Arth Ganga Project: District Farrukhabad

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National Mission for Clean Ganga (NMCG)

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EXECUTIVE SUMMARY

Farrukhabad, a district with great antiquity in sculpture, is located in the state of Uttar Pradesh. The district is historically rich and diverse and is traversed by the rivers Ganga, Ram Ganga, and Kali.

The total geographical area of the district is 2181 Km^2. The average annual growth rate of the primary sector from 2011-12 to 2018-19 was found to be 3.71%. Thus, its share decreased from 32.47% in 2011-12 to 27.22% in 2018-19. The share of the secondary sector increased from 13.78% in 2011-12 to 17.39% in 2018-19. The sector grew with a remarkable average annual growth rate of 11.40%. The tertiary sector occupies, on average, 53.84% share of the district economy. Moreover, the sector grew with an average annual growth rate of 6.61%, with its share increasing from 53.75% in 2011-12 to 55.39% in 2018-19. Major crop types are wheat, rice, maize, barley, corn, and pulses like pigeon pea, pea, lahi mustard, etc. along with sugarcane, potato, tobacco, groundnut, etc. The livestock consists of cattle (indigenous and crossbred), buffalos (indigenous and crossbred), pigs (indigenous and crossbred), sheep; along with poultry and fisheries. The total food grains along with pulses account for the production of 512905 MT.

In 2017-18, the net sown area represents 78.88%. The cropping intensity of the district is 142.35%. The total irrigated area is 169001 ha. From 2010-11 to 2018-19, the district's percentage of the net and gross irrigated areas have increased by an average of 94.87% and 88.18%, respectively. The share of cultivable wasteland, Barren, and uncultivable land decreased from 1.78% to 1.38% and 2.89% to 2.49% from 2010-11 to 2017-18. The net sown area from 67.44% in 2009-10 to 78.88% in 2017-18 whereas the area for non-agricultural use increased slightly over the period from 12.92% to 14.05%. The overall use of chemical fertilizers has decreased in the district from 428.93 kg/ ha GSA in 2010-11 to 143.06 kg/ ha GSA in 2017-18. In 2017-18, the nitrogen share decreased to 67.62%, while the phosphorus share increased to 26.89%, and the potassium share decreased to 5.48%. The use of nitrogen is more than the recommended ratio, while the Phosphorous and potassium ratio is less than the recommended ratio.

The share of livestock increased from 24.90% to 32.87% with an average annual growth rate of 9.26. The fishery & aquaculture share is around 2.30% in 2018-19 with a significant average annual growth rate of 99.24% from 2011-12 to 2018-19. Mines and quarrying recorded a remarkable average annual growth rate of 11.73%.

The total forest cover of the district is 47.45 Km^2. The forest area increased from 36 km^2 in 2001 to 46.45 km^2 in 2019. The share of area under trees and gardens decreased from 1.69% in 2009-10 to 0.71% in 2017-18. Majorly open forests (33.45 km^2) followed by medium dense forests (14 km^2) are present. The share of forestry & logging was around 2.43% in 2018-19 but grew with an average annual growth rate of 46.52%. A few places such as Bhagwaan Vimal Nath Ji Kampil Teerth, Sankisa temple, etc. located in the district along with festivals and events like Kumbh Mela have potentially attracted tourists. The district is well connected through roads and railways. In the year 2019, the district witnessed an 85.35% growth in the number of tourists, out of which the number of Indian visitors was 535855162 whereas foreign visitors were 4745181.

The main source of lightning is kerosene (71.04%) followed by electricity (27.50%) while only 0.63% is the usage of Solar energy. A 50 kW solar panel has been installed at Vikas Bhawan. According to Pugazenthi et. al. 2016, the total solar power potential available in the district is 0.0674. The main fuel source is firewood (42.96%) followed by cow dung cake (22.47%) whereas the use of LPG/PNG (19.22%). Electricity consumption in agriculture has increased significantly from 113.94 KWH in 2014-15 to 266.06 KWH in 2019-20, a net increase of approximately 133.51%. The percentage share of the agriculture sector in the total electricity consumption is about 26.59%. The total number of wetlands existing in the district is 770 consisting of both Man-made and Natural. Most of them are small or medium size and waterlogged and riverine wetlands. The district's biodiversity data includes various crop production, livestock population, bird species, and forest cover with 349 bird species and 6 threatened/rare species of bird in the district. Biogas potential from animal waste and agricultural waste was calculated approximately as 1 crore m^3/year and 20 crores m^3/year. In 2021, three new biogas plants are deemed to be set up at Sitwanpur pithy Gaushala, Maudha, and Shahpur Gangpur Gaushala under the Gobar Dhan project. No hydropower present or plans exist.

Biogas potential from animal and agricultural waste is calculated approximately as 2 crores m^3/year and 27 crores m^3/year respectively. There are no hydropower projects in the district.

The district needs special attention to the maintenance of temples, forts, etc. along with adapting eco-tourism, promoting sustainable tourism, creating awareness, involving more locals, etc. The district should practice Agroforestry, afforestation, using cultivable wasteland, reducing exploitation of different resources and forest products, etc for sustainable development. Measures should be taken to improve

tourism like introducing a plan of Travel Uttar Pradesh, fairs, festivities, etc. along with stressing hygiene, safety, transportation, maintenance of buildings, etc. Enhance the use of renewable energy especially by creating awareness. Use of high-yielding seeds, micro-irrigation, constructing and maintaining harvesting structures, adopting of greenhouse farming with organic farming, and encouraging farmers for adapting different crop cultivation and various irrigation methods. Along with focussing on agriculture practices Bee culture, dairy, poultry, fisheries, etc. needs encouragement as they have high economic potential. The district can adopt or promote the following activities adopting scientific cultivation practices, vermicompost, bio-fertilizers, and FYM, sustainable agriculture, processing units, storage, and export facilities, creation of Poly houses and shed net houses, and monitoring and inspection of all sectors.

1 DISTRICT OVERVIEW

1.1 INTRODUCTION

Farrukhabad is situated between latitude 26º46' and 27º43' north and Longitude 79º7'and 80º 2' east. The district is administratively divided into 03 tahsils namely Kaimganj, Amritpur and Farrukhabad. There are 512 Gram Panchayats and 1005 Revenue villages with 872 inhabited villages and 133 uninhabited villages in the district.

Agriculture in the main source of the economy of the district. 77.9 percent of people dwelling in countryside are dependent on agriculture. As is usual in the doab, the agriculture year yields three harvests : the Kharif, Rabi and Zaid. The last is of little significance in point of area and mainly consists of cucurbits, vegetables, spices, tobacco legumes and low-grade crereals. Melons, Kakri and Cucumbers are mostly grown in the Khadar and along the sandy banks of the rivers. The principal crops of Kharif are Maize, Rice,Bajra, Jawar, Urd, Moong and Moth, whereas thecrops covered in Rabi are Wheat, Gram, Barley, Pea, Arhar and Masur. The district is backward from industrial point of view. Except Bidi industry in Kamalganj area, no industry has been in operation. The district has name in printing but remained confined to itself only. Under the village and cottage industry, the many units were operational in the district.

The total population of the district is 18,85,204. In the district 592,267 persons about 31.42 per cent pertains to the category of working population. It may be mentioned that the working population in the district is about 31.42 per cent as compared to 32.9 per cent in the state.The working proportion main workers constitute 25.18 per cent of the total population. Non-workers contribute 68.58 per cent of total population.

Farrukhabad was founded by Nawab Mohammad Khan Bangash, who named it after the reigning emperor Farrukhsiyar, in 1714, the district of Farrukhabad forms part of Kanpur division. The township

of Farrukhabad, Fatehgarh consist of two towns, Farrukhabad & Fatehgarh, the former being the headquarters of the Tehsil & the latter forming the headquarters of the district, both lying about 5 Kms apart. The district as it exists now is bounded by Badaun and Shahjahanpur on the north, Hardoi on the east, Kannauj on the south and district Etah & Mainpuri on the west. Rivers Ganga & Ramganga are located towards the east & Kali Nadi towards the south.

Fatehgarh derives its name from an old fort. Fatehgarh remained a Military Station of considerable importance and in 1802 it became the headquarters of the Governor Generals Agent for the ceded provinces. In 1818 a gun carriage factory was established here.

The Farrukhabad district consist of 3 Tehsils with a total area of 2,28,830 Ha., has 7 Blocks, 603 Gram Panchayats, 1020 Revenue villages, 14 Police Stations, 2 Nagar Palikas and 4 Nagar Panchayats (Town Area) & 1 Cantt. Board with total population of 18.85 Lacs approximately.

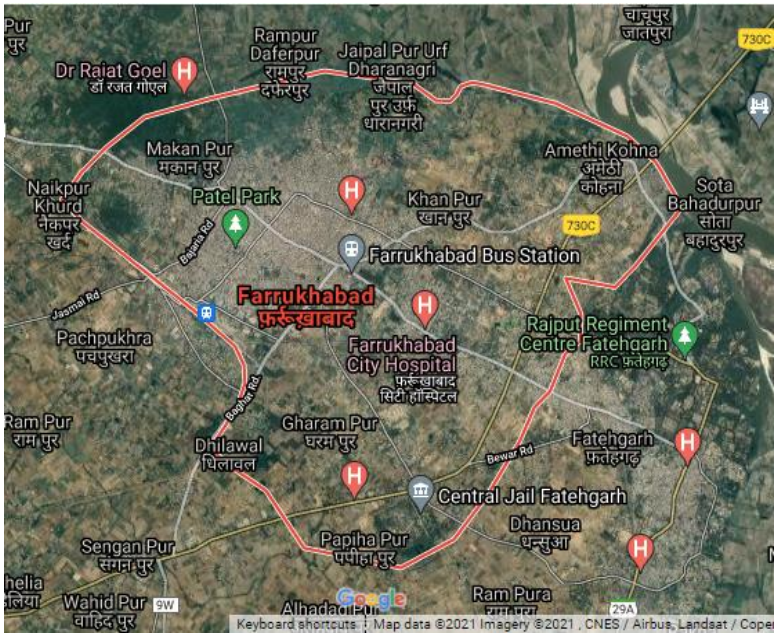


Figure 1 Map of the district

1.2 DEMOGRAPHIC PROFILE OF BADAUN

1. Economy and Livelihoods

- Geographical Area: 2181 Sq. Km.(ISFR 2019)
- Administrative Divisions:[1]

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

District Headquarters: Fatehgarh (Town)

No of Municipalities: 7

No of Tehsil: 3

No of Blocks: 7

No of Village panchayats: 594

No. of Gram Panchayat: 600

No. of Nagar panchayat: 4

No. of Nagar Palika Parishad: 2

No. Of Villages: 1007

- Demographic and socio-economic indicators:[2]

  Population: 18,85,204 (Census 2011)

  Population density (Total persons per sq. km): 864

  Sex ratio: 874

  Literacy: 69%

- Occupation/ other Livelihood source: Agriculture and Clothing (Zardozi)
- Major Rivers: Ganga, Ram Ganga and Kali
- Forest Area: 47.45 Sq. Km. (ISFR 2019)

[2] https://censusindia.gov.in/2011census/dchb/DCHB_A/09/0928_PART_A_DCHB_FARRUKHABAD.pdf

1.3 ECONOMIC PROFILE OF FARRUKHABAD

The District Economy

The primary sector has a significant impact on the district economy because it contributes, on average, 29.11% share in the district GDP. However, the average annual growth rate in this sector from 2011-12 to 2018-19 is 3.71%. Thus, its share decreased from 32.47% in 2011-12 to 27.22% in 2018-19. The share of the secondary sector increased from 13.78% in 2011-12 to 17.39% in 2018-19. The sector grew with a remarkable average annual growth rate of 11.40%. The tertiary sector occupies, on average, 53.84% share of the district economy. Moreover, the sector grew with an average annual growth rate of 6.61%, with its share increasing from 53.75% in 2011-12 to 55.39% in 2018-19. Overall, the district economy grew with an average annual growth rate of 5.93%. The growth in the primary sector is less than the other two sectors. Steps should be taken to increase the productivity of the primary sector to grow at a higher rate. This will improve the growth rate of the overall district economy and the primary sector. The sector performed better than the other sectors during the study period.

Table 1: Trends in Gross District Domestic product in Farrukhabad 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	1562.93	663.44	2587.32	4813.68	-	-	-	-
	(32.47)	(13.78)	(53.75)	(100)				
2012-13	1689.17	762.26	2762.52	5213.94	8.08	14.89	6.77	8.32
	(32.40)	(14.62)	(52.98)	(100)				
2013-14	1598.89	939.94	3135.23	5674.06	-5.34	23.31	13.49	8.82
	(28.18)	(16.57)	(55.26)	(100)				
2014-15	2031.58	905.45	3794.50	6731.53	27.06	-3.67	21.03	18.64
	(30.18)	(13.45)	(56.37)	(100)				
2015-16	1882.50	1257.22	4071.81	7211.53	-7.34	38.85	7.31	7.13
	(26.10)	(17.43)	(56.46)	(100)				
2016-17	1974.68	1718.60	3602.22	7295.49	4.90	36.70	-11.53	1.16
	(27.07)	(23.56)	(49.38)	(100)				
2017-18	2115.90	1413.92	3694.42	7224.25	7.15	-17.73	2.56	-0.98
	(29.29)	(19.57)	(51.14)	(100)				
2018-19	1935.91	1236.87	3939.06	7111.83	-8.51	-12.52	6.62	-1.56
	(27.22)	(17.39)	(55.39)	(100)				
Average Growth Rate					3.71	11.40	6.61	5.93

Source: UPDES
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 is driving the primary sector growth. Table 2 shows that agriculture with the horticulture sector grew, on

average, only by 1.41% from 2011-12 to 2018-19. Moreover, its share decreased from 79.56% in 2011-12 to 68.73% in 2018-19. On the other hand, the share of the livestock subsector increased from 17.68% to 26.54% in the same period as it grew with a remarkable average annual growth rate of 9.50%. This shows the importance of livestock in Farrukhabad District and the increased dependency of citizens on livestock products. The share of forestry & logging in the total agriculture and allied sector is small, around 2.43% in 2018-19, but it grew with a significant average annual growth rate of 46.52%. The fishery & aquaculture share is very minimal, around 2.30% in 2018-19, but it also grew with a significant average annual growth rate of 99.24% from 2011-12 to 2018-19. Mines and quarrying also recorded a remarkable average annual growth rate of 11.73%. 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 Primary sector performed below expectations during the study period. More work can be done on improving the agriculture (including horticulture) sub-sector as it has the most significant impact on the primary sector.

Table 2: Gross District Domestic Product Trends from Agriculture and allied activities in Farrukhabad 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	1225.25	272.25	38.59	3.86	1539.95	22.97	1562.93
	(79.56)	(17.68)	(2.51)	(0.25)	(100)		
	-	-	-	-	-	-	-
2012-13	1293.21	318.15	47.10	4.05	1662.51	26.66	1689.17
	(77.79)	(19.14)	(2.83)	(0.24)	(100)		
	[5.55]	[16.86]	[22.05]	[4.80]	[7.96]	[16.03]	[8.08]
2013-14	1185.92	331.97	47.78	4.17	1569.84	29.05	1598.89
	(75.54)	(21.15)	(3.04)	(0.27)	(100)		
	[-8.30]	[4.34]	[1.45]	[3.09]	[-5.57]	[8.98]	[-5.34]
2014-15	1391.63	351.92	253.69	4.47	2001.70	29.88	2031.58
	(69.52)	(17.58)	(12.67)	(0.22)	(100)		
	[17.35]	[6.01]	[430.93]	[6.98]	[27.51]	[2.86]	[27.06]
2015-16	1339.48	373.08	127.62	4.56	1844.74	37.76	1882.50
	(72.61)	(20.22)	(6.92)	(0.25)	(100)		
	[-3.75]	[6.01]	[-49.69]	[2.15]	[-7.84]	[26.35]	[-7.34]
2016-17	1396.60	466.82	62.69	5.58	1931.70	42.98	1974.68
	(72.30)	(24.17)	(3.25)	(0.29)	(100)		
	[4.26]	[25.13]	[-50.87]	[22.35]	[4.71]	[13.83]	[4.90]
2017-18	1507.23	476.40	53.09	5.84	2042.56	73.34	2115.90
	(73.79)	(23.32)	(2.60)	(0.29)	(100)		
	[7.92]	[2.05]	[-15.32]	[4.67]	[5.74]	[70.66]	[7.15]

2018-19	1308.71	505.27	46.23	43.85	1904.06	31.85	1935.91
	(68.73)	(26.54)	(2.43)	(2.30)	(100)		
	[-13.17]	[6.06]	[-12.92]	[650.66]	[-6.78]	[-56.57]	[-8.51]
Average Growth Rate	1.41	9.50	46.52	99.24	3.68	11.73	3.71
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 67.15% in 2018-19. The share has increased over the years as the average annual growth in this sector is 17.84%. The share of the electricity, gas, and water supplies subsector has decreased from 8.63% in 2011-12 to 6.08% in 2018-19. Moreover, this subsector grew with an average annual growth rate of 4.37%. The share of the construction sub-sector decreased from 39.16% to 26.76% in the same period, and the average annual growth rate is low (3.64%). This indicates that the secondary sector in Farrukhabad is heavily dependent on the Manufacturing and construction sub-sector, and the electricity subsector is also growing at a faster rate. Within the tertiary sector, the Real estate subsector made up the highest share (26.54%) in 2018-19, followed by Trade & Hotel subsector (19.66%), transport, storage, and communication subsector (16.47%), and public administration subsector (13.97%). Average annual growth is observed highest in Public Administration (18.90%), transport, storage and communication (12.33%), followed by trade and hotels (6.52%), financial services (6.11%) and lastly lowest in real estate subsector (4.43%). All the subsectors in the tertiary sector have performed well during the study period. More work needs to be done to improve Construction and financial services subsectors. Public Administration, Transport & Communication, and trade & hotel are the major contributors to the Tertiary sector's growth.

Table 3: Trends in percentage share of non-agriculture sub-sectors in DGDP in Farrukhabad 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	52.20	8.63	39.16	100	11.45	19.96	7.74	29.86	10.73	20.27	100
2012-13	58.49	7.10	34.40	100	11.75	19.70	8.04	29.70	13.18	17.63	100
2013-14	64.43	6.89	28.68	100	12.02	18.64	7.54	27.21	17.58	17.01	100
2014-15	62.87	6.94	30.19	100	11.94	19.51	6.80	23.53	25.06	13.17	100
2015-16	72.04	4.82	23.14	100	14.73	19.32	6.67	22.36	23.57	13.35	100
2016-17	79.89	4.08	16.03	100	16.47	24.83	7.61	26.02	11.12	13.96	100
2017-18	73.38	5.28	21.35	100	16.89	21.66	6.74	27.02	13.05	14.64	100
2018-19	67.15	6.08	26.76	100	16.47	19.66	7.54	26.54	13.97	15.82	100
Average Growth Rate	17.84	4.37	3.64	11.40	12.33	6.52	6.11	4.43	18.90	2.88	6.61
Source: Compiled from district statistical handbooks											

2. Quantitative Data Analysis

2.3 Agriculture and Allied Activities

2.3.1 Trend in Land Use Pattern

The total declared area of the district is 2199.11sq. km². The percentage share of forest area in the total reported area decreased from 0.24% in 2009-10 to 0.12% in 2017-18. The share of cultivable wasteland decreased from 1.78% in 2009-10 to 1.38% in 2017-18. Barren and uncultivable land share decreased slightly from 2.89% in 2009-10 to 2.84% in 2017-18. The share of area under trees and gardens decreased from 1.69% in 2009-10 to 0.71% in 2017-18. The current and other fallow lands also decreased over the years, which is good for the district economy. The net sown area (NSA) has increased over the years, from 67.44% in 2009-10 to 78.88% in 2017-18. The area for non-agricultural use increased slightly over the period from 12.92% to 14.05% (Table 4). Overall, the land use pattern shows that the fallow and uncultivable land area decreased while the increased during the same period.

Table 4: Trends in Land-use Pattern in Farrukhabad (as % of the 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	Pasturel and	Area under trees and gardens	Net Sown Area
1	2	3	4	5	6	7	8	9	10	11
2009-10	219911	0.24	1.78	10.65	2.12	2.89	12.92	0.28	1.69	67.44
2010-11	219911	0.24	1.71	10.50	2.13	2.73	13.11	0.28	1.72	67.59
2011-12	219911	0.13	1.69	9.69	2.33	3.40	13.23	0.28	1.48	67.76
2012-13	219911	0.12	1.70	10.13	2.13	2.70	13.46	0.28	1.69	67.79
2013-14	219911	0.12	1.56	9.23	2.60	3.40	13.48	0.28	1.46	67.88
2014-15	219911	0.12	3.51	10.19	2.83	3.51	13.53	0.28	1.53	64.50
2015-16	219911	0.12	3.51	10.19	2.83	3.51	13.53	0.28	1.53	64.50
2016-17	219911	0.12	1.38	1.14	0.57	2.84	14.05	0.31	0.71	78.88
2017-18	219911	0.12	1.38	1.14	0.57	2.84	14.05	0.31	0.71	78.88

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

2.3.2 Trends in Operational Land Holdings

In Farrukhabad district, the total number of operational farms increased from 250 thousand in 2010-11 to 254 thousand in 2015-16, a net increase of 1.60%. 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 landholdings positions in the district are marginal and small. These two size categories represented around 94.41% in the district in 2015-16, while the corresponding proportion in the state was 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. However, marginal land holdings increased in 2015-16.

Table 5: Distribution of Operational Holdings by Size-categories of farms (in %) in Farrukhabad

	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.)
Farrukhabad	2010-11	82.45	11.73	4.63	1.16	0.03	250
	2015-16	83.06	11.35	4.49	1.06	0.03	254
							[1.60]
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	0.1	23822
							[2.13]

Source: Compiled from Statistical Diary 2018-19, UPDES. Figures in [] are percentage increase/decrease in 2015-16 over 2010-11.

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

2.3.3.1 The Trend in Cropping Patterns

Rice, Wheat, Maize, and Potato 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 (31.84%), followed by Maize (16.34%) and Potato (16.27%). These three crops constitute around 64.45% of the GCA. The area shared by the total cereals has decreased from 60.09% in 2010-11 to 56.12% in 2017-18. The main pulses produced are Urad and Masoor, while the rest of the pulses are not significantly produced. The total pulse acreage has decreased slightly from 3.51% in 2010-11 to 3.37% in 2017-18. Thus, the food grains cover a majority (average, 62.04%) of the GCA. Mustard is the only major oilseeds crop produced, and the total oilseed acreage has decreased from 4.68% in 2010-11 to 4.41% in 2017-18. The area under sugarcane has decreased over the years, but at the same time, the area under Potato has increased. In general, there is no significant change in the cultivation pattern during the study period, except that the NSA has increased over the years, from 71.33% in 2010-11 to 75.97% in 2017-18. The average cropping intensity reported in the district is 142.35.

Table 6: Trends in Cropping Pattern (as % GSA) and Cropping Intensity

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	6.53	6.40	6.40	6.32	5.75	5.75	5.53	5.53
Wheat	35.42	35.05	35.37	35.64	33.09	33.09	31.84	31.84
Maize	15.16	15.19	15.16	15.35	16.98	16.98	16.34	16.34
Other Cereals	2.98	2.88	2.85	2.82	2.50	2.50	2.41	2.41
Total Cereals	60.09	59.52	59.78	60.13	58.33	58.33	56.12	56.12
Urad	1.19	1.21	1.20	1.09	1.22	1.22	1.17	1.17
Masoor	0.57	0.55	0.55	0.53	0.91	0.91	0.88	0.88

Other Pulses	1.75	1.85	1.84	1.82	1.37	1.37	1.32	1.32
Total Pulses	3.51	3.62	3.58	3.44	3.50	3.50	3.37	3.37
Total Foodgrains	63.60	63.13	63.36	63.57	61.83	61.83	59.48	59.48
Mustard	3.09	3.06	3.08	3.05	3.40	3.40	3.27	3.27
Other Oilseeds	1.59	1.46	1.48	1.45	1.18	1.18	1.13	1.13
Total Oilseeds	4.68	4.52	4.57	4.50	4.58	4.58	4.41	4.41
Sugarcane	3.62	3.64	3.67	3.66	3.49	3.49	3.35	3.35
Potato	15.14	15.68	15.49	15.49	16.91	16.91	16.27	16.27
Net Sown Area	71.33	70.66	70.36	70.46	64.57	64.57	75.97	75.97
Gross Sown Area (in 1000 Ha)	208.38	210.89	211.86	211.86	219.69	219.69	228.35	228.35
Cropping Intensity	140.20	141.52	142.12	141.93	154.88	154.88	131.64	131.64
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

2.3.3.2 Trends in per hectare yield of principal crops

Table 7 shows that the yield per hectare of most crops varies from year to year. However, the yield for most of the major crops has increased in the latter years of the study. This can be due to improved irrigation facilities and the availability of better infrastructure. Wheat and Maize are the major crops, and their per hectare yield (46.48 qtls and 29.80 qtls respectively, in 2017-18) are also high. Per hectare yield of total cereals increased from 28.40 qtls in 2010-11 to 39.33 qtls in 2017-18. Similarly, per hectare yield of total pulses increased from 10.52 qtls in 2010-11 to 11.62 qtls in 2017-18. However, the yield of Pulses is less than that of cereals, following which the total production of pulses is less. The yield of total oilseeds increased from 12.58 qtls in 2010-11 to 13.56 qtls in 2017-18. This 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, but, on average, it increased in the latter years of the study. The per hectare yield of sugarcane, on average, is 620.36 qtls. The yield of Potato is very high, average, 258.32 qtls/ha. Since Potato is a high-value crop, it can help in raising the farmers income if proper marketing and infrastructure support is provided. In summary, all crop yields show year-over-year fluctuations. 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 Farrukhabad District (Qtls)

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	15.04	22.57	28.18	28.00	28.08	19.64	19.64	34.10
Wheat	35.90	37.92	36.12	33.42	26.92	31.71	31.71	46.48
Maize	19.02	25.19	27.31	22.91	18.86	22.18	22.18	29.80
Total Cereal	28.40	31.96	32.18	29.34	24.17	27.17	27.17	39.33
Urad	9.02	7.64	7.47	6.66	6.20	6.48	6.48	15.41
Masoor	10.40	8.56	12.20	6.80	5.11	7.46	7.46	3.97
Total Pulses	10.52	10.28	10.56	8.57	5.77	8.03	8.03	11.62
Total Food Grains	27.41	30.71	30.96	28.22	23.13	26.09	26.09	37.76

Mustard	15.20	13.79	14.65	11.79	6.21	10.48	10.48	16.31
Total Oilseeds	12.58	10.99	11.28	8.97	5.16	8.49	8.49	13.56
Sugarcane	572.00	624.88	627.28	617.16	606.92	608.95	608.95	696.73
Potato	262.97	229.11	238.12	229.07	226.55	289.88	289.88	300.97
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

2.3.3.3 Trends in Production of Principal Crops

Table 8 shows the trends in the production of the main crops over the years. Wheat, Maize, Sugarcane, and Potato dominate the production. In 2017-18, Maize (111.19 thousand tons), and Wheat (337.88 thousand tons) formed a major part of the total cereal production (503.97 thousand tons). Among pulses, Urad and Masoor occupied the highest production. Urad had a production of 4.12 thousand tons, and Masoor had a production of 0.80 thousand tons in 2017-18. Although there has been a significant variation in the production of these pulses over the years, they still represent around 55% of the total pulse production. Mustard production was 12.18 thousand tons, which represented around 90% of the total oilseed production in 2017-18. Sugarcane is another important crop whose production has been significant in the district (533.76 thousand tons in 2017-18). Potato production has also been significant over the years (1118.06 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 changes in weather and partly due to market conditions. Proper insurance arrangements are the need of the hour so that they get assured income and can take more risk and diversify their production.

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

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	20.46	30.46	38.18	37.49	35.47	24.82	24.82	43.08
Wheat	264.96	280.25	270.71	252.34	195.70	230.50	230.50	337.88
Maize	60.06	80.69	87.70	74.51	70.36	82.75	82.75	111.19
Other Cereals	10.11	9.68	10.94	9.48	8.23	10.10	10.10	11.82
Total Cereals	355.59	401.08	407.54	373.83	309.76	348.16	348.16	503.97
Urad	2.24	1.95	1.89	1.54	1.66	1.73	1.73	4.12
Masoor	1.23	1.00	1.42	0.76	1.02	1.49	1.49	0.80
Other Pulses	4.22	4.89	4.70	3.94	1.75	2.94	3.00	4.02
Total Pulses	7.69	7.84	8.02	6.25	4.43	6.17	6.17	8.93
Total Foodgrains	363.28	408.92	415.55	380.07	314.20	354.33	354.33	512.91
Mustard	9.80	8.89	9.57	7.63	4.64	7.83	7.83	12.18
Other Oilseeds	2.48	1.58	1.35	0.93	0.56	0.71	0.71	1.47
Total Oilseeds	12.28	10.47	10.92	8.56	5.20	8.54	8.54	13.65
Sugarcane	431.12	480.16	487.33	478.48	464.96	466.52	466.52	533.76

Potato	829.80	757.74	781.56	751.51	841.59	1076.85	1076.85	1118.06
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

2.3.3.4 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) of the area, production, and yield of the main crops. Among different crops, the lowest variability in the area is observed in Sugarcane (0.92%), followed by Wheat (1.53%) and Rice (3.60%), and the highest in Masoor (28.48%). The variability in the area under total pulses (2.26%) is more than the variability in the area under total cereals (0.97%). Since Rice and Wheat dominate the production, the variability in the area under total food grains is also relatively low (0.99%).

Table 9: Variability in Area, Production, and Yield of Principal Crops (2010-11 to 2017-18)

	Area (1000 Ha)			Production (1000 Ha)			Yield (Qtl./Ha)		
Crop/Year	Average	SD	COV	Average	SD	COV	Average	SD	COV
Rice	13.07	0.47	3.60	31.85	7.94	24.94	24.41	6.22	25.49
Wheat	73.62	1.12	1.53	257.86	42.28	16.40	35.02	5.75	16.43
Maize	34.69	2.82	8.12	81.25	14.91	18.35	23.43	3.83	16.33
Total Cereals	127.17	1.24	0.97	381.01	58.75	15.42	29.96	4.61	15.37
Urad	2.57	0.13	5.08	2.11	0.84	39.91	8.17	3.07	37.54
Masoor	1.58	0.45	28.48	1.15	0.29	25.43	7.74	2.67	34.71
Total Pulses	7.57	0.17	2.26	6.94	1.44	20.71	9.17	1.91	20.83
Total Foodgrains	134.74	1.34	0.99	387.95	59.98	15.46	28.80	4.44	15.40
Mustard	6.97	0.53	7.67	8.55	2.17	25.44	12.36	3.30	26.68
Total Oilseeds	9.84	0.24	2.48	9.77	2.63	26.96	9.94	2.70	27.15
Sugarcane	7.67	0.07	0.92	476.11	28.80	6.05	620.36	35.23	5.68
Potato	34.86	2.49	7.15	904.24	157.94	17.47	258.32	31.53	12.21
Source: http://updes.up.nic.in/spiderreports/intialisePage.action									

The variability in production depends on the variability in the cultivated area and the variability in 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 Urad (39.91%), followed by Masoor (26.04%), Mustard (25.44%), Rice (24.94%), and Maize (18.35%). 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 Sugarcane (6.05%), followed by Wheat (16.40%) and Potato (17.47%).

In the case of yield, the greatest variability is estimated in Urad (37.54%), followed by Masoor (34.46%) and Mustard (26.68%). Yield variabilities in total cereals (15.37%) and total food grains

(15.40%) are lower as compared to that in total pulses (20.83%). Potato, 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.

2.3.4 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, while, Potato and sugarcane have, on average, a higher share in VOP than GCA. Farrukhabad is mainly a food grain production district; therefore, food grains account for around 62.04% of the gross area of the crops. Similarly, total foodgrains account for nearly 37.57% of the total value of the agricultural product. Three crops - Wheat, paddy, and Potato together accounted for, on average, around 55.96% of GCA and 74.96% of the total VOP. Overall, the total agricultural GCA has increased in the latter years of the study (average, 217.38 thousand hectares). The total value of the product has also increased significantly, that is, 1335.58 Cr. Rs. in 2010-11 to 2165.37 Cr. Rs in 2017-18.

Table 10: Share of Principal crops Total GCA and Total Value of agriculture products in Farrukhabad

Crop	% Share in	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Wheat	GCA	35.42	35.05	35.37	35.64	33.09	33.09	31.84	31.84
	VOP	22.58	29.77	25.47	23.48	23.94	21.27	21.27	27.31
Paddy	GCA	6.53	6.40	6.40	6.32	5.75	5.75	5.53	5.53
	VOP	2.19	3.98	4.37	4.64	5.99	3.57	3.57	5.09
Total Cereals	GCA	60.09	59.52	59.78	60.13	58.33	58.33	56.12	56.12
	VOP	29.59	41.81	37.57	34.45	37.56	30.52	30.52	42.00
Total Pulses	GCA	3.51	3.62	3.58	3.44	3.50	3.50	3.37	3.37
	VOP	1.89	1.66	1.98	2.25	2.38	2.49	2.49	1.42
Total Food Grains	GCA	63.60	63.13	63.36	63.57	61.83	61.83	59.48	59.48
	VOP	31.48	43.47	39.55	36.69	39.94	33.01	33.00	43.41
Total Oilseeds	GCA	4.68	4.52	4.57	4.50	4.58	4.58	4.41	4.41
	VOP	2.24	2.87	2.72	1.81	1.41	1.59	1.59	2.21
Potato	GCA	15.14	15.68	15.49	15.49	16.91	16.91	16.27	16.27
	VOP	49.58	47.51	42.03	43.56	39.86	52.36	52.37	43.89
Sugarcane	GCA	3.62	3.64	3.67	3.66	3.49	3.49	3.35	3.35
	VOP	8.07	9.67	8.94	8.26	10.28	6.48	6.48	8.01
Paddy + wheat + potato	GCA	57.09	57.13	57.26	57.44	55.75	55.75	53.64	53.64
	VOP	74.35	81.26	71.86	71.68	69.80	77.21	77.21	76.29
Total Agriculture	GCA (1000 Ha)	208.38	210.89	211.86	211.86	219.69	219.69	228.35	228.35
	VOP (in Cr Rs)	1335.58	1240.92	1417.06	1592.44	1266.81	2158.61	2158.44	2165.37
Per Worker VOP (Rs.1000 at current prices) in **Farrukhabad**		-	41.76	57.55	54.00	83.72	72.71	79.13	75.04

Per Worker VOP (Rs.1000 at current prices) in **UP**	-	40.66	48.69	52.50	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 Farrukhabad district increased from Rs.41.76 thousand in 2011-12 to Rs. 75.04 thousand in 2017-18, a net increase of 79.66% 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 per worker value of agricultural output 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 1.0272 in 2011-12 to 1.0767 in 2017-18.

2.3.5 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 69.43% of the total fertilizers used, while the proportions of phosphorus and potassium were 21.88% and 8.70%, respectively. In 2017-18, however, the nitrogen share decreased to 67.62%, while the phosphorus share increased to 26.89%, and the potassium share decreased to 5.48%. 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 from year to year, which can be due to several factors, including rainfall patterns and cultivation patterns. The overall use of chemical fertilizers has decreased in the district from 428.93 kg/ ha GSA in 2010-11 to 143.06 kg/ ha GSA in 2017-18, which is a good sign. However, still, the authorities need to take steps to further reduce their consumption as 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)

Fertilizer/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Nitrogen	297.80	234.27	162.32	106.52	110.21	99.56	224.01	96.74
Phosphorous	93.83	88.70	80.50	28.30	32.12	37.37	82.84	38.48
Potassium	37.30	20.17	23.28	3.84	6.65	7.04	33.70	7.84
Total	428.93	343.14	266.10	138.66	148.99	143.98	340.55	143.06
Gross Sown Area (Ha)	208375	210892	211864	211861	219690	219690	228352	228352
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

2.3.6 Irrigation Structure and Status

2.3.6.1 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 (144 km) over the years. A number of ground-level pump sets have also remained constant (10) over the years. The number of wells has also remained constant (29) over the years. The number of Government tube wells increased from 285 in 2010-11 to 325 in 2018-19. Shallow, medium, and deep tube wells increased by 3.85%, 24.37%, and 33.33%, 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 94.87% and 88.18%, 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)	144	144	144	144	144	144	144	144	144
No. of Govt. Tube wells	285	336	336	336	353	355	325	325	325
No of Wells	29	29	29	29	29	29	29	29	29
No. of Ground-level Pump set	10	10	10	10	10	10	10	10	10
Shallow Tube well	33568	33568	34164	34164	34372	34476	34570	34862	34862
Medium Tube well	521	521	571	571	587	621	621	648	648
Deep Tube well	123	123	135	135	150	156	156	164	164
% Of NIA	92.71	93.18	92.70	93.48	96.04	96.04	97.42	97.42	-
% Of GIA	85.17	85.44	85.45	85.69	88.00	88.00	93.85	93.85	-

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

2.3.6.2 Source-wise area under irrigation

Groundwater (GW) is the main sources of irrigation in the district. The canal's share in the NIA (average, 1.93%) has decreased over the years, and the share of wells and tube wells in NIA (average, 98.07%) has increased over the years. This shows the increased dependency of the district on the groundwater for irrigation, and it can have serious environmental issues if such a pattern continues in the long run.

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

Source/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Canal (surface Irri.)	1.94	2.06	2.86	2.12	2.91	2.91	0.33	0.33

Wells And Tube-wells (GW Irri.)	98.06	97.94	97.14	97.88	97.09	97.09	99.67	99.67
NIA (1000 ha)	137.80	138.86	138.20	139.54	136.23	136.23	169.00	169.00
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

2.3.6.3 Crop-wise Irrigated Area

Table 14 shows that a majority area under Rice (average, 98.76%), Wheat (average, 99.80%), Potato (average, 100%), and Sugarcane (average, 99.85%) is irrigated. Percentages of the irrigated area under pulses (average, 68.19%) and oilseeds (average, 74.49%) are relatively less.

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

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	97.60	98.01	98.15	98.40	99.48	99.48	99.48	99.48
Wheat	99.71	99.71	99.72	99.72	99.88	99.88	99.88	99.88
Total Cereal	82.97	83.24	83.40	83.59	85.96	85.96	85.96	85.96
Total Pulses	65.16	65.69	64.57	65.00	71.27	71.27	71.28	71.28
Total Foodgrains	81.99	82.23	82.34	82.58	85.12	85.12	85.13	85.13
Total Oilseeds	74.15	73.07	72.54	73.09	75.77	75.77	75.77	75.77
Sugarcane	99.34	100	99.58	99.90	100	100	100	100
Potato	100	100	100	100	100	100	100	100
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

2.3.7 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 113.94 KWH in 2014-15 to 266.06 KWH in 2019-20, a net increase of approximately 133.51%. 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, 26.59%) in the total electricity consumption in the district is quite significant. 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

Division/ Year	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Per Capita electricity consumption (KWH)	113.94	110.48	206.67	227.15	252.3	266.06
% Of electricity consumed in Agriculture sector to total consumption	30.21	37.32	33.79	32.63	28.27	27.33
Source: District-wise Development Indicators file.						

2.3.8 Status of Agriculture Market

Table 16 shows the marketing infrastructure in the district. It has four main markets and three sub-markets. The number of regulated mandis per lakh hectare of NSA decreased from 4.69 in 2013-14 to 4.03 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 remuneratively.

Table 16: Status of Agriculture Markets in Farrukhabad

Category/Year	2013 -14	2014 -15	2015 -16	2016 -17	2017 -18	2018 -19	2019 -20
Main Markets (No.)	4	4	4	4	4	4	4
Submarkets (No.)	3	3	3	3	3	3	3
Total Markets (No.)	7	7	7	7	7	7	7
No. of Regulated mandis per lakh Ha. of net area sown	4.69	3.18	-	2.31	2.82	4.03	-

Source: Compiled from Statistical Abstract, Uttar Pradesh and District-wise Development Indicators file.

2.3.9 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 years of the conversion period.

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. However, 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 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 95 groups in five development blocks. The highest number of groups are in Rajepur (33), followed by Kamalganj (21), Barhpur (20), Kaimganj (14), and Shamsabad (7). Significantly high variation can be seen in the number of farmers per group in the district. 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. No organic cluster under the Namami Gange scheme is reported till date.

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

S. No.	Block	Scheme	No. of groups	No. of farmers in groups			
				Total	Average	Median	SD
1	Barhpur	PKVY	20	687	34.35	33	9.29
2	Kaimganj	PKVY	14	467	33.35	32	9.07
3	Kamal Ganj	PKVY	21	695	33.09	33	6.23
4	Rajepur	PKVY	33	1042	31.57	30	7.92
5	Shamsabad	PKVY	7	231	33	29	13.11
6	District Total	PKVY	95	3122	32.86	32	8.4
		Total	95	3122	32.86	32	8.4

Source: https://pgsindia-ncof.gov.in/LGList.aspx

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 farming system, 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. The knowledge and awareness level regarding practices under organic farming was inadequate among farmers.

2.3.10 Livestock Sector

2.3.10.1 Trends in Livestock Population

Livestock forms an integrated part of the rural economy. Table 18 shows that the number of indigenous male and female cattle has decreased considerably from 79573 in 1997 to 6460 in 2019 and from 76335 in 1997 to 66846 in 2019, respectively. The number of exotic male cattle has decreased from 9580 in 1997 to 2380 in 2019, but the number of exotic female cattle has increased considerably from 15742 in 1997 to 38979 in 2019. Thus, the total number of cattle decreased only slightly from 181230 in 1997 to 114665 in 2019, thus, a net decrease of 36.72%. Similarly, the number of male buffaloes has decreased, but the number of female buffaloes has increased considerably over the years. Thus, a net increase of 61.35% in 2019 compared to that in 1997 is observed in the total population of buffalo. A significant reduction in the population of indigenous sheep is observed (57.30%) 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 59.60%. The total population of goats decreased from 177942 in 1997 to 119358 in 2019, a net decrease of 32.92%. The total pig population decreased considerably from 5146 in 1997 to 3050 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 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 21.22% share in the agriculture and allied activities sector and grew at a significant average annual growth rate of 9.50% from 2011-12 to 2018-19.

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

	Category	1997	2003	2007	2012	2019
Indigenous Cattle	Total Male	79573	50982	45648	26903	6460
	Total Female	76335	66907	66107	52070	66846
	Total	155908	117889	111755	78973	73306

Exotic Cattle	Total Male	9580	2737	4120	10009	2380
	Total Female	15742	7746	9229	23834	38979
	Total	25322	10483	13349	33843	41359
Total Cattle		181230	128372	125104	112816	114665
Buffalo	Total Male	89061	67493	70751	79925	20223
	Total Female	185928	162159	166641	210928	423478
	Total	274989	229652	237392	290853	443701
Sheep	Total Indigenous Sheep	17484	13246	12943	11858	7465
	Total Exotic Sheep	2021	0	165	1617	415
	Total Sheep	19505	13246	13108	13475	7880
Goat	Total	177942	152135	165073	127048	119358
Pig	Total Indigenous Pig		18262	18419	8923	2760
	Total Exotic Pig	31061	129	129	1820	290
	Total Pig	5146	18391	18548	10743	3050
Total Livestock		698215	547519	562504	557749	-
Total Poultry		78779	57549	49277	55224	-
Source: http://updes.up.nic.in/spiderreports/intialisePage.action And http://dahd.nic.in/animal-husbandry-statistics						

2.3.10.2 Cattle Care Centre

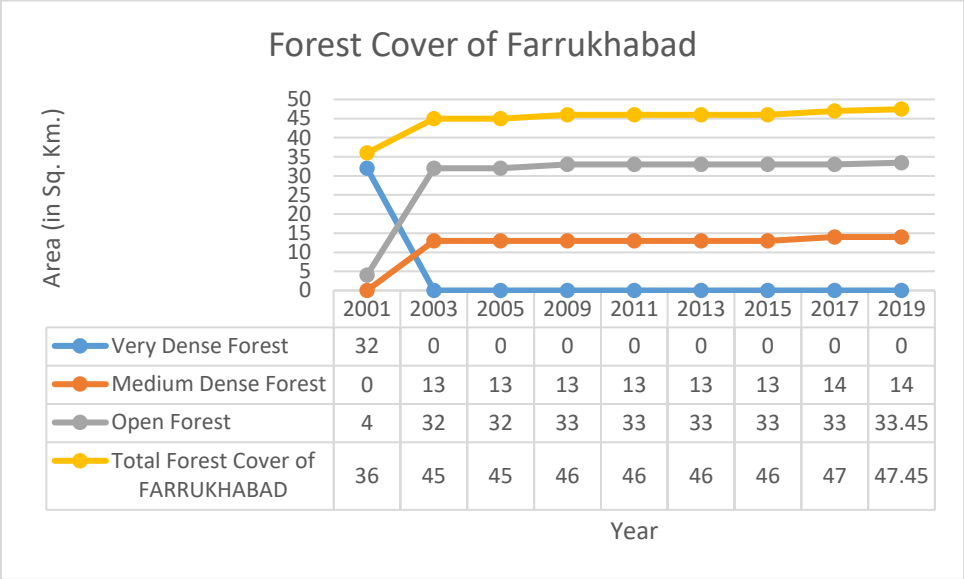
Table 19 shows that Farrukhabad district has an active network of cattle hospitals and development centres, which are very necessary for the livestock sub-sector to grow. The number of cattle hospitals has increased from 18 in 2010-11 to 27 in 2018-19. The number of cattle development centres (24) has remained constant over the years. The number of man-made reproduction centres increased from 27 in 2010-11 to 52 in 2018-19. There are very few sheep and pig development centres which might be one of the reasons for the declining sheep and pig population in the district.

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

Category	2010 -11	2011 -12	2012 -13	2013 -14	2014 -15	2015 -16	2016 -17	2017 -18	2018 -19
Cattle Hospital	18	18	18	27	27	27	27	27	27
D- category Cattle Dispensary	3	3	3	3	3	3	3	3	3
Cattle Development Centre	24	24	24	24	24	24	24	24	24
Man-Made Reproduction Centre	27	27	27	55	55	52	52	52	52
Pig Development Centre	5	5	5	5	5	5	5	5	5
Source: http://updes.up.nic.in/spiderreports/intialisePage.action									

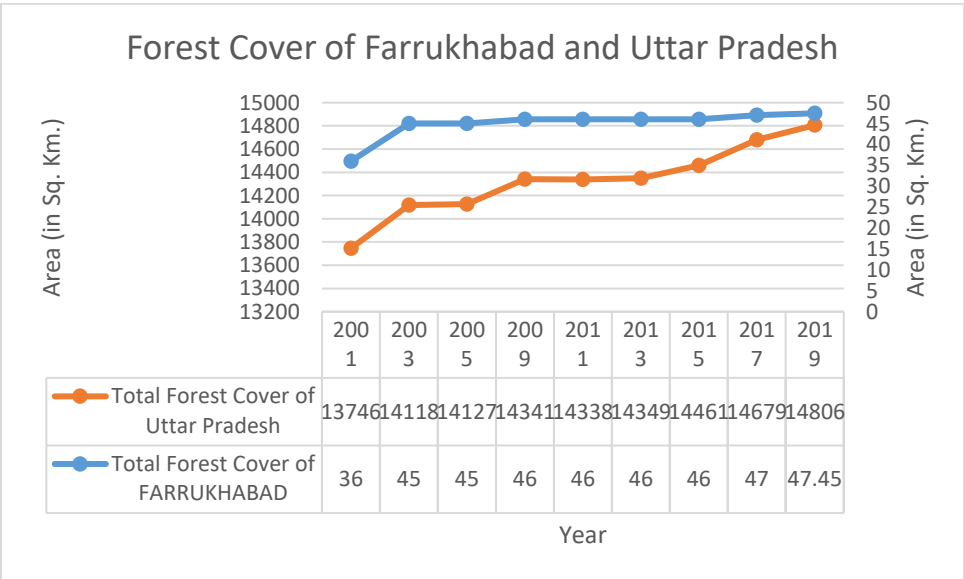
2.2 FORESTRY

1. **Baseline Data Analysis/ Quantitative Data Analysis**



	2001	2003	2005	2009	2011	2013	2015	2017	2019
Very Dense Forest	32	0	0	0	0	0	0	0	0
Medium Dense Forest	0	13	13	13	13	13	13	14	14
Open Forest	4	32	32	33	33	33	33	33	33.45
Total Forest Cover of FARRUKHABAD	36	45	45	46	46	46	46	47	47.45

According to the ISFR reports, the Farrukhabad district does not have major forest. Total of 46.45 Sq.Km. of Forest cover, majorly open forest followed by medium dense forest are found.



	2001	2003	2005	2009	2011	2013	2015	2017	2019
Total Forest Cover of Uttar Pradesh	13746	14118	14127	14341	14338	14349	14461	14679	14806
Total Forest Cover of FARRUKHABAD	36	45	45	46	46	46	46	47	47.45

Between 2001 and 2019, the forest cover of Farrukhabad increased slightly. The forest cover of Uttar Pradesh has increased between 2001-2019. **2.2.1 Biodiversity**

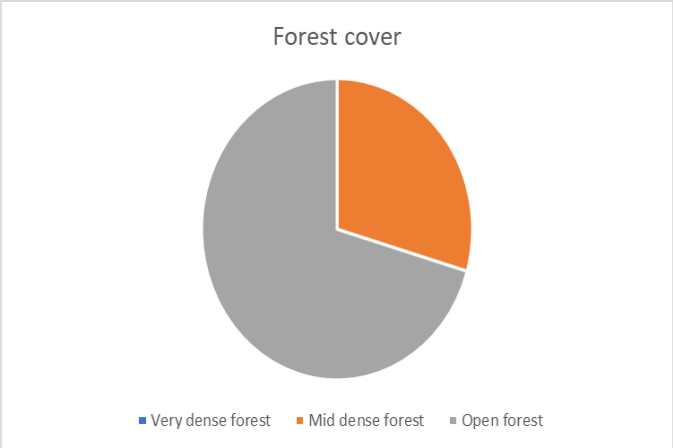
The district's biodiversity data includes various crop production, livestock population, bird species, and forest cover. The crop production trend shows an increase in crop production. Forest data shows that forest cover was increased by 0.45% in 2019. There are 349 bird species and six rare species of bird in the district.

Table 1 Bird species recorded in the district.

Number of species	349
Number of rare/accidental species	6

Table 2 Forest cover in a square kilometer.

Geographical area	Very dense forest	Mid dense forest	Open forest	Total	% of Geographical area `	Change with respect to 2017 assessment	Scrub
2181	0	14.00	33.45	47.45	2.18	0.45	2.00



2.3 TOURISM

1. **Domestic/foreign visitors in different years in Farrukhabad**

Year	Domestic	International
2013	NA	NA
2014	NA	NA
2015	NA	NA

2016	NA	NA
2017	NA	NA
2018	733668	233
2019	1359836	263
2020	376021	48

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

a. The above-given data table-2 is taken from the Uttar Pradesh tourism website. The data table shows the number of tourists visiting Prayagraj for tourism from 2013 to 2020. The tourist visits are bifurcated into two different groups – Domestic and Foreign tourists
b. Tourist arrival data is available 2018 onward.
c. In the year 2019 the district witnessed 85.35% growth in the number of tourists compared to 2018 data.
d. In 2020 -72.35%(negative growth) in the number of tourists can be seen in the figure.

2. Domestic and foreign visitors in different years in particular state

The Indian and Foreign Tourist visits in Uttar Pradesh from 2016 to 2020						
Year	**Indian**	**Foreigner**	**Total**	**Percentage increase/ reduce in comparison to previous year**		
				Indian (%)	**Foreigner (%)**	**Total**
2016	**213544204**	**3156812**	**216701016**	**3.4**	**1.69**	**3.37**
2017	**233977619**	**3556204**	**237533823**	**9.56**	**12.65**	**9.61**
2018	**285079848**	**3780752**	**288860600**	**21.84**	**6.31**	**21.6**
2019	**535855162**	**4745181**	**540600343**	**87.96**	**25.5**	**87.14**
2020	**86122293**	**890931**	**87013224**	**-83.92**	**81.92**	**-83.9**

Table-2; Source: Dept. of Tourism, Uttar Pradesh Government

a. The above-given graph shows the number of visitors who visited Uttar Pradesh from 2016 to 2020. In the year 2016 number of domestic tourists increased to 3.4% compared to 2015, and foreign tourists increased to 1.69%. In the year 2017, the growth rate increased to 9.56% in domestic tourists and 12.65% in foreign tourists.

b. Data shows that 2018 had been a fruitful year for Uttar Pradesh tourism. Uttar Pradesh encountered a 21.6% increase in tourist numbers from the previous year, a significant change in numbers. However, the patten is not similar in Kanpur

c. 2019 was a year when the global event Kumbh Mela 2019 was organized in Prayagraj (a District in Uttar Pradesh). The results are visible in the numbers (given in the data table above), 87.14% increase in the number of tourists compared to 2018. The data also shows foreign visitors increased to 25% in 2019. The enhanced response of tourists shows the consumer behaviour, which majorly depends on advertisements. A commodity that has been presented to be associate with the emotions of consumers has a high potential to sustain and perform better than its competitors.

d. The surge in the number of tourists in Kumbh Mela 2019 is attributed to expensive advertisements, extra-standard facilities, and a political campaign. All this together made the event a mega event. Security aspect in such organization is a significant factor which influences the success and failure. Kumbh Mela 2019 witnessed extra tight security and surveillance to prevent stampedes and violence in the Mela.

e. Such grand organization of events are also a factor on which the number of tourists to other districts (especially domestic tourists) and states (especially foreigner tourists) depend.

f. The scenario of foreign tourists is worse compared to state data. Even the mega event Kumbh mela could not increase the number of foreign tourists in Kanpur. This signifies the lack of transfer of information.

g. The district witnessed the increased growth in number of domestic tourists but not in foreign tourists. It is necessary to understand the shortfalls before working on upcoming policies and agendas.

3. Budget allotted/ Expenditure in different years by tourism dept.

Budget -Department of Tourism, in Different Years		
Year	**Budget in Rupees**	**Percent increase or decrease**
2015-16	**2,245,098,000.00**	
2016-17	**1,992,912,000.00**	**-11.23%**
2017-18	**2,671,016,000.00**	**34.03%**
2018-19	**6,870,209,000.00**	**157.21%**
2019-20	**8,596,205,000.00**	**25.12%**
2020-21	**10,382,037,000.00**	**20.77%**
2021-22	**10,759,153,000.00**	**3.63%**

Table-3; Source: Dept. of Tourism, Uttar Pradesh Government

The above-given table shows the budget sanctioned for the Department of Tourism, Uttar Pradesh, from the Financial Year (FY) 2015-16 to 2021-22. In the initial FYs, which are 2015-16, 2016-17, 2017-18, the amount sanctioned to the department is significantly low. In the FY 2018-19 Department received a 157.21% increased budget. Which followed a 25% increase in the next FY-2019-20. A similar trend is visible in the number of tourists, skyrocketing of tourists is found in the same years. This directly implies that the money spent is directly proportional to the tourists in particular FY.

2.4 WETLANDS

The district is known for large number of small wetlands. The data in Table 5 represent the number of wetlands and their area representation in the district. There are around 485 wetlands sized greater than 2.25 Ha and 285 less than 2.25 Ha areas. The region consists of small and medium size wetlands only, generally less than 200 Ha in area and there are 5 wetlands with size more than 200 Ha.

Table 5: Wetland Data of Farrukhabad 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	22	23	1	0	1	6	6	5	4	0	0	0	11
Ox-bow lakes/cut off meanders	18	107	89	0	4	2	2	8	2	0	0	0	7
High altitude Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0
Riverine Wetlands	139	170	31	0	8	19	26	48	33	5	0	0	51
Waterlogged	46	54	8	0	8	11	10	11	6	0	0	0	14
River/Stream	0	81	81	0	0	0	0	0	0	0	0	0	0
Man-made Wetlands	**NRCD**	**NWIA**	**Diff.**	**<2.25**	**<5**	**<10**	**<20**	**<50**	**<200**	**<500**	**<1000**	**>1000**	**AV**
Reservoirs/Barrages	0	0	0	0	0	0	0	0	0	0	0	0	0
Tanks/ponds	5	6	1	0	2	3	0	0	0	0	0	0	1
Waterlogged	40	44	4	0	12	15	8	4	1	0	0	0	16
Salt pans	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (770)	**270**	**485**	**215**	**285**	**35**	**56**	**52**	**76**	**46**	**5**	**0**	**0**	**100**

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

- District comprises 770 wetlands; most of them are waterlogged and riverine wetlands.
- The wetland size is small and medium sized in general.
- The number of natural wetlands is more than man-made.
- Many wetlands both man-made and natural are waterlogged.
- 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, 71.04% households in the district depend on kerosene for the main source of lightning, followed by 27.50% using electricity and only 0.63% using solar.

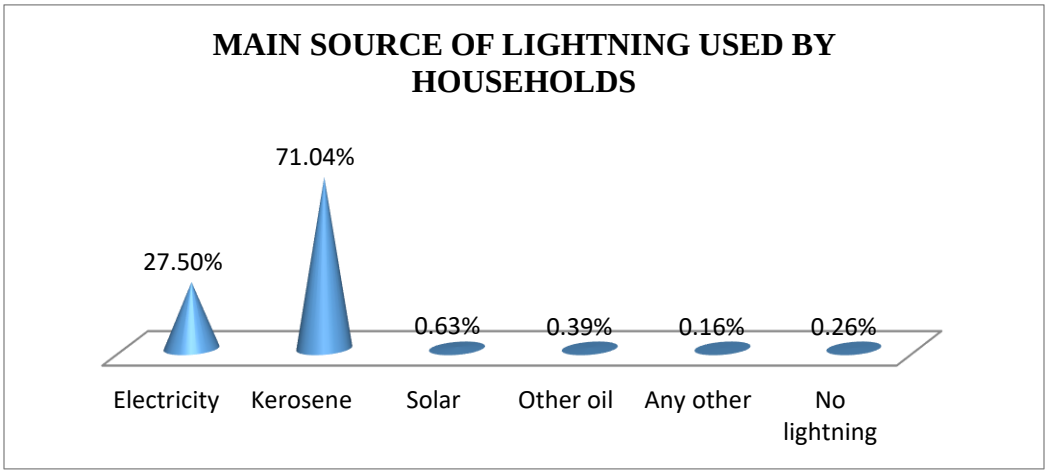


Fig. 1

A 50 kw solar panel has been installed at Vikas Bhawan, Farrukhabad as mentioned in the progress report by UPNEDA.

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), 49.96% households use firewood as a fuel for cooking followed by 22.47% using cowdung cake, 19.22% using LPG/PNG and 14.31% using firewood. Majority of population in the district is mainly dependent on agriculture as their primary source of income. Rice, wheat, maize, bajra, etc. are some of the major crops cultivated in the district. Rice is cultivated in 13500 ha, wheat in 73900 ha, maize in 31200 ha, bajra in 3900 ha and masoor in 100 ha of the district. The net sown area of the district is 149000 ha with the cropping intensity of 116%. A total of 3700 ha of cultivable wasteland and 21300 ha of current fallows is there in the district. The district produces 636.4 kT/Yr of agricultural biomass and 2.9 kT/Yr of forest based biomass (Kumar et. al. 2017).

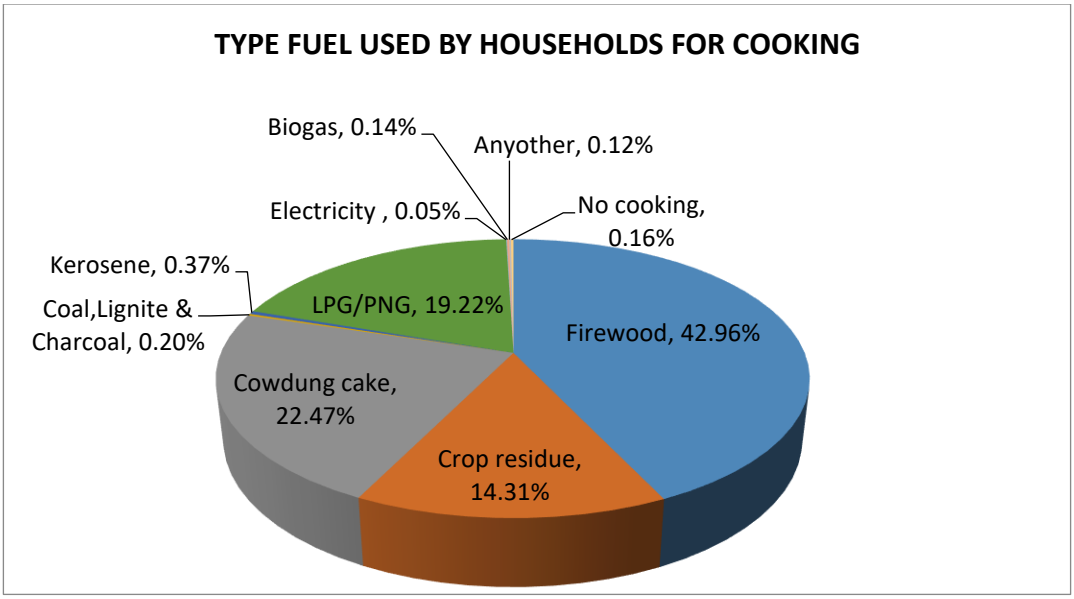


Fig. 1

2.5.3. Biogas

Sixty-three families benefitted from biogas schemes running in the district from 2002-03 to 2012-13. After 2012-13 biogas data is not available for the district. Based on the livestock population and agricultural waste biogas potential calculated. Biogas potential from animal waste was calculated as one crore m^3/year and twenty crores m^3/year. This amount of biogas generation can efficiently complete the energy demand of the district.

2.5.4. Hydro Power

No hydropower plant exists in the district. The district is situated on the banks of rivers Ganga, Ramganga, and Kali Nadi. These rivers can generate electricity by constructing the hydropower plant. However, a survey or identification of the site must require for the construction of hydropower plants.

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).

3.2.1. Biodiversity

The National Green Tribunal (NGT) collaborates with the government on Ganga cleanup and protection. On the banks of the Ganges, the NGT had ordered the construction of a biodiversity park (Navbharat times 30th June 2019).

3.2 ENERGY:

As per the data of the year 2013, Farrukhabad district energy consumption is around 1001 TJ/year and 3.6 GJ/capita/year. GHG emission of 68,925 Ton CO_2 equivalent and 0.249 Ton CO_2 equivalent/capita has been evaluated for the district.

3.2.1. Solar

According to a local daily the Ministry of Railways has started work on a plan to generate electricity by installing solar power plants on the roofs of its station buildings. Due to which the railway stations will get electricity round the clock, as well as the electricity bill of the stations will also be reduced by seventy to eighty percent. More than five thousand units of electricity will be generated daily by setting up a 990 kilowatt plant on the roofs of 17 railway stations including Chandausi (Sambhal), Bahjoi, Moradabad, Bareilly, Aonla, Farrukhabad, Hardoi, Shahjahanpur falling in Moradabad division. With this, the railway stations will not only be illuminated, but the electricity that is left will be sold to the Electricity Board.
A recent article in Jagran mentions about the power cutoffs in the district. According to which villagers and farmers are upset due to power cut. The farmers expressed their displeasure and protested against the electricity department by reaching the power house. Farmers expressed concern about drying up of crops due to lack of irrigation and demanded supply for at least 16 hours. , ballpura, Villagers of Manikpura and Hotapur etc villages gathered. The villagers said that the heat is increasing. These days power cuts are also becoming more. Supply is being provided for barely four to five hours in a day. Due to the lack of electricity, people have to suffer in the heat throughout the day. There is also the fear of drying up of crops due to lack of irrigation. It is said that in summer people need more electricity for irrigation of crops. More water is needed to save the crop. Villagers protested by raising slogans against the electricity department. Stopped the undeclared cuts and demanded that the fault be rectified soon.
According to Pugazenthi et. al. 2016, total solar power potential available in the district is 0.0674.

3.2.2. Biomass

The district deals with the problem of stubble burning as reported in India Today that the Uttar Pradesh government has answer from police chiefs of 26 districts of the state over incidents of stubble burning and absence of proper control over them despite the orders of the Supreme Court and directives of the Yogi Adityanath dispensation. The districts whose police chiefs have been asked to reply are Farrukhabad, Shamli, Meerut, Bulandshahr, Gautam Buddh Nagar, Baghpat, Hapur, Agra, Firozabad, Hathras, Kashiram Nagar, Badaun, Moradabad, Jyotibhaphule Nagar, Sambhal, Kanpur Dehat, Kannauj, Lalitpur, Banda, Hamirpur, Mahoba, Chitrakoot, Bhadohi, Amethi, Jalaun and Rampur.
The district also faces the problem of power cuts, local faults, the problem of low-voltage has now arisen. As reported in an article in Jagran that power crisis in cities and villages has deepened. Villages are getting five and urban areas only 17 are getting electricity. There are instructions from the government to provide

24 hours electricity to urban areas and 18 hours to villages. All the preparations to provide uninterrupted electricity in summer have failed. With the increase in temperature, the cut time also increases. Local faults have increased. Due to this, 17 cities and villages are not getting electricity for more than five hours. The problem of low-voltage has also arisen due to increased load. Only about nine thousand volt current is being received from the line of 11 thousand capacity. Due to this, only 160 to 180 voltage is coming to the houses. The district is facing such problems and the only solution to this appears the adaptation of renewable energy on large scale in the district.

3.2.3. Biogas:

As per the news article of 1st September 2021 by Amar Ujala, three new biogas plants is will be set up at Sitwanpur pithu Gaushala, Maudha, and Shahpur Gangpur Gaushala under the Gobar Dhan project. The capacity of the biogas plant will be 5 kW and could save the cost of electricity coming to a gaushala. The district has a high potential to generate biogas from agricultural, animal, and human waste.

3.2.4. Hydropower:

he 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. The district is near the upper Ganges or Ganga canal and can generate electricity from it.

3.3 TOURISM

Bhagwaan Vimal Nath ji Kampil Teerth

Situated at about 45 Kms. from district headquarter in Tehsil Kaimganj, it is a place of great antiquity and is said to have been founded by the Sant Kampila. It was here that the famous Svayamvara took place in which Arjun succeeded in winning the hand of Draupadi. The temple of Rameshwarnath Mahadev, which stands in the town is very old. The temple is traditionally attributed to Shatrughana brother of Rama. It is said that he had brought the idol (Lingam) of Shiva, which was worshipped by Sita, the wife of Rama in Ashok Vatika while she was held in captivity in Lanka. This idol is said to be stalled in this temple. The Sarogi community subscribed to the erection of three temples dedicated to the Jain tirthankara, Neminath which has made the place sacred to the Jains.

Sankisa Temple

Situated at about 38 Kms. to the south-west of the district headquarters. The lace is known for its association with Budha and its ancient Buddhist remains. According to the Buddhist belief it is believed that it was here that Buddha descended again upon earth after he had been for three months in heaven.

Data Analysis

Due to unavailability of records data analysis is not possible.

4 ACTION PLAN DEVELOPMENT

4.1 FORESTRY

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]

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 –

- Action plan made for cleaning Ganga and public awareness programs.
- Focus on the conservation of local species presence in the Ganga.
- Purification of polluted water through bioremediation and use it for irrigation purposes.
- For conserving biodiversity, sustainability, and climate change, various initiatives such as Mission on the sustainable Himalayan ecosystem, Green UP mission, and sustainable habitat mission have been implemented in the district.

4.2 Tourism

- **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.

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

- **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.

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		A well-researched document as a reference for other processes. Factors that affect tourism in Uttar Pradesh. Define the determinant of tourism activity.

		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.		
	Planning	● Action plans can be developed for intervention based on the research and analysis of different data and reports. ● 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. **Eg Jardodi works** should be pumped with		Planning to be based on research and previous lessons. Realistic planning for successful implementation . .

		financial and infrastructure support and eventually tourism activities ● 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 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 websites along with tour packages. • An extensive market research for the development of strategies		To attract more 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.

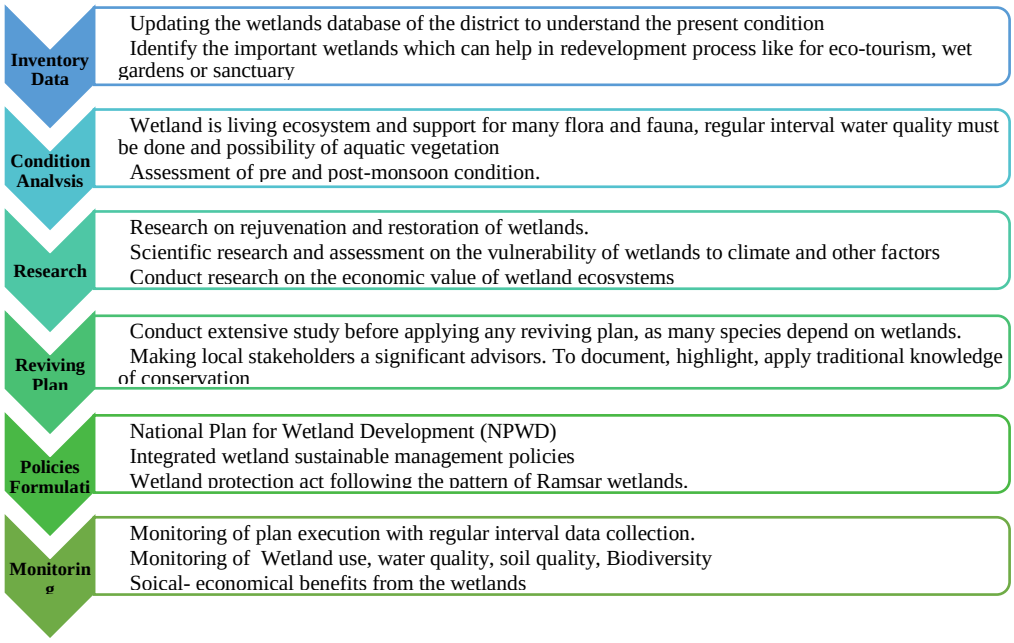
	Impact Assessment of results	• Calculating what the touch points are. • The reason for failure • The reason for the success • Lesson for next planning		To learn the lesson and find out the root cause of success and failure, to be used further with modification

SWOT analysis of Tourism

S No.	Strength	Weakness	Opportunity	Threat
	• Ganga ghats • Rich History	• Not located in the tourism zone of the state. • No data available before 2018 hence interpretation of tourist arrival is no possible. • No availability of ghats.	• Get benefitted with ecotourism spot near the district eg. Pilibhit tiger reserve.	• Pollution • Overlooked district. • Far from the state capital. • Under funding to develop tourism in the district.

4.3 WETLANDS

The district is comprising of some of the healthy and wealthy wetland ecosystems. They directly or indirectly support millions of people and provide goods and services to them. They support all life forms through extensive food webs. They are a 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 and action on different fronts needs to 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

The district deals with the problem of power cutoffs, especially the farmers who do not get enough power supply so that they could easily irrigate their crops when the summers are at the peak. Farmers should be made aware of the Kusum Yojana since they have stayed aloof to solar energy in the district. Solar energy will make them independent of the power supply. A small district oriented survey would definitely help the administration decide which component of Kusum Yojana best suits the district. The Kusum Yojana should be implemented as on the lines similar to the Maharashtra. In Maharashtra component A of Kusum Yojana has been successfully implemented under Government of Maharashtra's Krishi Vahini Yojana. Government should pay attention on strengthening the infrastructure of the district. This would help in increasing the Solar rooftop panel installations under the National Solar Mission- Phase II. Feeder segregation should be done in the villages, so that DICSOMs are able to fulfill the power requirement at cheap prices in the district.Solar rooftop panel should be popularized in the district, and people especially in urban areas should be encouraged to install them, under the National solar mission. Installation of solar power units at public places should also be taken up by the district

4.4.2. Biomass

The problem of stubble burning is very common in the district Farrukhabad and hence to divert the farmers away from this, it becomes important to make them aware of the biomass energy. 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. Moreover the rice mill owners should be encouraged to set up their own biomass plants and if not possible then provisions should be made such that a group of them and own a single biomass plants. Community based biomass plants should be developed from the village panchayats.

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 as the district has a lot of fallow land.

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.

4.4.4. Biogas:

- All Gaushala present in the district should use biogas plants to reutilize cow dung for electricity purposes.

4.4.5 Hydropower:

- Construct canals in villages such as Harsinghpur Kayastha, Ugarpur, Kudri Sarangpur, Tritham ki Madaiya, Jograjpur, and investigate the potential of canals for hydropower projects in the district.

5 RECOMMENDATIONS

5.1 AGRICULTURE AND ALLIED SECTORS

1. Groundwater shares over 98% of NIA in the district and number of medium and deep tube-wells increased substantially during the study period, indicating the depletion of water table. Therefore, Drip and Sprinkler irrigation systems should be encouraged, especially for vegetable and fruits cultivations. It will help to increase the water use efficiency and productivity of crops.

2. Farmers should be sensitized to the overuse of fertilizer and pesticides application.

3. Food grains constituted about 59% of the GCA in the district, while their share in the total value of agricultural output is about 43 percent. In contrast, Potato comprised 16.29 percent share in GCA and 43.89 percent share in total value of agricultural output. Although Potato is high-value crop, it is riskier than food grains and need better marketing and insurance system. The government can promote Potato micro and small units of Potato processing.

4. The share of the livestock subsector in the agriculture sector increased from 17.68% in 2011-12 to 26.54% in 2018-19, with a remarkable average annual growth rate of 9.50%. This indicates that

livestock is the key driver of agriculture growth in the district, which need to be promoted through creating an efficient marketing network and setting up processing units. Organic milk production can be incentive.

5. The share of forestry & logging in the total agriculture and allied sector is small, around 2.43% in 2018-19, but it grew with a significant average annual growth rate of 46.52%. The fishery & aquaculture share is 2.30%, but it also grew with a significant average annual growth rate of 99.24% from 2011-12 to 2018-19. These two sub-sectors of primary sector have the scope for income and livelihood generation. Action plan is required to promote fishery and agro-forestry.

6. Organic farming should be encouraged to boost soil health, reduce water-use and ensure ecological, economic and social sustainability of agriculture. It could be an economically viable option 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.

7. Training to prepare the Vermicomposting and Green manuring should be organized for the farmers.

8. About 94% of farmers in the district are small and marginal with landholdings less than two hectares. They can contribute substantial to livestock, vegetables and other labour-intensive allied farm activities.

9. There is a huge scope for mushroom cultivation for the rural youth and farm women to enhance the farmer’s income. Poly house and greenhouse could be commercially used for the high revenue crops, like capsicum and strawberry, for much returns to the farmers.

10. The district has scope for beekeeping and Sericulture. It should be encouraged among the farmers.

11. Per capita electricity consumption in the district agriculture increased significantly over the period. Since electricity consumption has increased over the years, there is a need to promote the use of solar energy use in agriculture.

12. Agriculture production is vulnerable to natural and market risks. A compulsory and subsidized crop insurance system must be adopted to protect farmers' livelihood and income.

13. A new institutional framework needs to be set up at the district level where the concerned line departments’ technical, human and financial resources may be pooled or converged together to provide customized solutions to the farmers related to technology, training, marketing needs and advisory services.

14. 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.

5.2 FORESTRY

Farrukhabad located on the bank of river Ganga, Ramganga and Kali river. According to ISFR 2019, 47.45 Sq. Km. area of Farrukhabad is covered with forest. As discussed above, the forest cover of Farrukhabad has increased slightly as compared to previous assessment of ISFR 2017. No major forest found 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.). Government can promote the afforestation, agroforestry activities by providing output based incentives.

5.2.1 Biodiversity

- Strict law and participation of local people are required to prevent forest as illegal green tree cutting is one of the problems in the district.
- Plants that are rich in medicinal, aromatic, and nutritional properties should be used in industrial applications. Cultivating threatened valued medicinal plants rather than wild harvesting may sustain traditional usage while simultaneously conserving natural populations.

5.3 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.

- Potato production is high which need to turn into finished products.

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

- It is recommended to rejuvenate and restore the water bodies of the district.

- Boost to crops like millets, oats, and pulses.

- It is recommended to promote animal husbandry, sugarcane in the area. Production enhancement and conservation of green fodder for livestock

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

- It is recommended to promote eco-tourism in the region. As the region can be development with flower garden around the wetlands area and biodiversity's.

5.4 ENERGY

5.4.1. Solar

- ❖ People should be made aware of the schemes that are presently being run to increase the solar energy penetration.
- ❖ Solar Rooftops Panels should be popularized in the district under the National Solar Mission, Phase II.
- ❖ Kusum Yojana should be popularized among the farmers.
- ❖
- ❖ Infrastructure for feeder segregation should be developed in the district.

5.4.2. Biomass

- ❖ People should be made aware of the biomass energy.
- ❖ Rice husk based biomass plants should be developed and promoted in the district.
- ❖ Research required to develop a 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.

5.4.3. Biogas

- It is recommended to check the condition of existing household biogas plants in the district and further motivate other families to install this system.

5.4.4. Hydropower

- It is recommended to install a multipurpose small hydropower plant of 1 to 5 MW capcity for electricity, irrigation, boating, etc., near villages such as Harsinghpur Kayastha, Ugarpur, Kudri Sarangpur, Tritham ki Madaiya, Jograjpur.

5.5. TOURISM

S. No.	Broad objectives / recommendations	Key activities / interventions to be planned			Monitoring & Evaluation	Impact
		2022	2023	2024		
	Encourage tourism related startups and ideas. **I**ncubation centers to develop prototype and working model with the assistance of industry leaders (tourism industry). **T**raining of skilled manpower to work in tourism	**R**esearch to figure out the factors impacting the tourism in the district. **D**evelopment of strategies to address the issues. **D**evelopment of policies to protect the ecosystem. **A**dopting PPP (Public Private Partnership) model in the	**I**mplementation of strategies. **T**raining and Incubation Centre support to innovative ideas **S**tructural developments Support to **Jardodi** Industry and native artisans.	**S**ampling for analysis. Evaluation of interventions. **R**edesigning of strategies based on Impact analysis	**I**ntervention impact- RCTs, regression analysis, propensity scores, econometrics, structural equation modelling, Contribution analysis, process tracing, Bradford Hill criteria. **T**hrough Participatory approaches and impact	**P**erformance of interventions. **W**orking model and scalability of ideas from incubation Centre. **M**ore tourist footfall. **T**rained youth to be a part of Tourism industry. **U**pgraded staff and facilities

	sector (through earn while you learn programs). **U**pgradation of UP state tourism corporation policies, the hotels and integration of PPP. Make the district a picnic hub and an ecotourism spot.	tourism sector to reduce the burden on government spendings Structural developments.			evaluations use the standard OECD-DAC criteria. **B**ased on satisfaction of pre decided key questions.	associated with UP State Tourism Corporation **R**educed impact of unlawful activities on tourism.

6. Discussion during the Report Presentation

- Farrukhabad is a historical city with a rich culture defined by the traditions of Ganga-Jamuni tahzeeb which amalgamates aspects of Hindu and Muslim cultural practices, rituals, folk and linguistic traditions.
- Farrukhabad is known for its block printing (made of wood and brass). These blocks are used on various items including blanket covers, shawls, sarees, suits, scarfs, stoles etc. The products made here are in demand not only in India but also in U.S., Brazil and several Asian and European countries.
- Shekhpur Mela of Kamalganj is also a famous place.
- Panchal Ghat at river Ganges is also a known holy place.
- Farrukhabad is also getting prominence for prospering sugar mills and an abundant production of potato and sunflower.
- Sem Ka beej namkeen is a popular and unique snack from the grounds of Farrukhabad in Uttar Pradesh.
- 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.

7. REFERENCES

- *https://www.researchgate.net/publication/314836204_Survey_on_Present_Scenario_of_Biomass_energy_and_its_future_prospect_in_Uttar_Pradesh_India*
- *http://www.nicra-icar.in/nicrarevised/images/statewiseplans/Uttar%20Pradesh/UP45-Farrukhabad-26.07.14.pdf*
- *https://www.indiatoday.in/india/story/up-government-reply-districts-police-chiefs-stubble-burning-air-1624253-2019-12-01*
- *https://www.amarujala.com/uttar-pradesh/farrukhabad/farrukhabad-news-katauti-electric-problem-farrukhabad-news-knp6940258171*
- *https://www.researchgate.net/publication/285632903_Husk_Power_Systems_Bringing_Light_to_Rural_India_and_Tapping_Fortune_at_the_Bottom_of_the_Pyramid*
- *https://farrukhabad.nic.in/*
- *http://uptourism.gov.in/*
- *https://www.researchgate.net/publication/295863538_Replication_and_scaling-up_of_isolated_mini-grid_type_of_off-grid_interventions_in_India*
- *https://public.knoema.com/pteweie/indian-households-by-main-source-of-lighting-census-2011*
- *https://censusindia.gov.in/2011census/dchb/DCHB_A/09/0928_PART_A_DCHB_FARRUKHABAD.pdf*
- *https://www.amarujala.com/uttar-pradesh/sambhal/chandausi-railway-make-electric-self-chandausi-news-mbd3138654159*
- *https://www.jagran.com/uttar-pradesh/farrukhabad-villagers-protested-due-to-power-cut-22641148.htm*

6 APPENDICES

6.3 AUXILLLARY DATA

Table 1: Biogas potential from animal waste in the district.

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/m³)**	**Biogas potential (m³/yr)**
Cattle	Manure	1,12,816	10	41,17,78,400	308833800	61766760	25	2470670.4
Buffalo	Manure	2,90,853	15	1,59,24,20,175	1194315131	238863026.3	25	9554521.05

Sheep	Manure	13,475	1	49,18,375	3688781.25	737756.25	25	29510.25
Goat	Manure	1,27,048	1	4,63,72,520	34779390	6955878	25	278235.12
Pig	Manure	10,743	2.5	98,02,988	7352240.625	1470448.125	25	58817.925
Poultry	manure	11,419	0.1	4,16,794	312595.125	62519.025	25	2500.761
Total		5,66,354		2,06,57,09,252				1,23,94,256

Table 2: Biogas potential from agricultural waste in the district.

Crop	**residue type**	**Total crop production (tons) (2017-18)**	**Residue production ratio**	**Residue amount (tons)**	**Average collection (70%)**	**Moisture content**	**Residue amount after removing moisture (tons)**	**Biogas potential [m3/(tons of dry matter)]**	**Overall biogas potential (m3)**
Maize	straw	111191	1.5	166786.5	116750.55	15	99237.9675	800	79390374
Wheat	straw	337876	1.5	506814	354769.8	30	248338.86	800	198671088
Sugarcane	Bagasse	533762	0.33	176141.46	123299.022	80	24659.8044	750	18494853.3
Total		982829							296556315.3

Table 3: Livestock trend in district.

Livestock	**2003**	**2007**	**2012**
Cattle (Cow)	128372	125104	112816
Buffalos	229652	237392	290853
Sheep	13246	13108	13475
Goat	152135	165073	127048
Pigs	18391	18548	10743
Chicken	57549	49277	5224
Other Poultry	542	16747	6195

Horses and Ponies	1030	244	1236
Others	4693	3035	1578

Table 4: Livestock trend in District.

Livestock	**2003**	**2007**	**2012**
Cattle (Cow)	128372	125104	112816
Buffalos	229652	237392	290853
Sheep	13246	13108	13475
Goat	152135	165073	127048
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