity consumption has increased over the years, the authorities need to switch to more sustainable modes of electricity production, such as solar energy.

Table 15: Trends of Electricity consumption in Agriculture in Bijnor						
Division/ Year	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**
Per Capita electricity consumption (KWH)	276.72	230.33	453.47	532.91	511.5	527.23
% Of electricity consumed in Agriculture sector to total consumption	46.99	45.25	42.68	45.51	45.96	51.85
Source: District-wise Development Indicators file.						

2.1.8 Status of Agriculture Market

Table 16 shows the marketing infrastructure in the district. It has three main markets and three sub-markets. The number of regulated mandis per lakh hectare of NSA has decreased from 3.49 in 2013-14 to 3.43 in 2018-19, which is a cause of concern as it is very important to increase the number of regulated mandis so that farmers can sell their products efficiently.

Table 16: Status of Agriculture Markets in Bijnor							
Category/Year	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**
Main Markets (No.)	3	3	3	3	3	3	3
Sub Markets (No.)	3	3	3	3	3	3	3
Total Markets (No.)	6	6	6	6	6	6	6
No. of Regulated mandis per lakh Ha. of net area sown	3.49	2.77	0	1.75	1.71	3.43	-
Source: Compiled from Statistical Abstract, Uttar Pradesh and District-wise Development Indicators file.							

2.1.9 Status of Organic Farming

To promote sustainable agricultural practices and improve the farmers' livelihood, the Government of India launched PKVY and Namami Gange schemes. Under these schemes, farmers are incentivized to form groups to do organic farming and sell their products with PGS certification. Under the programme, the beneficiary farmers get Rs.12000, Rs. 10000 and Rs.9000 per hectare, respectively, in the first, second, and third year of conversion.

The transition period for the full conversion from conventional to organic is considered three years. During this period, crop yield, on average, is expected to decline by 10—15 percent. But after three years, it may reach its original level. Financial assistance received by the beneficiary farmers seems to be adequate to compensate for the yield losses and motivate them to do organic farming. There is a need to set up an integrated processing unit for organic products. Monitoring of the project should be periodically done through MIS, Geo-tagging, and monthly physical and financial reports.

However, the policy-related issue is what would be after the three years? Will the government protect their income? There may be a possibility that the beneficiary farmers may revert to conventional farming in the absence of the regulatory framework. In this context, two things need to be thought of—a well-designed regulatory and monitoring framework and introduction of payments

for ecosystem services for the organic farmers after the transition period to carry on the activity on a sustainable basis. Organic and zero-budget farming will provide ecological services in terms of soil health, human and animal health, saving of water, protection bio-diversity, etc. To sustain the organic farming initiative, a long-term system of payments for ecological services may be evolved to retain the existing farmers and motivate others to move towards this sustainable farming system. There is no assured market for these products, and farmers do not get premium prices. They sell their products at the same prices their conventional counterparts do. Certification and quality check and monitoring mechanisms are yet to be set up.

Table 17 shows the details of the establishment of organic clusters under the Paramparagat Krishi Vikas Yojana in the district. The district has three groups in two development blocks. The highest number of groups are in Hasanpur (2), followed by Gajrola (1). It is reported that the maximum limit of land under a cluster per farmer is 2.00 hectares. Hence, the majority of the beneficiary farmers are small and marginal. It is very important for the authorities to incentivize the farmers to establish more organic farming groups in the district.

Table 17: Status of Organic Farming PGS Groups under PKVY and Namami Gange Schemes in Bijnor (as on June 30, 2021)

S. No.	Block	Scheme	No. of groups	No. of farmers in groups			
				Total	Average	Median	SD
1	Gajrola	PKVY	1	50	50	50	0
2	Hasanpur	PKVY	2	100	50	50	0
3	District Total	PKVY	3	150	50	50	0
		Total	3	150	50	50	0

Source: Compiled from https://pgsindia-ncof.gov.in/

Since per hectare use of chemical fertilizer is quite high in district agriculture, a gradual shift of farmers from conventional to the organic farming system is likely to positively impact water quality and soil health along with farming sustainability. However, being a knowledge-intensive system of farming, farmers need proper training to know the practical details of the integrated sustainable farming system. Since economies of scale in both production and marketing matter in organic farming, some institutional framework may be needed in the forms of SHGs/ farm cooperative/PFOs/contract farming, etc. Organic farming could be an economically viable option in the district if the government builds strong marketing networks linking farmers, processors, and distributors with the easy certification process and minimizes farmers' risk by protecting their farm income through payments of ecosystem services. A long-term system of incentive and regulation needs to be evolved to retain the existing farmers and motivate others to move towards the sustainable farming system in the district.

The major problem for the growth of organic farming observed are:

1. The major problem of the farmers was poor marketing of the organic products and not being able to fetch a premium.
2. Scaling up organic production is another problem. The problem of marketing is even more serious in the case of perishable vegetable crops. Contract farming companies and Farmer Producers' companies can be encouraged.

3. To get the scheme's benefit, farmers generally practice organic farming only on a small part of their land (less than one ha).
4. Although organic farming clusters are formed, the farmers allocated a part of their lands to organic farming and practiced conventional farming in the rest of the area, which may contaminate the organic produce and fail the purpose of the cluster approach in organic farming.
5. According to the farmers, implementing policies initiated to promote organic farming in the area is not very efficient as the inspection is not conducted regularly, and the farmers did not receive subsidies in time under the scheme.
6. The knowledge and awareness level regarding practices under organic farming was inadequate among farmers.

2.1.10 Livestock Sector

2.1.10.1 Trends in Livestock Population

Livestock forms an integrated part of the rural economy. From Table 18, we can infer that indigenous male cattle decreased considerably from 86533 in 1997 to 20339 in 2019, but the exotic male cattle has increased from 5206 in 1997 to 15436 in 2019. On the other hand, indigenous and exotic female cattle increased considerably from 84026 in 1997 to 93113 in 2019 and 8711 in 1997 to 87761 in 2019. Thus, the total number of cattle increased from 184475 in 1997 to 216649 in 2019, thus, a net increase of 17.44%. Similar inferences can be drawn from the buffalo data as the number of male buffalo decreased, but the number of female buffalo increased; thus, a net increase of 51.35% in 2019 compared to that in 1997 is observed in the total population of buffalo. A significant reduction in the indigenous sheep population is observed (49.97%) in 2019 compared to that in 1997. During the same period, the population of exotic sheep also decreased, thus, indicating a decrease in the total sheep population by 53.68%. The total population of goats increased from 71913 in 1997 to 75742 in 2019, a net increase of 5.32%. The total pig population decreased considerably from 15165 in 1997 to 1736 in 2019.

It is significant to note that the number of female cattle and buffaloes has substantially increased over the period, indicating the growth of livestock products, including milk. The substantial decline in the number of male cattle and male buffaloes also shows the rising farm mechanization and declining relevance of animal power, mainly because of the high maintenance cost of livestock. The livestock subsector has around 24.77% share in the agriculture and allied activities sector and grew at a significant average annual growth rate of 18.66% from 2011-12 to 2018-19.

Table 18: Trends in Livestock population (in numbers) Bijnor

	Category	1997	2003	2007	2012	2019
Indigenous Cattle	Total Male	86533	64888	49860	40204	20339
	Total Female	84026	32837	61588	52191	93113
	Total	170558	97725	111448	92395	113452
Exotic Cattle	Total Male	5206	7357	6295	19204	15436
	Total Female	8711	13319	12390	37904	87761
	Total	13917	20676	18685	57108	103197

Total Cattle		184475	118401	130133	149502	216649
Buffalo	Total Male	93459	135337	102942	203323	75752
	Total Female	246517	155593	268071	454622	438795
	Total	339976	290930	371013	657945	514547
Sheep	Total Indigenous Sheep	1951	2189	2249	1444	976
	Total Exotic Sheep	372	0	0	36	100
	Total Sheep	2323	2189	2249	1480	1076
Goat	Total	71913	58592	56222	74252	75742
Pig	Total Indigenous Pig	13849	9669	8934	6301	1479
	Total Exotic Pig	1316	1225	1038	417	257
	Total Pig	15165	10894	9972	6718	1736
Total Livestock		667025	484579	571738	891994	-
Total Poultry		117102	78865	77813	134227	-
Source: http://updes.up.nic.in/spiderreports/intialisePage.action And http://dahd.nic.in/animal-husbandry-statistics						

2.1.10.2 Cattle Care Centre

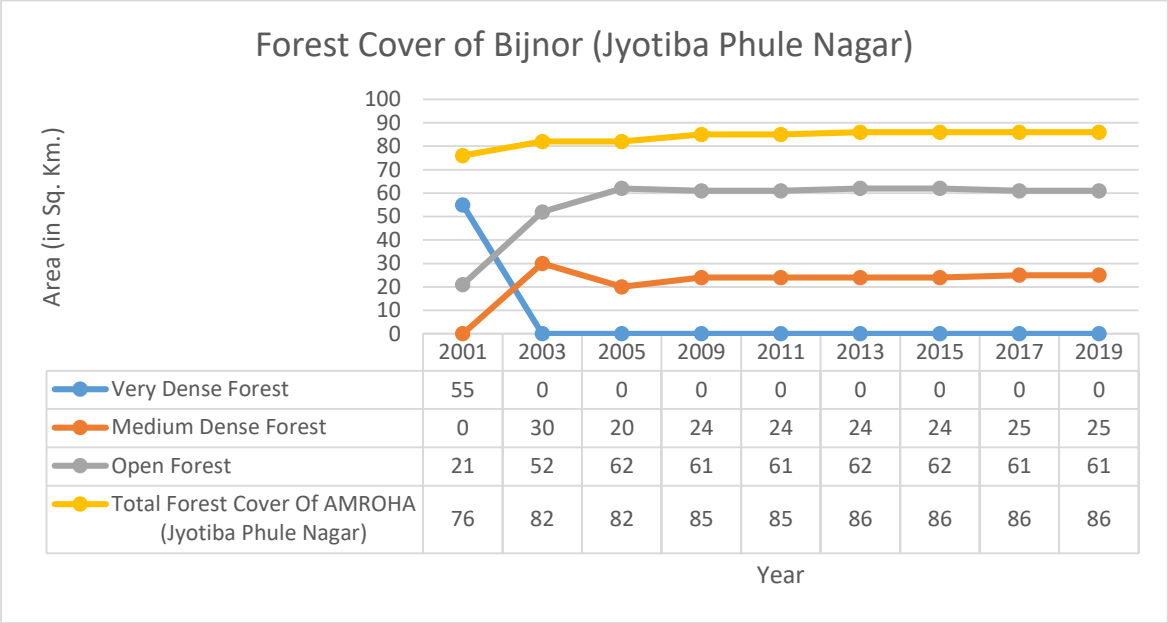
Table 19 shows that the Bijnor district has an active network of cattle hospitals and development centres, which are necessary for the livestock sub-sector to grow. The number of cattle hospitals has increased from 20 in 2010-11 to 21 in 2018-19. The number of cattle development centres (40) has remained constant over the years. The number of man-made reproduction centres increased from 63 in 2010-11 to 65 in 2018-19. There are very few sheep (6) and pig (3) development centres which might be one reason for the declining sheep and pig population in the district.

Table 19: Year-wise number of Cattle Hospitals and Development Centers

Category	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Cattle Hospital	20	20	20	20	20	20	20	21	21
D- category Cattle Dispensary	3	3	3	3	3	3	3	3	3
Cattle Development Centre	40	40	40	40	40	40	40	40	40
Man-Made Reproduction Centre	63	63	63	63	63	63	63	64	65
Sheep Development Centre	6	6	6	6	6	6	6	6	6
Pig Development Centre	3	3	3	3	3	3	3	3	3
Source: http://updes.up.nic.in/spiderreports/intialisePage.action									

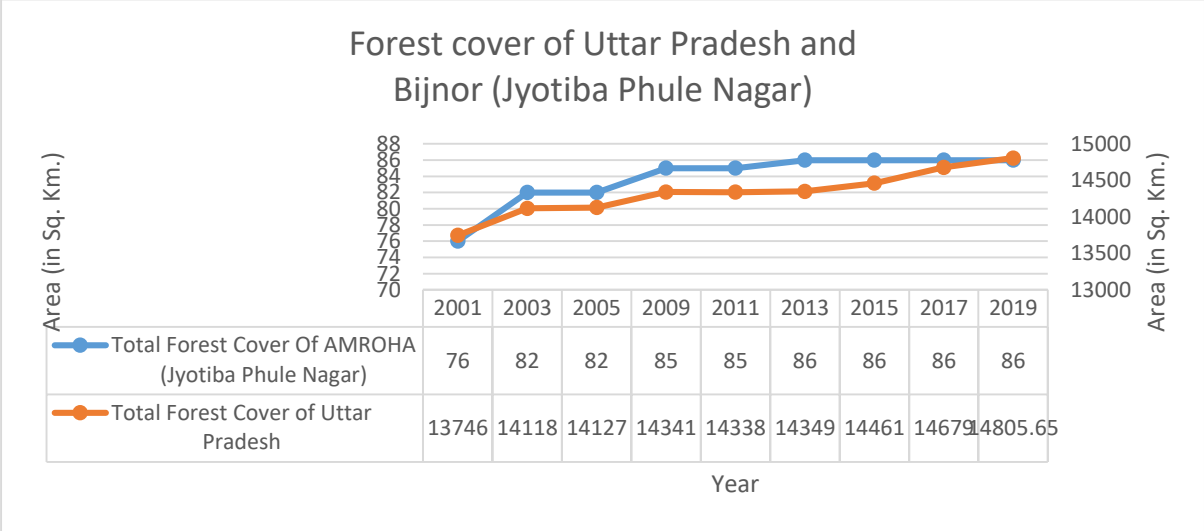
2.2 Forestry

Baseline Data Analysis/ Quantitative Data Analysis



	2001	2003	2005	2009	2011	2013	2015	2017	2019
Very Dense Forest	55	0	0	0	0	0	0	0	0
Medium Dense Forest	0	30	20	24	24	24	24	25	25
Open Forest	21	52	62	61	61	62	62	61	61
Total Forest Cover Of AMROHA (Jyotiba Phule Nagar)	76	82	82	85	85	86	86	86	86

According to FSI reports, over the years the forest cover of Bijnor has increased, and as per the latest assessment, the forest cover is Bijnor is 86 SQ. Km. Majorly. Open forest followed by medium dense forest are found in the district.



	2001	2003	2005	2009	2011	2013	2015	2017	2019
Total Forest Cover Of AMROHA (Jyotiba Phule Nagar)	76	82	82	85	85	86	86	86	86
Total Forest Cover of Uttar Pradesh	13746	14118	14127	14341	14338	14349	14461	14679	14805.65

According to the FSI assessment, the forest cover of the state Uttar Pradesh has increased significantly, but the forest cover of Bijnor district has also increased, but at a slower pace.

In July 2019, government of Uttar Pradesh taken the initiative to plant 22 crore saplings. The Forest Department involved the farmers as stakeholders to plant seedlings in their fields. Farmers are expected to sow quality planting material such as clonal plants, which are not

available in the UP forest department nurseries. There is also the need to have minimum support price (MSP) for the timber produced by farmers with buy-back arrangement. This in turn will motivate them to plant more trees, which would benefit the economy as well as the environment.[3]

in the district. There is a wide scope of Afforestation on waste land, trees outside forest (on the sides of the roads, banks of river etc.) and scrub area. Government can promote the afforestation, agroforestry activities by providing output based incentives.

2.2.1 Biodiversity

The district's biodiversity data includes various crop production, livestock population, bird species, and forest cover. The crop production trend shows a grain and potato crop reduction but increases in all other crops. Forest data shows that forest cover was increased by 1.61 % in 2019. A study of freshwater fish fauna in the district indicates that there are 36 fish species in the river, reservoir, and pond of the district*.

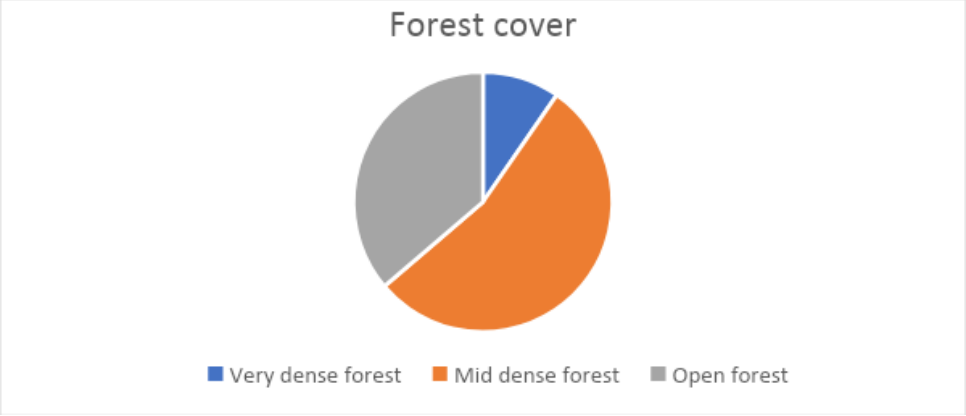
**Nagma and M Afzal Khan, "Studies on Freshwater Fish Fauna of District Bijnor in Western Uttar Pradesh, India," International Journal of Life Sciences, Biotechnology, and Pharma Research, Vol. 2, No. 3, July 2013, pp. 410-417.*

Table 3 Bird species recorded in the district.

Number of species	514
Number of rare/accidental species	6

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
4561	39.0	218.38	146.23	403.61	8.85	1.61	5.52



[3] https://www.teriin.org/article/special-drive-tree-plantations-uttar-pradesh-faces-several-challenges

2.3 Tourism

Baseline data/Quantitative Data

Total number of tourists visiting Bijnor -(2016-2020)

YEAR	INDIAN	FOREIGN	TOTAL
2016	765492	386	765878
2017	844091	408	844499
2018	925086	505	925591
2019	978753	600	979353
2020	274412	148	274560

Table-1; Source: Dept. of Tourism, Uttar Pradesh Government

a. The above-given data table-1 is taken from the Uttar Pradesh tourism website. The data table shows the number of tourists visiting Bijnor for tourism from 2016 to 2020. The tourist visits are bifurcated into two different groups – Domestic and Foreign tourists.

b. In the year 2016 Bijnor received total **765878** tourists. Number of Domestic travellers were 765492 and total international travellers were 386.

c. In the year 2017 Bijnor received total **844499** tourists. Total number of Domestic travellers were 844091 and total international travellers were 408. The district experienced a total growth of 10.26% in total number of tourists compared to number in the previous year.

d. In the year 2018 Bijnor received total **925591** tourists. Total number of Domestic travellers were 925086 and total international travellers were 505. The district experienced a total growth of 9.6% in total number of tourists compared to number in the previous year.

e. In the year 2019 Bijnor received total **979353** tourists. Total number of Domestic travellers were 978753 and total international travellers were 600. The district experienced a total growth 5.4% in total number of tourists compared to number in the previous year.

f. In the year 2020 Bijnor received total **274560**. Total number of Domestic travellers were 274412 and total international travellers were 148. The district experienced a total loss of -71.9% in total number of tourists compared to number in the previous year.

2.4 Wetlands

The district is known for a large number of small and medium wetlands. This district is Ha). Table 1 represents the number of wetlands and their area representation in the district. There are around 349 wetlands sized greater than 2.25 Ha and 1359 less than 2.25 Ha areas. The region consists of small and medium-size wetlands only, generally less than 200 Ha in the area, and there are around 3 wetlands with size for than 200 Ha and 1 above 500 Ha

Table 1: Wetland Data of Bijnor District

Wetland Types	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	19	21	2	0	13	3	3	0	0	0	0	0	13
Ox-bow lakes/cut off meanders	10	16	6	0	1	4	1	4	0	0	0	0	2
High altitude Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0
Riverine Wetlands	10	16	6	0	0	3	2	2	1	2	0	0	4
Waterlogged	23	24	1	0	4	12	4	2	0	1	0	0	13
River/Stream	0	64	64	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	4	6	2	0	0	0	0	1	2	0	1	0	3
Tanks/ponds	172	186	14	0	132	34	6	0	0	0	0	0	73
Waterlogged	16	16	0	0	6	1	3	4	2	0	0	0	9
Salt pans	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (1708)	**254**	**349**	**95**	**1359**	**156**	**57**	**19**	**13**	**5**	**3**	**1**	**0**	**117**

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

- The district comprises wetlands; most are man-made tanks/ponds.
- The wetland size is small and medium-sized in general.
- The number of natural wetlands is less than man-made.
- Many wetlands (man-made and natural) are waterlogged and small ponds made for water storage.
- Many wetlands have aquatic vegetation.

2.5 Energy

2.5.1. Solar

The Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) is the nodal agency which looks after the growth and expansion of renewable energy in the state. UPNEDA takes efforts to develop the capacity in renewable energy sources such as solar energy, small-scale hydro-electricity and biomass-based electricity production in the state.

According to the 2011 census, 61.13% households in the district depend on kerosene for the main sourceof lightning, followed by 36.82% using electricity and only 0.99% using solar.

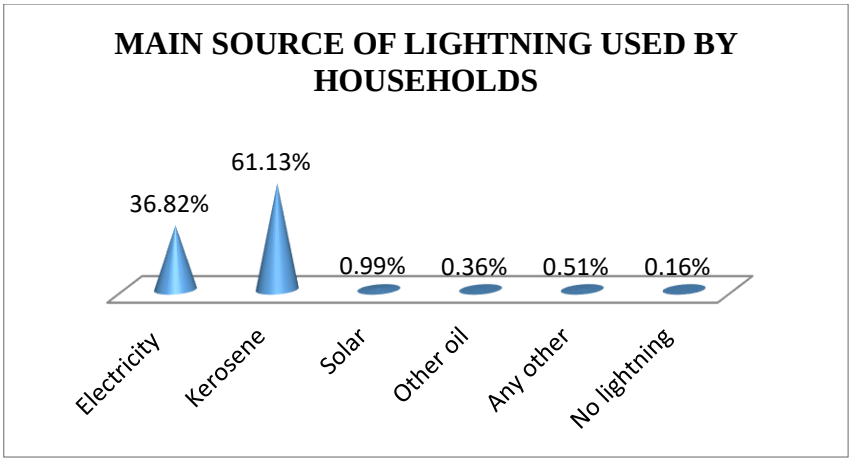


Fig. 1

2.5.2. Biomass

The Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) is the nodal agency which looks after the growth and expansion of renewable energy in the state. UPNEDA takes efforts to develop the capacity in renewable energy sources such as solar energy, small-scale hydro-electricity and biomass-based electricity production in the state.

According to the 2011 census (Fig. 1), 40.02% households use cowdung cake as the cooking fuel followed by 36.72% households using firewood and 17.60% depending on LPG/PNG. Majority of population in the district is mainly dependent on agriculture as their primary source of income. Rice, maize, sugarcane, mustard etc. are the main crops grown in are some of the major crops grown in the district.

The net sown area of the district is 172181 ha with the cropping intensity of 151.36%. The district has 21001 ha of forest land. A total of 904 ha of cultivable wasteland and 2818 ha of current fallow is there in the district. The district produces 854.1 KT/Yr of agricultural biomass and 1.5 Kt/Yr forest based biomass (Kumar et. al. 2017).

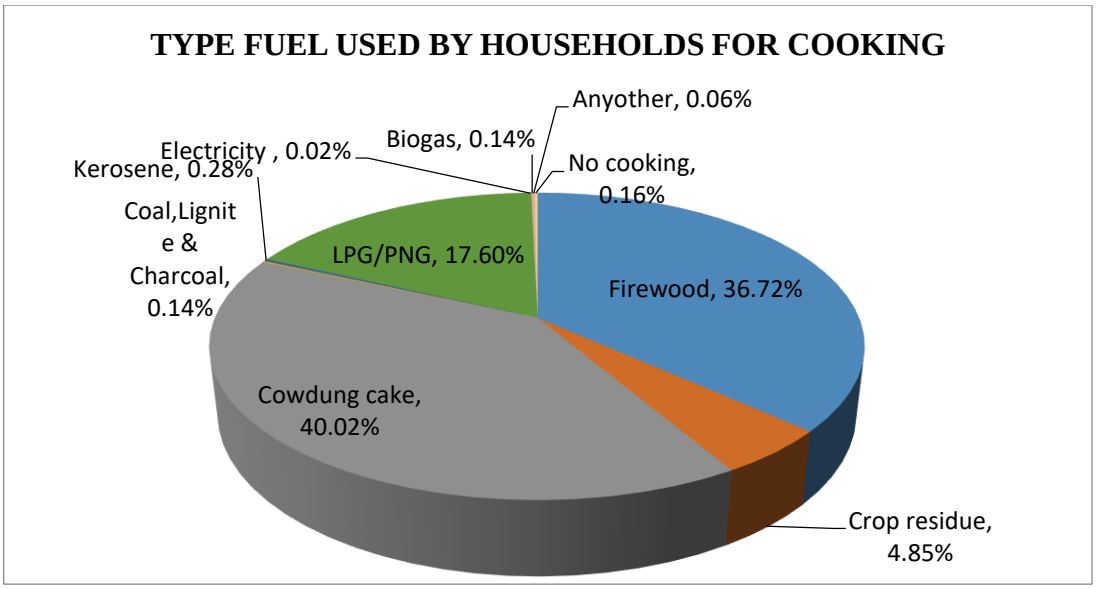


Fig. 1

Table.1 gives an account of productivity of some of the major crops in the district. The productivity of the crops appears to be good consequently a good amount of crop residue is produced.

CROPS	PRODUCTIVITY (kg/ha)
Rice	2029
Wheat	3155
Sugarcane	62420
Maize	909
Mustard	932
Pigeon pea	1052
Lentil	817
Toria	918

Table 1

According to the progress report of UPNEDA, a 2 MW biomass energy plant (Industrial waste) at Vam organic, Gajraula and a biomass gasifier at Insilco Limited, Gajaraula is installed in the district.

2.5.3. Biogas

Biogas data is not available for the district. Based on the livestock population and agricultural waste biogas potential calculated. Biogas potential from animal waste and agricultural waste was calculated approximately as two crore m3/year and forty-one crores m3/year. This amount of biogas generation can efficiently complete the energy demand of the district.

2.5.4. Hydro Power

No hydropower plant exists, nor the site has been identified in the district. The district's main rivers are the Ganga, Baha, and Krishna. Hydropower sites should be identified in these district.

3 QUALITATIVE DATA ANALYSIS

3.1 FORESTRY

To increase forest resources in the country, Ministry of Environment, Forest and Climate Change is implementing a number of Schemes under which financial assistance is provided to State/UT Governments. Some of major schemes of the Ministry are National Afforestation Programme (NAP) and Green India Mission (GIM), Integrated Development of Wildlife Habitat (IDWH), Intensification of Forest Management Scheme (IFMS), Project Tiger and Project Elephant including funds under Compensatory Afforestation Fund Management and Planning Authority (CAMPA). The use of timber in house construction, furniture and agricultural implements, etc. is around 61.38 million cum. By using alternatives, we can reduce this which in turn will result in reduction in tree felling. In the context of State of Uttar Pradesh 10.495 million people are using fuel wood from forests. Taking an average family size of 5 persons per family it can be concluded that 2.1 million families are directly dependent on forests for fuel wood. By giving them alternative sources of energy it will be possible to reduce Carbon dioxide to the tune of 2.1 million tonnes annually.

3.2.1. Biodiversity

Positive findings in the field of biodiversity on the soil of Bijnor district, which is located in the Himalayan foothills, have emerged in recent years. The district has two forest divisions: Bijnor Forest Division Najibabad and Social Forestry Bijnor. There are natural homes for species as well as a stockpile of precious forest wealth. The good news is that the Bijnor forest division previously had 84 elephants, which increased to 103 in the December 2020 census. At the same time, two tigers were sighted earlier in the Kaudiya forest region, bringing the total to five. The rise in the number of tigers indicates that there is adequate food for him, such as deer. The number of leopards is expected to be quite large; however, an accurate count is not yet available. Viper snakes are also frequently observed in the Najibabad forest. (Danik Jagaran 22nd May 2021)

3.2 ENERGY:

As per the data of the year 2013, Bijnor district energy consumption is around 365 TJ and 3.9 GJ/capita. GHG emission of 24647 Ton CO_2 equivalent and 0.264 Ton CO_2 equivalent/capita has been evaluated for the district.

3.2.1. Solar

The district Bijnor has witnessed a few solar power units installations and can perform better if work is done in promoting solar energy in the district. According to an article in The Times of India four government primary schools in Uttar Pradesh's Bijnor district are set to be illuminated with solar panels. The schools were unable to get electricity before as they are situated near the Hastinapur Wildlife Sanctuary, through which power lines cannot be drawn. The schools are situated in four villages.

Another article in Saur energy mentions Sun Source Energy has announced that the company has commissioned the first phase of the 45 MW solar energy project in Uttar Pradesh. SunSource is one of the leading companies in the distributed solar sector and the commissioned project is situated in the Shivala Kalan Village of Bijnor District. It's an open access project. The first phase is built on 64 acres of land and is connected through a 16km long transmission line. The official statement of SunSource says that the entire solar power project is being developed on 164 acres of land. A 40km long transmission line will be employed for grid connection for the complete project. The official statement said that SunSource will supply clean and reliable power through the state's power grid to leading corporations in the state including Taj Hotels and Coca Cola bottling plant. The project will offset more than 1500 million kg of CO2 emission over its technical lifetime and also generate employment in the district.According to Pugazenthi et. al. 2016, total solar power potential available in the district is 0.0142.

3.2.2. Biomass

The district is progressing quite well in the biomass energy sector in the district. This is evident from a latest move in the district in the biomass energy sector as mentioned in an article in Business Standard. According to the article ShivOm Dayal Energies (P) Ltd., is setting up two biofuel projects worth Rs 800 Crore. The two biofuel plants will be set up in the districts of Saharanpur and Bijnor. The UP government in its cabinet meeting held on 7th February 2019, approved the two second-generation ethanol plants which will incur an investment of INR 400 crore each. Each of the sanctioned biofuel facility is expected to utilise about 200 tonnes of agro-waste per day for the production of 50,000 litres of second-generation ethanol. The plants will be set up under technical collaboration with the Institute of Nuclear Energy Research (INER), Taiwan. The facilities will be utilizing agro-waste including rice straw, wheat straw and bagasse as raw materials to produce second-generation ethanol. The benefits of the project include additional income for farmers, reduction in stubble burning, socio-economic upliftment of farmers, saving on foreign currency and lowering bills of crude. The two plants are also expected to reduce carbon footprint and increase employment generation.

3.2.3. Biogas:

A biogas facility, which will use agricultural waste and cow dung to create methane and electricity, is due to open on the grounds of the Barkaatpur sugar mill, giving optimism to communities in the Bijnor

district that they would soon be self-sufficient in terms of cooking gas and power supply (The Times of India 2015).

3.2.4. Hydropower:

No sites have been identified for micro hydel project in the district. The State's national-level program runs for hydropower generation, such as the small hydropower project program. The implementation of small hydropower in the State is carried out by Uttar Pradesh New and Renewable Energy Development Agency.

3.3 TOURISM

Places of Interest

Bijnor Daranagar

Bijnor is surrounded by many tourist attractions which can be reached from the city through roadways or railways. The well-versed transport system and the quality highways in Bijnor make easier to travel down to its neighbouring cities. Near Bijnor there are historical forts, popular temples, sanctuaries, ashrams and rivers which are popular among people.

Daranagar was of historical importance during Mahabharata. When the war between Kauravas and Pandavas began, both sides wished to safeguard their wives and children under the protection of Vidur Kuti before starting the war. Since it took much a place to home all the family members of Kauravas and Pandavas Vidur Kuti established an exclusive region which was called as Daranagar.

The famous Nijab-ud-Daulah's fort

Najibabad popularly called as "Gateway of Himalayas" is situated about 37 km from Bijnor. The city was founded by Nawab Najib-ud-Daulah who is also called as Najib Khan. The famous Nijab-udDaulah's fort is located in this area, it was addressed as Sultana Dakoo's shelter by the English East India company.

Vidur Kuti Temple

Like the Kanva Ashram, Vitur Kuti has a lot of importance in mythology. It is believed that during the Mahabharata, the well-known philosopher was located on the banks of the Ganges. It is believed that in Krishna Ji and Hastinapur, failing to explain to Kauravas, he turned down the 56 demands of Kauravas and crossed the Ganges and came to Mahatma Vidur's ashram. The footprint of Mahatma Vidur in the Vidur Ashram is still safe on marble.

Indra Park Bijnor

indra park, Bijnor is a perfect destination for a great time with your dear ones. Enjoy the attractions of this popular tourist spot. With so much to lure your senses and offer you recreation at its best, get drenched in the spirit of adventure that you get to explore at Indra park, Bijnor. Enjoy together all the points of popular interests and bring back several memorable moments.

Indra park, Bijnor is not just the place for sightseeing, but it also enables you to steal a self-indulgent moment for yourself as well. So, check out the Indra park tourist spot for all the attractions that is on offer and visit this spot on weekends for a rejuvenating time.

World standards, extraordinary architecture, innovative layouts, and well-thought execution make place a highly coveted point of tourist interest. Do not forget to carry your camera and capture special moments. Indra park, Bijnor is the sure way to refresh and relax after a busy weekday. Explore interesting themes, fabulous designs, colourful landscapes, amusing characters, ambient music, props and merchandise available in nearby stores- all at one place. Indra park, Bijnor is the best way to have a memorable time with kids and family. So, enjoy a fulfilling outing at Indra park in Bijnor.

Vidur Kuti temple

Bijnor: Situated at the bank of Ganges, around 11 km from Bijnor, is the Vidur Kuti temple, a heritage site with ties to the Mahabharata of Uttar Pradesh tourism. Even though work on the Mahabharata began in 2006, the temple lies in a dilapidated state.

Najibuddaula fort

Najibuddaula fort is the historical significance of the city of Najibabad in Bijnor district. This Ghulam Qadir alias Najibuddaula made the pledge to fall into the 18th century Mughal empire. Earlier the name of this city was Najibuddaula which was called Najibabad in the debate.

Dargahe Aaliya Najaf-E-Hind Jogipura Najibabad

Syed Allaouddin Bukhari ,the father of Syed Raju ,was Deewan ,during the reign of ShahJahan (1627-1658). He was held in reverence in the royal court due to his noble behaviour and personal ability. After his death ,his son Syed Raju , was assigned the post of his deceased father. During Mughal period some of the nobles were counted among the most learned sages of their time.Syed Raju was empiricist learned sage ,beside being devout ,pious ,and God-Fearing person. These qualities of Syed Raju had made him so significiant in the eyes of Shah Jahan that he entrusted him the responsibility of supervising and protecting his palace.

3.4 WETLANDS

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 region has good wheat, rice, and sugarcane production. The area is known for the nagina handicraft. The data collected and analysed show the region's production and possible product derived from the raw product. The list of sources and the possible outcomes are mentioned below:

- Sugarcane and wheat production is recommended as commercial crops in the region, leading to sugar, flour, and finished products.
- The district stats show a good amount of finger millet, pearl millet, in the region, which can be promoted in the scheme.

- Also, products like oil, finished pulses can be derived from the crops and millets grown in the region.
- Also, this region is a belt of large varieties of oil production like mustard seeds which can turn into a valuable market for oil production.
- The region has a large production of dairy products, leading to increased animal husbandry. Wetlands can support the growth of fodder for animals.

4 ACTION PLAN DEVELOPMENT

4.1 FORESTRY

Culturable Waste Land includes land available for cultivation, whether taken up or not taken up for cultivation once, but not cultivated during the last five years or more in succession including the current year for some reason or the other. This area is about 440 thousand hectares and can be taken up for plantations by Forest Department. Scrub forest area 74500 ha should also be taken up for plantations. Similarly Fallow Lands other than Current Fallows include all land which was taken up for cultivation but is temporarily out of cultivation for a period of not less than one year and not more than five years. The total of such area available is 540 thousand hectares. This area can be brought under plantations by the land owners or by forest department by taking recourse under section 8 and 9 of UP Tree Protection Act, 1976. If the target period is 20 years the target of plantations should be as follows:

	Target for 20 Years	**Target per year**
Plantation by Forest Department	514,500 ha	52725 ha
Plantation by Private Land Owners	540,000 ha	27000 ha

Figure 6 Targets to increase forest and agro-forestry plantation
Source: State Action on Climate Change, Uttar Pradesh

Plantations along canals embankments and roadsides, Conversion of Moderately Dense Forest, Open Forest and Scrub into Very Dense Forest upto maximum possible extent, Agroforestry, afforestation.

Projections & Monitoring Matrix

Outcome indicators can be forest produce, buyback of products by the state, annual gross income generated by these outputs, contribution of the forest output in the district domestic product.

4.1.1 Biodiversity - While the number of extinct species has risen owing to the growth of the forest ecosystem, environmentalists have begun working hard to make the planet green with the help of multi-year-old trees.

4.2TOURISM

- **Ecotourism Projects**

Travelling to places where flora, wildlife, and cultural legacy are the main attractions is known as ecotourism. Ecotourism aims to provide visitors with a better understanding of how humans affect the environment and create a greater appreciation for our natural ecosystems. There is a huge opportunity to develop ecotourism projects in the Mirzapur district. The project will minimize the negative aspects of conventional tourism on the environment and enhance the cultural integrity of local people. Also, this project will boost the tourist inflow in the district. Lakes, Ponds, forests, and protected ranges can be protected to give Prayagraj a new face in tourism.

- **Sustainable Tourism**

It is a type of tourism in which all the needs and desires of a tourist/ and other stakeholders of the tourism industry is fulfilled without compromising the ability of the future generation to utilize the tourism. Several goals of Sustainable Developments Goals are also seen associated with sustainable tourism. Such as life below water and life on land are impacted by human activities if the tourism place is a water body of forest area; hence it is the duty of all of us to take care of sustainability aspect in the tourism. Sustainability for locals/natives can be provided by including them in trade and business activities.

There is a sense of responsibility of different stakeholders associated with tourism to develop sustainable tourism. In which each stakeholder takes care of other stakeholders and biotic and abiotic factors. For example, reducing the Carbon footprint per visitor, using eco-friendly vehicles to roam around, supporting local businesses.

One example of sustainable tourism is promoting tourists to travel off-season. It will reduce the impact of seasonal unemployment on the marginal traders and other workers in the tourism sector.

Offering eco-friendly services is another example of sustainable tourism. Providing tourists with a cycle to roam around nearby places with help in reducing carbon footprint and it economical. It is aimed at the minimum negative impact on the environment created by tourism activities.

Amangarh Tiger Reserve, Bijnor

Amangarh is one of the most prestigious important, beautiful and richest wilderness areas in district Bijnor of Uttar Pradesh. Spreading over an area of 9500 Hq (95 Sq.Kms) with a combination of grasslands, wetlands and dense forest.

It has been declared as buffer area of Corbett Tiger Reserve to be known as the Amangarh Tiger Reserve, so lying adjacent to Corbett Tiger Reserve is now a corridor to Asiatic Elephant, Tiger and much other wild life.

The robust Asiatic Elephant and the roaring Tiger among the wild animals are the star attractions of this area. The Cheetal, Sambhar, Kakar, Leopard, Bear, Porcupine. Wild Boar, Jackal, Jungle cat etc., and the avifauna including Spangled Drongo, Golden Backed Wood Pecker, Jungle owlet, Red jungle fowl, grey horn bill and hornbill make this area a prestigious natural heritage

Projections and Monitoring matrix

Sector	Intervention	Strategy	Total cost	Expected Outcomes
Tourism	**Research**	• Based on various data and matrices, it is possible to predict the reason and motivation for tourism. Through extensive qualitative and quantitative research, it is also possible to determine the variables affecting tourism in Uttar Pradesh. • Research must be free from all the political pressures and influences. • The researchers must ensure that the field data and secondary data are correct and not modified while entering the new records. • Need to involve unbiased researchers.		A well-researched document as a reference for other processes. Factors that affect tourism in Uttar Pradesh. Define the determinant of tourism activity.
	Planning	• Action plans can be developed for intervention based on the research and analysis of different data and reports.		Planning to be based on research and previous lessons. Realistic planning for

		• Developing an Action plan is vital because results depend on how it is planned. • Planning must consider the social status of the State and the image in the tourists' minds. • No place should be given to non-practical projections. • Planning about when to organized Mahotsav/ festivals/ fairs to pump the local economy. • Separate planning for different demographics of tourists for comfort and leisure tours. For example, while planning the tour packages and tariffs, it is crucial to consider the demography of tourists. Foreign tourists ask much for hygiene while local tourists ask much for discounts. Hence these concerns must be included. • Need to develop the sites as per a set of standards to		successful implementation. .

		attract a wide range of tourists. ● Brand Manufacturing to increase tourism activity. ● Organizations of grand events. ● Use of allocated budget.		
	Implementations	● Various schemes can be developed, such as tourist packages, tariff plans etc., to attract more and more tourists. ● Mahotsav and Fairs to be organized to rejuvenate the local economy and attract tourists. ● Developing tourist circuits. ● Developing eateries ● Connecting tourism with local culture and food. ● Extensive marketing for advertisement. ● Famous face as brand ambassador. ● Extensive branding and marketing. ● Development of tourism spots and heritage sites. ● Availability of information on government		To attract a greater number of tourists and maximize the revenue from tourism. To improve the image of the State and not let the other social factor affect the revenue of tourism.

		websites along with tour packages. ● An extensive market research for the development of strategies		
	Impact Assessment of results	● Calculating what the touch points are. ● The reason for failure ● The reason for the success ● Lesson for next planning		To learn the lesson and find out the root cause of success and failure, to be used further with modification

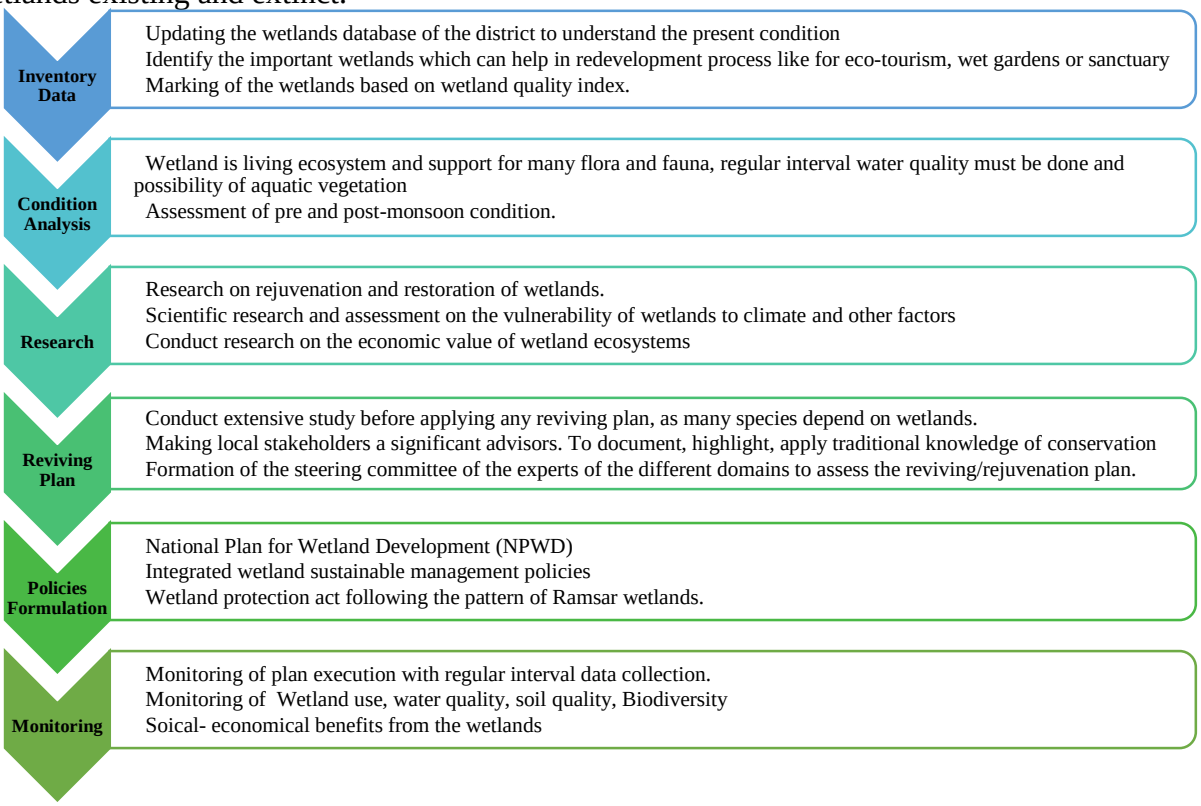
SWOT analysis of Tourism

S No.	Strength	Weakness	Opportunity	Threat
	● Location wise destination is at prime region. In the Shivalik ranges, near the himalyan range. ● Amangarh Tiger Reserve, Bijnor as eco-tourism centre. ● Forts in the district.	● No availability of ghats. ● Insignificant international tourists.	● Get benefitted with ecotourism spot near the district. ● Resorts can be made. ● Adventure tourism can be developed as the location is suitable for such kind of tourism.	● Pollution ● Overlooked district. ● Under funding to develop tourism in the district. ● Natural disasters.

4.3 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. 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.



4.4 ENERGY

4.4.1. Solar

There have been installations of solar plants at the public places and recently a 45 megawatt solar energy project has also been commissioned for the district. This will definitely add value to the livelihood of the people in the district. People in the district should be made aware of the solar energy schemes so that they can take benefit. This will encourage people to incline towards the solar energy and also generate employment opportunities. Other than this Kusum Yojana should be promoted among farmers, which will help them to perform the agriculture activities using the advanced tools. This would ultimately bring efficiency in farming. The small scale industries should also be given the benefit of net metering and subsidy so that they don't have to wait for longer periods to get returns. Solar rooftop installations should be popularized under the National solar Mission- Phase II, especially in the urban areas. This will also help in reducing the burdens on the DISCOMs.

4.4.2. Biomass

The district is in the developing stage of the biomass energy sector as a biofuel plant is being established in the district. Presently it has become important that people are made aware of the

advancement that is being made in the district. Administration should seek into the price fixation of the biomass waste so that neither the sellers nor the buyers are at loss. Since the district largely produces rice and wheat, hence rice husk based biomass power plants should be encouraged in the district among the new entrepreneurs. These can be developed on the lines of Husk Power Systems, Champaran, Bihar. From their plant, HPS wires carried electricity to houses via a local distribution grid, which could travel a maximum distance of 2–3 km. This will be helpful in villages where there are regular power cut offs.

A small district based survey for understanding the land availability would be of use in recognizing the apt lands for setting up the biomass plants.

Research is also required to develop technology which can not only produce energy from rice husk alone but also wastes from other crops can be used alongwith, such as wheat, etc.

4.5.3. Biogas:

- Government should support local organization or committee like Ritvijam Committee and built biogas plant in Chandpur district near Gaushalas.

.5.4. Hydropower:

- Government should construct hydropower plant on identified site in Ramganga river and investigate more sites near rural area for irrigation and electricity purposes.

4 RECOMMENDATIONS

4.1 AGRICULTURE AND ALLIED SECTORS

- Quality seeds and high-yield varieties (HYV) should be introduced and encouraged to the farmers to increase the productivity of the crops.
- Irrigation facilities are constrained into bore wells and open wells; it covers nearly more than 95% of total irrigated areas.
- Farm ponds should be constructed under the IWSM programme to reduce the dependency on groundwater, especially in four blocks, namely Noorpur, Jalilpur, Kritpur, and Burhanpur.
- The district has good potential to grow mango farming under suitable agro-climatic conditions; farmers can be encouraged for qualitative mango cultivation.
- Sugarcane is the major cash crop in the district; it is advisable to adopt scientific ratooning practices to increase productivity.
- More farmers should be trained to tackle major diseases like leaf blight, yellow rust, loose smut in wheat and stem borer, and red rots in sugarcane.
- Micro-irrigation (drip irrigation) with fertigation concept should be promoted for high-value vegetables, orchard, and flower cultivation.

- Inter-cropping such as sugarcane with short duration summer mung bean will increase the farmer's income, which should be encouraged.
- Farmers should control the over-use of fertilizer for potato cultivation.
- Mustard, sesame, and groundnut are the major oilseeds in the district but the seed replacement ratio is low for sesame and groundnut, which can be improved.
- Farmers should adopt group farm mechanization as most farmers are small landholders.
- Practicing mulching zero tillage as resource conservation techniques should be encouraged.
- Beekeeping should be introduced in the district.
- The district should promote organic farming under the government's schemes (PKVY).
- The farmers should adopt vermicomposting and green manuring to maintain soil health.
- Gotary and poultry farming can be promoted for the small landholders.
- To improve productivity, farmers should be encouraged for the cross-breeds instead of local breeds for cattle and buffaloes.
- More farmers should be encouraged to produce mushrooms and also need to provide training on the primary processing of mushrooms.

4.2 FORESTRY

Bijnor located on the banks of two major rivers, i.e. Ganga. 403 Sq. Km. area of Bijnor is covered with forest. As discussed above, the forest cover of Bijnor has decreased over time, there is a wide scope of Afforestation on waste land, trees outside forest (on the sides of the roads, banks of river etc.). Government can promote the afforestation, agroforestry activities by providing output based incentives.

4.3 Biodiversity

It is suggested that the government help women like Alka Lohati, who are fighting for the lives of cattle and looking after the cowshed, which houses 137 cows.

4.4 WETLAND

- 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.

- Unlike wheat and rice like oilseeds, maise needs to turn into finished products.

- Diversification through introducing vegetable, mushroom, beekeeping, fruits, medicinal plants, dairy, poultry etc. for nutritional security

- Need to the introduction of improved cultivars and production technologies for sesame.

- Production enhancement and conservation of green fodder for livestock

- It is recommended to promote the production of medicinal plants in the region to support the promote ayurvedic medicine, and wetland can support the water supply for the cultivation.

- Promote Nagina handicraft

- Support cultivation of sesame production

4.5 ENERGY

4.5.1. Solar

- ❖ The people of the district should be made aware of the solar energy scheme of the government.
- ❖ Kusum Yojana should be popularized among the farmers of the district.
- ❖ Solar rooftop installations should be popularized under the National solar Mission- Phase II.

4.5.2. Biomass

- ❖ People should be made aware of the biomass energy.
- ❖ Rice husk based biomass plants should be developed and promoted in the district among the small and new entrepreneurs.
- ❖ Research is also required to develop technology which can not only produce energy from rice husk alone but also wastes from other crops can be used along with, such as wheat, etc.

4.5.3. Biogas

It is recommended to provide an incentive for maintaining and constructing biogas plants parallel to Gaushala, such as Shri Krishna Gaushala, Braj Gaushala etc

4.5.4. Hydropower

It is recommended to investigate the site in the Khadar area of Bijnor and built a small hydropower plant.

4.5.5. TOURISM

S. No.	Broad objectives / recommendations	Key activities / interventions to be planned			Monitoring & Evaluation
		2022	2023	2024	
	Encourage tourism related startups and ideas. Incubation centers to develop prototype and working model with the assistance of industry leaders (tourism industry). Training of skilled manpower to work in tourism sector (through earn while you learn programs). Upgradation of UP state tourism corporation policies, the hotels and integration of PPP. Promotion to Nagina Handicraft Worker	Research to figure out the factors impacting the tourism in the district. Development of strategies to address the issues. Development of policies to protect the ecosystem. Adopting PPP (Public Private Partnership) model in the tourism sector to reduce the burden on government spendings Structural developments.	Implementation of strategies. Training and Incubation Centre support to innovative ideas Structural developments	Sampling for analysis. Evaluation of interventions. Redesigning of strategies based on Impact analysis	Intervention impact- RCTs, regression analysis, propensity scores, econometrics, structural equation modelling, Contribution analysis, process tracing, Bradford Hill criteria. Through Participatory approaches and impact evaluations use the standard OECD-DAC criteria. Based on satisfaction of pre decided key questions.

5. Discussion during the Report Presentation

- Bijnor is very active in the export of organic farming produce.
- A proposal has been submitted regarding creation of a display center of the organic produce at the Ganga Basin and Ganga Ghaat.
- Jalaj Safari and Dolphin sighting is major part of tourist attraction.
- Tourism : Bijnor holds a great mythological value as it is known as the birthplace of King Bharat. There is a need of creating awareness and advertising such aspects of Bijnor through awareness program and light and music show.
- The beautification of the Bird Sanctuary is in the plan.
- Agriculture: Bijnor farmers are majorly involved in the production of Rice, Sugarcane, Fruits and Vegetables etc. There are currently 22 active FPOs out of which 12 FPOs is operational near Ganga basin. These 12 FPOs are actively involved in Natural Farming. Further, Karnva Rishi Ashram in Bijnor is being developed into a learning and training center with a joint effort by administration and the farmers of the Bijnor. DM Office seeks Namami Gange's support in development of Karna Rishi Ashram. DM, Bijnor requested an exposure visit to understand the scenario.
- Ganga Aarti: Ganga aarti is to be organized in Anoop Shahr, Barrighat and Narora
- 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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5 APPENDICES

5.5 AUXILLLARY DATA

Table 1 Crop production in the district.

Crop/Year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Non-grain crops (Metric Tonne)	32465	38687	36799	42372	22457	22485	23598	44337	44249
Grain crops (Metric Tonne)	628736	691668	810028	788538	702012	623337	626192	864269	858606
Sugarcane (Metric Tonne)	241488	231057	245520	299791	212453	219085	232591	415380	356248
Potato (Metric Tonne)	171269	198001	213947	194754	62558	103645	133331	229259	214913

Table 2 Livestock population in district.

Livestock	2003	2007	2012
Cattle (Cow)	263580	239936	273848
Buffalos	186571	209859	233907
Sheep	18272	17435	23170
Goat	153667	168339	154580
Pigs	28989	1941	15476
Chicken	212846	225766	227593
Other Poultry	5188	64990	4412
Horses and Ponies	1703	524	1664
Others	8531	4929	6966

Table 3 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 Moisture content	Manure required for biogas * (kg/m^3)	Biogas potential (m^3/yr)
Cattle	Manure	2,73,848	10	99,95,45,200	749658900	149931780	25	5997271.2

Buffalo	Manure	2,33,907	15	1,28,06,40,825	960480618.8	192096123.8	25	7683844.95
Sheep	Manure	23,170	1	84,57,050	6342787.5	1268557.5	25	50742.3
Goat	Manure	1,54,580	1	5,64,21,700	42316275	8463255	25	338530.2
Pig	Manure	15,476	2.5	1,41,21,850	10591387.5	2118277.5	25	84731.1
Poultry	Manure	2,32,005	0.1	84,68,183	6351136.875	1270227.375	25	50809.095
Total		9,32,986						14205928.85

6

7 Table 6 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 [m^3/(tons of dry matter)]**	**Overall biogas potential (m^3)**
Maize	straw	102	1.5	153	107.1	15	91.035	800	72828
Wheat	straw	569328	1.5	853992	597794.4	30	418456.08	800	334764864
Sugarcane	Bagasse	168191350	0.33	55503145.5	38852201.85	80	7770440.37	750	582783027 8
Total		168760780							616266797 0