Arth Ganga Project: District Unnao

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EXECUTIVE SUMMARY

Unnao, a district with a rich history is located in the Ganga Plain in the state of Uttar Pradesh. The district is an industrial hub known for leather, chemical, etc. industries. The district has been envisioned as Trans Ganga city, a satellite town.

The total geographical area of the district is 4558 Km^2, out of this area, the total cultivable land is 372800 ha, the permanent pastures are 3400 ha, the Cultivable wasteland is 11000 ha. The barren and uncultivable land constitutes 11700 ha. The area for non-agricultural use increased slightly over the period from 11.88% to 12.40%. The share of cultivable wasteland decreased from 2.50% to 2.31% whereas barren and uncultivable land decreased from 2.61% to 2.48% from 2010-11 to 2017-18. Majorly based on the different characteristics' soils are Alluvial, Calcareous, and Salt affected. The soil types are Deep-sandy soils, Deep-stratified loamy soils, and Deep, fine soils. The district lies in the Central Plain Zone (IV) and lies in the Agro-ecological situation of tremendous floods during the rainy seasons. With the net sown area of 309000 ha and gross cropped area of 493600 ha, the Cropping intensity of the district is 132.4%. The net irrigated area is 292501 ha whereas the rainfed area is 16478 ha. The major farming system is divided into Paddy-Wheat-Fallow, Paddy-Wheat-Moong; Paddy-Wheat-Dhaincha, Maize-Toria-Wheat-Fallow; Groundnut-Pea vegetable- Groundnut; Groundnut-Wheat-Fallow and Okra-Vegetable Pea-Cucurbits. The major crops types are wheat, rice, maize, paddy, sugarcane, etc. In 2017-18, the nitrogen share decreased to 69.72%, while the phosphorus share increased to 27.58%, and the potassium share fell to 2.7%. The overall use of chemical fertilizers has reduced in the district from 150.19 kg/ ha in 2010-11 to 116.24 kg/ ha in 2017-18 The livestock consists of cattle and goats, buffalos, goats, sheep. The district economy grew with an average annual growth rate of 6.12% with the main contribution of the secondary sector (9.02%) followed by the tertiary sector (6.62%) in 2018-19. The average annual growth rate of agriculture was 2.66% whereas for livestock growth was 12.23% from 2011-12 to 2018-19. Also, their respective share varied from 77.62% to 71.29% and 15.01% to 23.88% respectively, from 2011-12 to 2018-19.

The total forest cover of the district is only 264.59 km^2. Out of total forest cover, the maximum area is covered by Open Forest (236.59 km^2) followed by Moderately dense forest (28 km^2). The share of forestry and logging was around 3.25% in 2018-19, but it grew remarkably well with an average annual growth rate of 42.48% and so did mining and quarrying with 38.43% growth. To increase forest resources in the country, the Ministry of Environment, Forest and Climate Change is implementing several schemes. The number of species is 364 with 4 rare/accidental species. Shahid Chandra Shekhar Azad Bird Sanctuary, also a Ramsar site, is home to many migrating birds, with 25,000 waterbirds reported regularly and 220 permanent and migratory birds which also makes it a potential tourist attraction as well. The district comprises small and medium-sized 2561 mostly are waterlogged and lake/ponds/tanks wetlands. The number of natural wetlands is less than man-made. There have been slight fluctuations in several tourists visiting the district with an increase in most of the years since 2016. The number of domestic visitors has been more

than foreign visitors with a sharp increase for both in the year 2018. Along with Bird Sanctuary, Badarga Harbans, Baksar, Shiv Temple, Kalyani Devi Temple are the touristic places in the district.

The main source of lightning is kerosene (81.21%) closely followed by electricity (17.53%) while only 0.71% is the usage of Solar energy. Electricity consumption in agriculture has increased significantly from 150.24 kWh in 2011-12 to 275.81 kWh in 2019-20, a net increase of approximately 83.57%. The main fuel source is firewood (67.20%) followed by cow dung cake (12.79%) and LPG/PNG (12.42%). The district has good agro residue as well as forest and wasteland potential as 840.7kT/Yr and 1.9 kT/Yr of biomass is generated in the district respectively. Biomass-based co-generation in the state sugar mills and rice husks has been encouraged. Biogas potential from animal and agricultural waste was calculated approximately as 2 crores m^3/year and 51 crores m^3/year respectively. Fifty biogas plants have been proposed in the district. The district lags in its planning and implementation to enhance the use of solar and hydropower energy.

The district should practice afforestation for further increasing the forest cover, involving nad educating locals for maintenance of forest cover as well as tourist places. The district has a high scope of eco-tourism, agro-forestry, using renewable energies, especially with a high amount of biomass and biogas production, etc. Agricultural mechanization, Micro-irrigation, organic farming, awareness and participation by the farmers, adopting poly house and greenhouses, developing food processing units, etc. are a few practices that need to be incorporated in the agriculture sector. Also, certain practices such as gypsum application and leaching method, introducing suitable salt-tolerant varieties of rice, wheat, mustard, barley, sugarcane, and vegetables, cultivation of medicinal plants and high revenue plants, etc along with encouraging beekeeping, fisheries, and animal husbandry, etc. should be adapted and encouraged in the district.

1 DISTRICT OVERVIEW

1.1 INTRODUCTION

Unnao is a district of Uttar Pradesh with its administrative headquarters located at Unnao town. The district encompasses a geographical area of 4558 sq kms. And in terms of geographical area it occupies the rank of 13th in the state and 248th in India. In the year 2019, there was a total

5.80% forest area of total geographical area. Administration wise the district is divided into tehsils namely, Unnao, Bangarmau, Hasanganj, Safipur, Purwa and Bighapur. There is 1 Lok Sabha seat and 6 Assembly constituencies in the district. Moreover the district comprises 5 sub-districts, 21 towns and 1795 villages.

According to 2011, census the district has a population of 3108367. In the total population of the district of Unnao, as much as 36.2 per cent are workers and rest of 63.8 per cent are non-workers. Among workers 24.5 per cent are main workers and rest of 11.7 per cent are marginal workers. The extent of workers in rural parts and non-workers in urban parts is higher. In the district among workers 40.00 per cent are cultivators and 26.0 per cent other workers.

The economy of the district is pivoted around agriculture, nearly 69.6 percent of the workers are engaged in agriculture related work. Among the Kharif crops paddy is the most important in point of the area under it. Other Kharif crops are Jowar, Bajra, Arhar, Maize, Urad and Moong . The Rabi crops consists of wheat,barley, gram and pea grown alone or in combination of two crops. Most of the population of the district is engaged in agriculture since it is scantily industrialized. Only some leather industries are available in the district because Unnao district is famous for its leather industries and leather goods.

An area of 17000 ha is under forests. The rapid increase of population and consecutive spread of cultivation have caused jungle to disappear because it is more profitable to cultivate the land. The chief species of trees found in the district are dhak, shisham, neem, babul, bel, peepal, bargad, gular, kakar and mahua. Among the other species, mango, khair, safed siris, kala siris, kachnar, amaltas, jamun, sagon, semal, arjun, and bahera are commonly seen in the area under the forest department and along the roadside.

Figure 1 Map of the district

1.2 DEMOGRAPHIC PROFILE OF UNNAO

- Geographical Area: 4558 Sq. Km.
- Administrative Divisions:[1]

  District Headquarters: Unnao

  No of Tehsil: 6

  No of Blocks: 16

  No of Gram panchayats: 1044

  No. Of Villages: 1044

- Demographic and socio-economic indicators:[2]

  Population: 31,08,367 (Census 2011)

  Population density (Total persons per sq. km): 682

  Sex ratio: 907

  Literacy: 66.40%

- Occupation/ other Livelihood source: Tanning and Leather industry
- Major Rivers: Ganga
- Forest Area: 264.59 Sq. Km. (ISFR 2019)

1.3 AGRO CLIMATIC PROFILE OF THE DISTRICT

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

[2] https://censusindia.gov.in/2011census/dchb/0925_PART_B_DCHB_UNNAO.pdf

1.4 ECONOMIC PROFILE OF UNNAO

The primary sector does have a significant impact because it contributes around 30% of the district's GDP. However, this sector's average annual growth rate from 2011-12 to 2018-19 is only 4.06%. Its share decreased from 32.89% in 2011-12 to 28.37% in 2018-19. The share of the secondary sector increased from 18.70% in 2011-12 to 21.04% in 2018-19. It increases with a magnificent average annual growth rate of 9.02%. The tertiary sector occupies around 50% of the share in the district economy. The sector grew with a remarkable average annual growth rate of 6.62%, with its share increasing from 48.41% in 2011-12 to 50.59% in 2018-19. Overall, the district economy grew with an average annual growth rate of 6.12%. The growth in the secondary sector is more than in 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 and the primary sector, which has a decent (30%) contribution to the district GDP.

Table 1: Trends in Gross District Domestic product in Unnao 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	2852.24	1621.45	4197.85	8671.54	-	-	-	-
	(32.89)	(18.70)	(48.41)	(100)				
2012-13	2819.36	1670.33	4314.72	8804.41	-1.15	3.01	2.78	1.53
	(32.02)	(18.97)	(49.01)	(100)				
2013-14	3013.24	1727.74	4727.79	9468.76	6.88	3.44	9.57	7.55
	(31.82)	(18.25)	(49.93)	(100)				
2014-15	2706.68	1602.03	4964.50	9273.22	-10.17	-7.28	5.01	-2.07
	(29.19)	(17.28)	(53.54)	(100)				
2015-16	3251.48	2295.52	5700.93	11247.93	20.13	43.29	14.83	21.29
	(28.91)	(20.41)	(50.68)	(100)				
2016-17	3386.17	2654.81	5880.26	11921.24	4.14	15.65	3.15	5.99
	(28.40)	(22.27)	(49.33)	(100)				
2017-18	3738.28	3143.99	6130.77	13013.05	10.40	18.43	4.26	9.16
	(28.73)	(24.16)	(47.11)	(100)				
2018-19	3670.53	2721.62	6545.48	12937.64	-1.81	-13.43	6.76	-0.58
	(28.37)	(21.04)	(50.59)	(100)				
Average Growth Rate					4.06	9.02	6.62	6.12

Source: UPDES
Note: Figures in Parentheses are percentage share in the total GDDP

We further break down the primary sector GDP to determine which subsector is lagging and which is driving the primary sector growth. Table 2 shows that agriculture, including the horticulture sector, grew at an average annual growth rate of 2.66% from 2011-12 to 2018-19.

However, its share fell from 77.62% in 2011-12 to 71.29% in 2018-19. On the other hand, the share of Livestock increased from 15.01% to 23.88% in the same period, with a remarkable average annual growth rate of 12.23%. This shows the importance of Livestock in Unnao District and the increased dependency of citizens on livestock products. The share of forestry and logging in the total agriculture and allied sector is small, around 3.25% in 2018-19, but it grew remarkably well with an average annual growth rate of 42.48%. The fishery and aquaculture subsector share is very low, around 1.58% in 2018-19, as it has had a negative average annual growth of 1.83% from 2011-12 to 2018-19. Mines and quarrying also recorded a remarkable annual growth rate of 38.43%. However, its growth is not consistent over the years. 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 well during the time period of the study, with all its subsectors doing well. More work can be done to improve agriculture (including horticulture) and fishing sub-sectors.

Table 2: Trends in Gross District Domestic product from Agriculture and allied activities in Unnao 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	2175.61	420.71	118.74	87.77	2802.83	49.41	2852.24
	(77.62)	(15.01)	(4.24)	(3.13)	(100)		
	-	-	-	-	-	-	-
2012-13	2170.49	436.41	83.97	91.97	2782.84	36.53	2819.36
	(78.00)	(15.68)	(3.02)	(3.30)	(100)		
	[-0.24]	[3.73]	[-29.28]	[4.78]	[-0.71]	[-26.07]	[-1.15]
2013-14	2156.53	464.75	246.97	94.82	2963.07	50.16	3013.24
	(72.78)	(15.68)	(8.33)	(3.20)	(100)		
	[-0.64]	[6.49]	[194.12]	[3.10]	[6.48]	[37.33]	[6.88]
2014-15	1915.08	486.15	140.72	101.36	2643.31	63.37	2706.68
	(72.45)	(18.39)	(5.32)	(3.83)	(100)		
	[-11.20]	[4.60]	[-43.02]	[6.90]	[-10.79]	[26.33]	[-10.17]
2015-16	2007.10	441.92	470.55	103.48	3023.05	228.43	3251.48
	(66.39)	(14.62)	(15.57)	(3.42)	(100)		
	[4.80]	[-9.10]	[234.38]	[2.09]	[14.37]	[260.47]	[20.13]
2016-17	2321.99	576.46	187.18	126.65	3212.28	173.89	3386.17
	(72.28)	(17.95)	(5.83)	(3.94)	(100)		
	[15.69]	[30.44]	[-60.22]	[22.38]	[6.26]	[-23.87]	[4.14]
2017-18	2430.88	572.06	305.25	133.34	3441.52	296.76	3738.28
	(70.63)	(16.62)	(8.87)	(3.87)	(100)		
	[4.69]	[-0.76]	[63.08]	[5.28]	[7.14]	[70.66]	[10.40]

2018-19	2565.65	859.34	116.94	56.90	3598.83	71.70	3670.53
	(71.29)	(23.88)	(3.25)	(1.58)	(100)		
	[5.54]	[50.22]	[-61.69]	[-57.33]	[4.57]	[-75.84]	[-1.81]
Average Growth Rate	2.66	12.23	42.48	-1.83	3.90	38.43	4.06

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 79.66% of the secondary sector in 2018-19. The share shows consistency over the year and has increased by an average growth rate of 12.09% over the years. This indicated that the secondary sector in Unnao is heavily dependent on the manufacturing sub-sector. The electricity, gas, and water supplies subsector has around 2.5% share of the secondary sector and has increased from 2.14% in 2011-12 to 3.02% in 2018-19 with a remarkable average annual growth rate of 15.38%. The share of the construction sub-sector decreased from 27.97% to 17.32% in the same period, with a low average annual growth of 0.66%. The manufacturing subsector, thus, makes an important contribution to the growth of the secondary sector.

Within the tertiary sector, the real estate and professional services subsector made up the highest share of (26.05%) in 2018-19, followed by the trade & hotel (23.99%), transport, storage and communication (22.44%), and Public administration (10.13%). Average annual growth is observed highest in Transport, Storage & Communication (13.02%), followed by public administration (7.15%) and financial services (7.18) and lastly lowest in Real estate (3.17%). All the subsectors in secondary and tertiary sectors have performed well during the study period. More work needs to be done to improve the construction and real estate subsector. Transport and Communication and Public Administration sub-sectors are the major contributors to the Tertiary sector's growth.

Table 3: Trends in percentage share of non-agriculture sub-sectors in DGDP in Unnao 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	69.89	2.14	27.97	100	15.43	24.85	7.26	32.68	10.15	9.64	100
2012-13	72.41	1.98	25.61	100	17.03	23.91	7.79	33.54	9.13	8.60	100
2013-14	74.01	1.78	24.20	100	17.13	24.68	8.09	31.60	9.86	8.64	100
2014-15	69.92	2.59	27.48	100	18.91	23.59	8.61	31.19	8.41	9.29	100
2015-16	78.23	2.57	19.20	100	23.04	25.46	8.00	27.30	7.51	8.70	100
2016-17	82.02	2.10	15.88	100	21.88	25.89	7.68	26.81	8.53	9.21	100
2017-18	83.21	2.64	14.14	100	22.04	25.42	6.59	27.00	9.34	9.60	100
2018-19	79.66	3.02	17.32	100	22.44	23.99	7.36	26.05	10.13	10.03	100
Average Growth Rate	12.09	15.38	0.66	9.02	13.02	6.33	7.18	3.17	7.15	7.38	6.62
Source: Compiled from District Statistical Handbooks											

2 QUANTITATIVE DATA ANALYSIS

2.1 Agriculture and Allied Activities

2.1.1 Trend in Land Use Pattern

The total declared area of the district is 4602.22 sq. km². The forest area represents 3.69% of the total declared area. The share of cultivable wasteland decreased from 2.50% in 2010-11 to 2.31% in 2017-18, which is a good development indicator. The share of Barren and uncultivable land decreased from 2.61% in 2010-11 to 2.48% in 2017-18; however, the decrease could have been more significant. The share of area under trees and gardens has been consistent over the years (around 0.6%). The fallow land also shows a remarkable decline over the period. The net sown area (NSA) is around 68% of the total reported area and has increased slightly over the years. The area for non-agricultural use increased slightly over the period from 11.88% to 12.40% (Table 4). Overall, the land use pattern shows that the acreage for non-agricultural use has increased significantly.

Table 4: Trends in Land-use Pattern in Unnao (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	Pasture land	The area under trees and gardens	Net Sown Area
1	2	3	4	5	6	7	8	9	10	11
2010-11	460222	3.69	2.50	5.79	5.88	2.61	11.88	0.74	0.54	66.37
2011-12	460222	3.69	2.39	5.87	5.01	2.53	12.03	0.75	0.59	67.14
2012-13	460222	3.69	2.48	5.59	5.87	2.58	10.66	0.74	0.53	67.85
2013-14	460222	3.69	2.28	5.04	4.92	2.51	12.05	0.75	0.57	68.19
2014-15	460222	3.69	2.21	5.43	4.87	2.51	12.10	0.75	0.60	67.84
2015-16	460222	3.69	2.21	4.84	4.86	2.50	12.27	0.75	0.60	68.27
2016-17	460222	3.69	2.27	5.11	4.38	2.48	12.32	0.75	0.59	68.41
2017-18	460222	3.69	2.31	5.32	4.14	2.48	12.40	0.76	0.48	68.41

Source: Compiled from http://updes.up.nic.in/spiderreports/intialisePage.action
And District-wise Development Indicators file.

2.1.2 Trends in Operational Land Holdings

In Unnao district, the total number of operational farms increased from 487 thousand in 2010-11 to 523 thousand in 2015-16, a net increase of 7.39%. While in the state, their numbers increased from 23,325 thousand in 2010-11 to 2,822 thousand in 2015-16, a net increase of 2.13%. Most land positions in the district are marginal and small. These two size categories represented around 95.62% in the district in 2015-16, while the corresponding proportion in the state was 92.81% (Table 5). The two agricultural census of 2010-11 and 2015-16 report no significant change in the percentage share across the various categories of landholdings.

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

	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.)
Unnao	2010-11	82.73	12.16	4.15	0.92	0.05	487
	2015-16	83.92	11.70	3.57	0.77	0.03	523
							[7.39]
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.

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

i- The Trend in Cropping Patterns

Rice and Wheat 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 (47.57%), followed by Rice (19.91%) and Maize (5.29%). Together these three crops constitute around 72.77% of the GCA. The area shared by the cereals has remained consistent over the years (around 75%). The main pulse produced is Urad. The rest of the pulses are significantly produced. The total pulse acreage has also remained consistent over the time period of the study (around 7.3%). Thus, the food grains cover a majority (around 82%) of the GCA. Mustard and till are the major oilseeds crop produced, and the total oilseed acreage has also remained consistent over the years (around 6%). The area under sugarcane is almost negligible. The acreage of Potato has remained consistent over the years (around 1.8%). In general, there is no significant change in the cultivation pattern reported in the district during the study period. The average cropping intensity reported in the district is 159.02.

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	18.42	19.62	19.44	20.48	20.53	20.23	20.08	19.91
Wheat	49.68	48.57	49.02	48.64	49.05	48.33	47.98	47.57
Maize	6.28	6.39	5.98	5.67	5.46	5.38	5.34	5.29
Other Cereals	1.50	1.35	1.22	1.12	1.12	1.11	1.10	1.09
Total Cereals	75.88	75.93	75.66	75.91	76.17	75.04	74.50	73.86
Urad	5.76	5.90	5.77	5.59	5.41	5.33	5.29	5.25
Moong	0.90	0.96	0.92	0.89	0.87	0.85	0.85	0.84
Other Pulses	1.63	1.44	1.37	1.29	1.26	1.24	1.23	1.22
Total Pulses	8.29	8.30	8.06	7.77	7.54	7.43	7.38	7.31
Total Foodgrains	84.17	84.23	83.72	83.68	83.71	82.47	81.87	81.17
Mustard	2.66	2.63	3.02	3.11	2.90	2.86	2.83	2.81
Til (Net)	2.63	2.67	2.53	2.31	2.86	2.82	2.80	2.77
Other Oilseeds	0.58	0.61	0.56	0.57	0.41	0.40	0.40	0.39
Total Oilseeds	5.87	5.92	6.11	5.99	6.16	6.07	6.03	5.98
Sugarcane	0.16	0.16	0.17	0.17	0.14	0.14	0.14	0.14
Potato	1.68	1.59	1.62	1.75	1.85	1.82	1.81	1.79
Net Sown Area	63.81	62.60	63.03	62.77	63.43	62.88	62.56	62.02
Gross Sown Area (in 1000 Ha)	478.65	493.61	495.46	499.97	492.25	499.63	503.26	507.61
Cropping Intensity	156.71	159.76	158.66	159.31	157.67	159.02	159.85	161.23
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

ii- 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 district irrigation facilities and better infrastructure. Wheat and Rice are the major crops in the district, and their per hectare yield (33.06 qtls and 19.71 qtls respectively, in 2017-18) are also high. Per hectare yield of total cereals increases from 24.30 qtls in 2010-11 to 28.55 qtls in 2017.18. Similarly, per hectare yield of total pulses also increases from 5.70 qtls in 2010-11 to 8.03 qtls in 2017-18. The yield of total oilseeds has increased from 4.80 in 2010-11 to 7.43 in 2017-18, which is a significant improvement. This can be due to the availability of hybrid seeds in the district. The per hectare yield of Sugarcane is very high, particularly 689.61 qtls in 2017-18. Similarly, the yield of Potato was 195.50 qtls in 2017-18. In summary, all crop yields show year-over-year fluctuations, with the lowest in 2015-16. 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 Unnao District (Qtls)

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	16.62	17.77	19.64	21.26	16.74	13.68	19.19	19.71
Wheat	29.64	30.21	28.47	29.12	20.04	21.88	31.99	33.06
Maize	7.79	10.43	12.02	15.58	13.61	14.84	18.82	24.43
Total Cereal	24.30	25.00	24.66	25.73	18.53	18.95	27.35	28.55
Urad	5.03	4.96	5.33	5.61	3.65	5.17	6.49	6.68
Moong	4.70	4.32	4.92	3.11	3.17	5.58	6.21	8.12
Total Pulses	5.70	6.29	6.07	5.45	3.84	5.54	6.78	8.03
Total Food Grains	22.47	23.16	22.87	23.85	17.21	17.75	25.49	26.70
Mustard	9.00	8.67	10.57	8.18	5.42	8.20	10.42	13.27
Till (Net)	0.60	0.80	0.89	1.28	1.71	1.25	1.17	0.92
Total Oilseeds	4.80	4.89	6.14	5.54	3.84	4.86	6.00	7.43
Sugarcane	541.19	597.58	613.47	630.08	655.04	588.37	805.18	689.61
Potato	211.52	194.16	200.35	185.46	187.47	192.99	192.18	195.50
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

iii- Trends in Production of Principal Crops

Table 8 shows the trends in the production of the main crops over the years. Rice, Wheat, Sugarcane, and Potato dominate the production. In 2017-18, Rice (199.19 thousand tonnes), Wheat (798.32 thousand tonnes), and Maize (65.62 thousand tonnes) formed a major part of the total cereal production (1070.33 thousand tonnes). Among pulses, Urad and moong occupied the highest production. Urad had a production of (17.81 thousand tons); Moong had a production of (3.47 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 66% of the total pulse production.

Mustard production was 18.94 thousand tons, which represented around 85% of the total oilseed production in 2017-18. Sugarcane production ranges between 42.70 thousand tons to 55.80 thousand tons, indicating high variation in the production. Potato production varies from 161.28 thousand tons to 177.65 thousand tons over the years. 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 fluctuated over the years, partly due to changes in nature and partly due to market conditions. Proper insurance arrangements are the need of the hour so that the farmers may get assured income and can take more risk and diversify their production.

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

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	146.54	172.11	189.22	217.68	169.25	138.22	193.98	199.19
Wheat	704.91	724.24	691.41	708.12	483.79	528.31	772.55	798.32
Maize	23.43	32.87	35.60	44.14	36.56	39.86	50.55	65.62

Other Cereals	7.88	7.83	8.27	6.52	5.11	4.24	8.17	7.20
Total Cereals	882.76	937.05	924.50	976.46	694.71	710.63	1025.25	1070.33
Urad	13.85	14.44	15.22	15.70	9.74	13.78	17.29	17.81
Moong	2.03	2.04	2.24	1.38	1.35	2.38	2.65	3.47
Other Pulses	6.75	9.29	6.75	4.09	3.15	4.42	5.21	8.52
Total Pulses	22.63	25.77	24.21	21.16	14.24	20.58	25.16	29.79
Total Foodgrains	905.39	962.81	948.70	997.62	708.95	731.21	1050.40	1100.12
Mustard	11.48	11.26	15.83	12.71	7.73	11.69	14.87	18.94
Til (Net)	0.75	1.06	1.12	1.48	2.41	1.76	1.65	1.29
Other Oilseeds	1.26	1.98	1.65	2.40	1.53	1.28	1.70	2.31
Total Oilseeds	13.50	14.30	18.60	16.58	11.66	14.74	18.21	22.54
Sugarcane	42.70	46.67	50.37	54.19	45.39	40.77	55.80	47.79
Potato	169.70	152.38	161.28	162.24	170.35	175.37	174.63	177.65
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

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 wheat (0.72%), followed by Urad (3.62%) and moong (3.98%), and the highest in sugarcane (9.06%). The variability in the area under total pulses (4.07%) is much more than the variability in the area under total cereals (1.24%). Since Rice and wheat dominate the production, the variability in the area under total food grains is very low (1.1%).

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	98.51	4.72	4.79	178.27	26.96	15.12	18.08	2.39	13.20
Wheat	241.19	1.73	0.72	676.45	111.78	16.53	28.05	4.65	16.58
Maize	28.37	1.83	6.46	41.08	12.72	30.96	14.69	5.17	35.16
Total Cereal	374.02	4.66	1.24	902.71	136.67	15.14	24.13	3.62	14.99
Urad	27.47	0.99	3.62	14.73	2.50	17.01	5.37	0.95	17.70
Moong	4.39	0.17	3.98	2.19	0.69	31.25	5.02	1.65	32.87
Total Pulses	38.48	1.57	4.07	22.94	4.57	19.91	5.96	1.20	20.12
Total Food Grains	412.50	4.53	1.10	925.65	140.55	15.18	22.44	3.37	15.03
Mustard	14.17	0.92	6.52	13.06	3.41	26.13	9.22	2.29	24.82
Till (Net)	13.27	0.97	7.29	1.44	0.51	35.49	1.08	0.35	32.25
Total Oilseeds	29.86	0.81	2.70	16.27	3.46	21.27	5.44	1.09	20.11
Sugarcane	0.75	0.07	9.06	47.96	5.26	10.97	640.07	80.18	12.53

Potato	8.63	0.56	6.45	167.95	8.64	5.14	194.95	8.13	4.17
Source: http://updes.up.nic.in/spiderreports/intialisePage.action									

The variability of production depends on the cultivated area's variability and the yield's variability. 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 Til (35.49%), followed by moong (31.25%), maize (30.96%), and Mustard (26.13%). High variation in the production of oilseeds is partly due to variation in the land area under them and partly due to the high rate of oilseeds and non-availability of hybrid oilseeds. Improvement in crop insurance conditions and better market accessibility can lower this variation. Variability is lowest in Potato (5.14%), followed by sugarcane (10.97%) and Rice (15.12%)

In the case of yield, the greatest variability is estimated in maize (35.16%), till (32.25%), and moong (32.87%). Yield variability in total cereals (14.99%) and total food grains (15.03) is lower as compared to that in total pulses (20.12%). Potato, sugarcane, and Rice 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.

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 on average, total pulses and oilseeds have a relatively larger share in GCA than their share in VOP, while Rice, Wheat, Potato, and Sugarcane have, on average, a greater share in VOP than GCA. Food grains accounted for around 83% of the gross area of the crops. Similarly, total foodgrains account for nearly 88% of the total value of the agricultural product. Three crops - Wheat, Rice, and Potato together accounted for, on average, around 70.18% of GCA and 84.7 % of the total VOP. Overall, the total agricultural GCA has remained consistent over the years (around 496 thousand hectares) while the total value of the product has increased significantly that it became more than double of what it was in 2011-12, that is, (1265.45 Cr. Rs.) in 2011-12 to (2773.52 Cr. Rs) in 2017-18.

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

Crop	% Share in	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Wheat	GCA	49.68	48.57	49.02	48.64	49.05	48.33	47.98	47.57
	VOP	61.28	56.60	52.40	45.27	42.88	44.16	55.44	54.69
Paddy	GCA	18.42	19.62	19.44	20.48	20.53	20.23	20.08	19.91
	VOP	17.37	22.22	24.41	34.79	32.68	21.08	21.98	21.55
Total Cereals	GCA	75.88	75.93	75.66	75.91	76.17	75.04	74.50	73.86
	VOP	80.84	81.49	79.68	82.81	78.56	69.24	81.99	81.53
Total Pulses	GCA	8.29	8.30	8.06	7.77	7.54	7.43	7.38	7.31
	VOP	7.10	7.34	7.10	5.54	5.85	12.46	6.43	7.80

Total Food Grains	GCA	84.17	84.23	83.72	83.68	83.71	82.47	81.87	81.17
	VOP	87.94	88.84	86.79	88.34	84.41	81.70	88.43	89.33
Total Oilseeds	GCA	5.87	5.92	6.11	5.99	6.16	6.07	6.03	5.98
	VOP	3.41	3.34	4.31	3.35	3.21	4.97	4.25	3.67
Potato	GCA	1.68	1.59	1.62	1.75	1.85	1.82	1.81	1.79
	VOP	8.05	7.25	8.32	7.78	11.86	12.59	6.60	6.41
Sugarcane	GCA	0.16	0.16	0.17	0.17	0.14	0.14	0.14	0.14
	VOP	0.61	0.57	0.58	0.52	0.52	0.74	0.72	0.59
Paddy + wheat + potato	GCA	69.78	69.78	70.09	70.88	71.43	70.38	69.87	69.27
	VOP	86.69	86.07	85.13	87.85	87.42	77.83	84.02	82.64
Total Agriculture	GCA (1000 Ha)	478.65	493.61	495.46	499.97	492.25	499.63	503.26	507.61
	VOP (in Cr Rs)	1265.45	1471.60	1550.49	1876.87	1579.56	1824.52	2647.44	2773.52
Per Worker VOP (Rs.1000 at current prices) in Unnao		-	33.86	40.33	52.35	36.06	45.97	51.85	58.29
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 Unnao district increased from Rs.33.86 thousand in 2011-12 to Rs.58.29 thousand in 2017-18, a net increase of 72.15% at current prices, while in UP it increased from Rs. 40.66 thousand to Rs.69.69 thousand, a net increase of 71.40%. Thus, the total value of agricultural output per agricultural worker is much higher in the state than in the district. The ratio of per worker output of the district to the state average has slightly increased from 0.8327 in 2011-12 to 0.8364 in 2017-18.

2.1.4. 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 70.13% of the total fertilizers used, while the proportions of phosphorus and potassium were 24.98% and 4.88%, respectively. In 2017-18, however, the nitrogen share decreased to 69.72%, while the phosphorus share increased to 27.58%, and the potassium share fell to 2.7%. The use of nitrogen is more than the recommended ratio, while that of the Phosphorous and potassium 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, cultivation patterns, etc. Although the overall use of chemical fertilizers

has reduced in the district from 150.19 kg/ ha in 2010-11 to 116.24 kg/ ha in 2017-18 but still the authorities can 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	105.33	85.16	101.88	101.36	109.88	99.65	98.03	81.05
Phosphorous	37.52	27.63	36.47	26.24	31.79	37.36	38.55	32.06
Potassium	7.34	2.66	2.98	3.59	6.52	6.90	8.03	3.14
Total	150.19	115.44	141.33	131.18	148.19	143.91	144.61	116.24
Gross Sown Area (Ha)	478649	493612	495456	499966	492250	499631	503259	507608

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

2.1.5. Irrigation Structure and Status

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 canals (1757 kms), the number of Government Tube wells (170), and the number of wells (228) have remained constant since 2011-12. Shallow, medium, and deep tube wells increased by 14.1%, 125.09%, and 53.47%, respectively, in 2018-19 compared to 2010-11. The district's net and gross irrigated areas have shown consistency over the years, with an average of 94.29% and 81.41%, 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)	1757	1757	1757	1757	1757	1757	1757	1757	1757
No. of Govt. Tube wells	170	170	170	170	170	170	170	170	170
No. of Wells	228	228	228	228	228	228	228	228	228
Shallow Tube well	91886	96136	98376	99617	101145	102907	103784	104846	104846
Medium Tube well	1654	1987	2315	2811	3133	3418	3506	3723	3723
Deep Tube well	187	223	226	248	248	280	280	287	287
% Of NIA	94.62	94.67	94.72	94.61	94.89	93.49	93.70	93.64	-
% Of GIA	81.81	79.72	80.76	81.67	81.95	81.73	81.76	81.85	-

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

Canals and groundwater (GW) are the main irrigation source in the district. The canal's share in the NIA (average, 22.49%) has remained consistent over the years, with a slight fall observed later. The share of wells and tube wells in NIA (average, 77.40%) has also remained consistent over the years, with a slight increase observed later. Table 13 also shows that the development of the GW in the district has been quite high and that only about 38.47% of the GW has yet to be exploited.

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

Source/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Canal (surface Irri.)	23.76	24.48	24.25	23.80	23.19	20.06	20.17	20.18
Wells And Tube-wells (GW Irri.)	76.07	75.35	75.65	76.03	76.67	79.89	79.80	79.77
Others	0.17	0.17	0.10	0.17	0.14	0.05	0.03	0.05
NIA (1000 ha)	289.01	292.50	295.78	296.92	296.25	293.73	294.99	294.81
% Of Remaining GW to Total GW	34.71	-	27.19	-	34.71	65.29	38.47	-

Source: http://updes.up.nic.in/spiderreports/intialisePage.action
And District-wise Indicator reports

Table 14 shows that a majority area under Rice (average, 100%), Wheat (average, 100%), Potato (average, 100%), and Sugarcane (average, 100%) is irrigated. Percentages of the irrigated area under pulses (average, 10.19%) and oilseeds (average, 45.35%) are relatively less.

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

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	100	100	100	100	100	100	100	100
Wheat	100	100	100	100	100	100	100	100
Total Cereal	90.13	90.33	91.04	91.56	91.96	91.96	91.96	91.96
Total Pulses	12.41	11.05	10.25	9.15	9.67	9.67	9.67	9.67
Total Foodgrains	82.48	82.51	83.27	83.92	84.55	84.55	84.55	84.55
Total Oilseeds	42.92	42.22	47.25	49.91	45.13	45.13	45.13	45.13
Sugarcane	99.87	100	100	99.88	100	100	100	100
Potato	100	100	100	100	100	100	100	100

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

2.1.6. Electricity Intensity 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 150.24 KWH in 2011-12 to

275.81 KWH in 2019-20, a net increase of approximately 83.57%. 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 agriculture (average, 10.54%) in the total electricity consumption in the district is very minimal. This can be due to high electricity consumption in secondary and tertiary sectors. Since electricity consumption has increased over the years, the authorities need to switch to more sustainable modes of electricity production, such as solar power.

Table 15: Trends of Electricity consumption in Agriculture

Division/ Year	2011-12	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Per Capita electricity consumption (KWH)	150.24	160.48	164.57	235.53	267.28	261.22	275.81
% Of electricity consumed in Agriculture sector to total consumption	9.52	7.96	10.04	10.25	11.13	12.73	12.16
Source: District-wise Development Indicators file.							

2.1.7. Status of Agriculture Markets

Table 16 shows the marketing infrastructure in the district. It has three main markets and four sub-markets, which have remained constant over the period. The number of regulated mandis per lakh hectare of NSA had decreased from 2.23 in 2013-14 to 0.96 in 2017-18, which is a notable issue as farmers need to have proper access to mandis for them to be able to sell their produce. However, a sudden increase in the number of mandis (2.86) is observed in 2018-19.

Table 16: Status of Agriculture Markets in Unnao

Category/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Main Markets (No.)	3	3	3	3	3	3	3
Submarkets (No.)	4	4	4	5	5	6	6
Total Markets (No.)	7	7	7	8	8	9	9
No. of Regulated mandis per lakh Ha. of net area sown	2.23	1.74	-	0.95	0.96	2.86	-
Source: District-wise Development Indicators file and District-wise Statistical Report							

2.1.8. Status of Organic Farming

To promote sustainable agricultural practices and improve the farmers' livelihood, the Government of India launched PKVY and Namami Gange schemes. Under these schemes, farmers are incentivized to form groups to do organic farming and sell their products with PGS certification. Under the programme, the beneficiary farmers get Rs.12000, Rs. 10000 and Rs.9000 per hectare, respectively, in the first, second and third year of 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. But after three years, it may reach its original level. Financial assistance received by the beneficiary farmers seems to be adequate to compensate for the yield losses and motivate them to do organic farming. There is a need to set up an integrated processing unit for organic products. Monitoring of the project should be periodically done through MIS, Geo-tagging, and monthly physical and financial reports.

However, the policy-related issue is what would be after the three years? Will the government protect their income? There may be a possibility that the beneficiary farmers may revert to conventional farming in the absence of the regulatory framework. In this context, two things need to be thought of—a well-designed regulatory and monitoring framework and introduction of payments for ecosystem services for the organic farmers after the transition period to carry on the activity on a sustainable basis. Organic and zero-budget farming will provide ecological services in terms of soil health, human and animal health, saving of water, protection bio-diversity, etc. To sustain the organic farming initiative, a long-term system of payments for ecological services may be evolved to retain the existing farmers and motivate others to move towards this sustainable farming system. There is no assured market for these products and farmers do not get premium prices. They sell their products at the same prices their conventional counterparts do. Certification and quality check and monitoring mechanisms are yet to be set up.

Table 17 shows the details of the establishment of organic clusters under the Paramparagat Krishi Vikas Yojana in the district. The district has 95 groups in fifteen development blocks. The highest number of groups are in Sikandarapur Sarausi (16), Sumerpur (16), closely followed by Bangarmau (14), Ganj Moradabad (13), and Fatehpur Chaurasi (10). These five blocks together consisted of about 72% of the total groups. Significantly high variation can be seen in the number of farmers per group across the various development blocks. 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.

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

S. No.	Block	Scheme	No. of groups	No. of farmers in groups			
				Total	Average	Median	SD
1	Asoha	PKVY	1	50	50	50	0
2	Auras	PKVY	1	50	50	50	0
3	Bangarmau	PKVY	14	404	28.85	28	6.89
4	Bichhiya	PKVY	1	50	50	50	0
5	Bighapur	PKVY	3	101	33.66	27	14.22

6	Fatehpur Chaurasi	PKVY	10	300	30	29	8.2
7	Ganj Moradabad	PKVY	13	409	31.46	27	10.17
8	Hilauli	PKVY	1	50	50	50	0
9	Mianganj	PKVY	1	50	50	50	0
10	Nawabganj	PKVY	1	50	50	50	0
11	Purwa	PKVY	1	50	50	50	0
12	Safipur	PKVY	7	220	31.42	28	9.19
13	Sikandarapur Karan	PKVY	9	290	32.22	30	7.79
14	Sikandarpur Sarausi	PKVY	16	444	27.75	25	7.24
15	Sumerpur	PKVY	16	481	30.06	25	10.75
16	District Total	PKVY	95	2999	31.56	29	9.88
		Total	95	2999	31.56	29	9.88
Source: https://pgsindia-ncof.gov.in/LGList.aspx							

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

- The major problem of the farmers was poor marketing of the organic products and not being able to fetch a premium.
- 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.
- Farmers practice organic farming only on a small part of their land (less than one ha) to get the scheme's benefit.
- 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.
- The knowledge and awareness level regarding practices under organic farming was inadequate among farmers.

2.2. Trends in Livestock

Livestock forms an integrated part of the rural economy. From Table 18, we can infer that the number of indigenous and exotic male cattle has decreased considerably from 259391 in 1997 to 64194 in 2019 and from 3916 in 1997 to 3403 in 2019, respectively. However, on the other hand, the number of indigenous and exotic female cattle has increased considerably from 185579 in 1997 to 220734 in 2019 and from 3765 in 1997 to 35854 in 2019, respectively. Thus, the total number of cattle decreased only slightly from 452651 in 1997 to 324185 in 2019, thus, a net decrease of 28.38%. Similar inferences can be drawn from the buffalo data as the number of male buffalo decreased, but the number of female buffalo increased; thus, a net increase of 87.41% in 2019 compared to 1997 is observed in the total population of buffalo. A significant reduction in the indigenous sheep population is observed (71.84%) in 2019 compared to that in 1997. During the same period, the population of exotic sheep also decreased significantly, thus, indicating a decrease in the total sheep population by 77.93%. The total population of goats increased from 229155 in 1997 to 320399 in 2019, a net increase of 39.81%. The total pig population decreased considerably from 78068 in 1997 to 6877 in 2019.

It is significant to note that the number of female cattle and buffaloes has substantially increased over the period, indicating the growth of livestock products, including milk. The substantial decline in the number of male cattle and male buffaloes also shows the rising farm mechanization and declining relevance of animal power, mainly because of the high maintenance cost of Livestock. The livestock subsector has around 15% share in the agriculture and allied activities sector and grew at a significant average annual growth rate of 12.23% from 2011-12 to 2018-19.

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

	Category	1997	2003	2007	2012	2019
Indigenous Cattle	Total Male	259391	223998	176435	161220	64194
	Total Female	185579	180199	209224	211996	220734
	Total	444970	404197	385659	373216	284928
Exotic Cattle	Total Male	3916	772	853	2676	3403
	Total Female	3765	1244	1858	5314	35854
	Total	7681	2016	2711	7990	39257
Total Cattle		452651	406213	388370	381206	324185
Buffalo	Total Male	112117	125684	145712	130524	68975
	Total Female	238176	292779	362524	375063	587517
	Total	350293	418463	508236	505587	656492
Sheep	Total Indigenous Sheep	49897	38611	34659	15845	14049
	Total Exotic Sheep	14490	244	199	310	160
	Total Sheep	64387	38855	34858	16155	14209

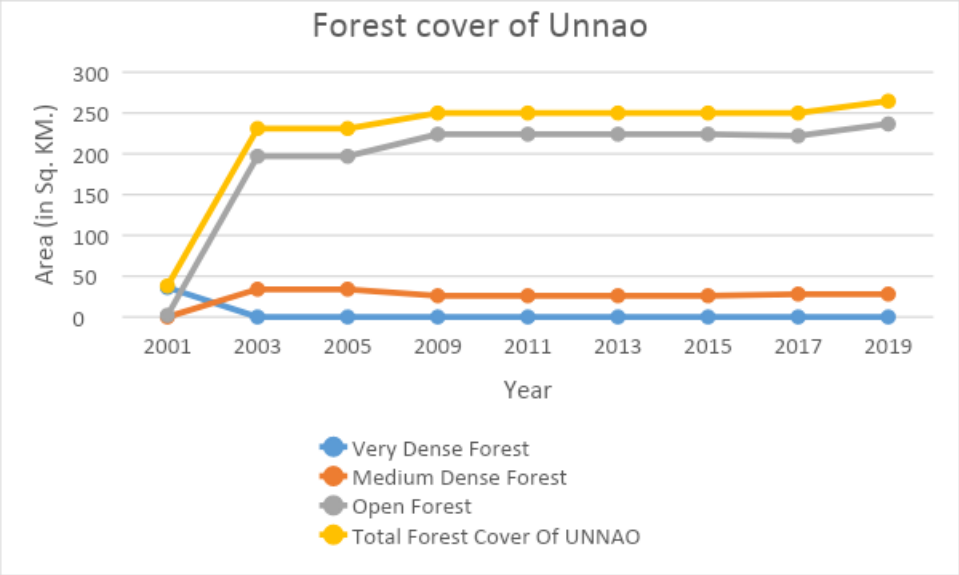
Goat	Total	229155	314625	376734	367779	320399
Pig	Total Indigenous Pig	59697	72105	76586	25098	6874
	Total Exotic Pig	18371	1324	1490	1366	3
	Total Pig	78068	73429	78076	26464	6877
Total Livestock		1185532	1260075	1388206	1299915	-
Total Poultry		142079	185990	161696	280702	-
Source: http://updes.up.nic.in/spiderreports/intialisePage.action And http://dahd.nic.in/animal-husbandry-statistics						

Table 19 shows that the Unnao 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 remained consistent around 52 over the years. Similarly, the number of cattle development centers has increased from 35 to 41 over the years, and man-made reproduction centers have also increased from 92 to 99 over the years. There are very few pig development centres in the district (2), which might be one of the reasons for the declining pig population in the district.

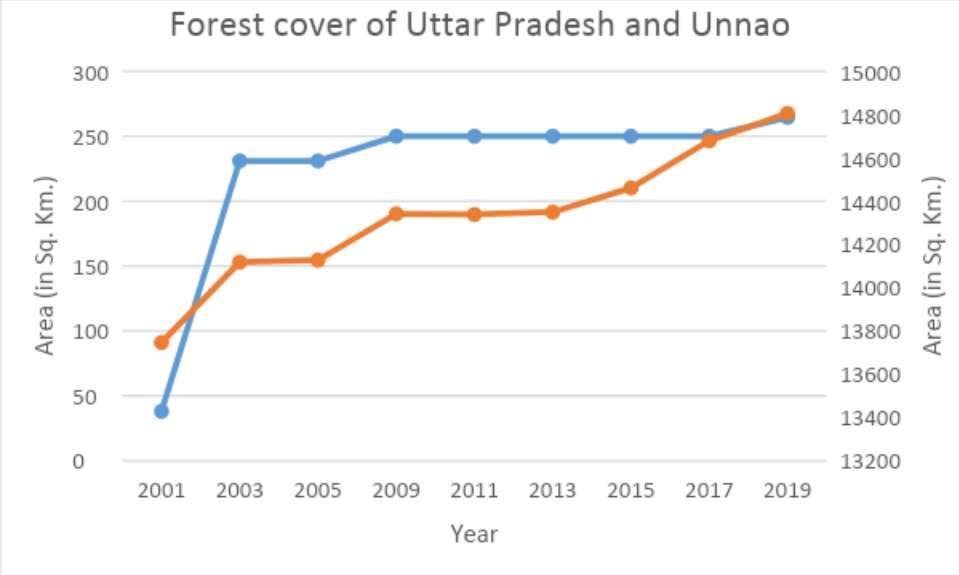
Table 19: Year-wise number of Cattle Hospitals and Development Centres

Category	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Cattle Hospital	47	47	47	52	52	52	52	52	52
D- category Cattle Dispensary	6	6	6	6	6	6	6	6	6
Cattle Development Centre	35	35	35	35	35	41	41	41	41
Man-Made Reproduction Centre	92	92	92	92	92	99	99	99	99
Pig Development Center	2	2	2	2	2	2	2	2	2
Source: http://updes.up.nic.in/spiderreports/intialisePage.action									

2.3 Forestry



According to the FSI assessment, the forest cover of Unnao has increased between 2001 and 2019. Majorly open followed by medium dense forest are found in the district.



The forest cover of the Uttar Pradesh has increased over the years, and the forest cover of Unnao district has also increased but at a slower rate.

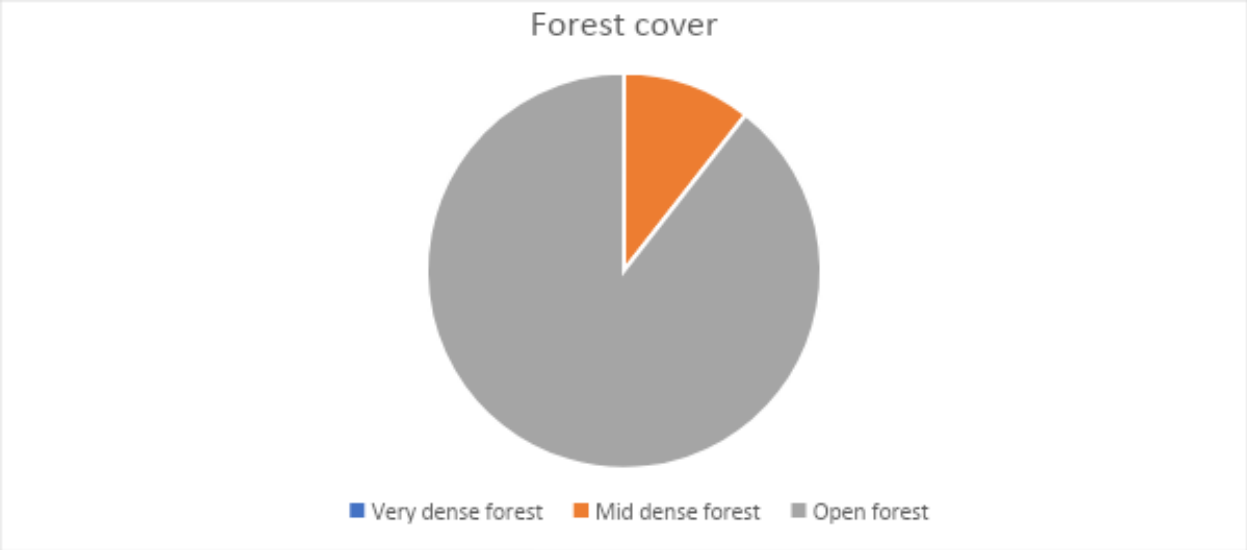
2.3.1. Biodiversity: The district's biodiversity data includes crop production, livestock population, bird species, and forest cover. The crop production trend shows a reduction in the non-grain crop but increases in all other crops. The Shahid Chandra Shekhar Azad Bird Sanctuary is located on a 224.6-hectare plot of land in the Unnao District of Uttar Pradesh. During the winter, the sanctuary becomes a bustling home for migrating birds from over the world, including Garganey Teal, Mallard, Purple Moorhen, Little Grebe, Spoonbill Duck, Red Wattled Lapwing, Wigon, and many more.

Table 1 Bird species recorded in the district.

Number of species	364
Number of rare/accidental species	4
https://avibase.bsc-eoc.org/checklist.jsp?region=INggupah	

Forest cover (in sq. km.)

Geographical area	Very dense forest	Mid dense forest	Open forest	Total	% of Geographical area `	Change with respect to 2017 assessment	Scrub
4558	0	28	236.59	264.59	5.80	14.590	0.0



2.4 Tourism

Domestic/foreign visitors in different years in a particular city

ANNUAL TOURIST VISITS STATISTICS- Unnao Uttar Pradesh				%Increase in total Tourists
Year	**Tourist-Domestic**	**Tourists-Foreigner**	**Total**	
2013	6870	30	6900	

2014	6871	32	6903	0.04%
2015	6929	138	6967	0.93%
2016	6943	39	6982	0.22%
2017	6963	48	7011	0.42%
2018	11165	167	11332	61.63%
2019	11596	211	11807	4.19%
2020	7565	30	7595	-35.67%

Table-2; Source:Year-wise-statistics2020.pdf (uptourism.gov.in)

a. The above-given data table is taken from the Uttar Pradesh tourism website. The data table shows the number of tourists visiting Unnao for tourism from 2013 to 2020. The tourist visits are bifurcated into two different groups – Domestic and Foreign tourists. The table also embraces data showing the change in the number of total tourists compared to previous years.
b. The data table shows that the number of domestic tourists in 2014 increase by a negligible percentage.
c. 2015 seems a good year for tourism, as it witnessed a nearly 1% increase in the number of domestic tourists compared to 2014. Although only if the numbers are not considered, there is a very slight increase in domestic tourists.
d. 2016 data also shows that the year received a stagnant growth rate. The number of domestic tourists increased was 14 tourists compared to 2015 data.
e. In the year 2017, Unnao again witnessed stagnant growth in the number of tourists. The number of tourists in 2017 increased by 20 compared to the previous year.
f. 2018, Unnao witnessed the highest growth in the number of tourists. In this year number of domestic tourists increased 60.34% compared to 2017 data.
g. 2019 data shows that Unnao witnessed a 3.8% growth in domestic tourists compared to the previous year's data.
h. The year 2020 is the exception year for all the economic activities. Due to pandemic conditions, the hospitality and tourism sector suffered the most. As a result, Unnao recorded a loss of tourists this year.
i. The number of foreign tourists increases from 2013 to 2017, although the growth rate is shallow.
j. The number of foreign tourists in the year 2018 is relatively on the higher side, which is more than 3times compared to previous year data.
k. In 2019, Unnao again recorded significant growth in the number of foreign tourists. The number of foreign tourists increased was 44.
l. In 2020 the number of foreign tourists lowered by 85% in Unnao compared to the previous year's data.

Domestic and foreign visitors in different years in a particular state

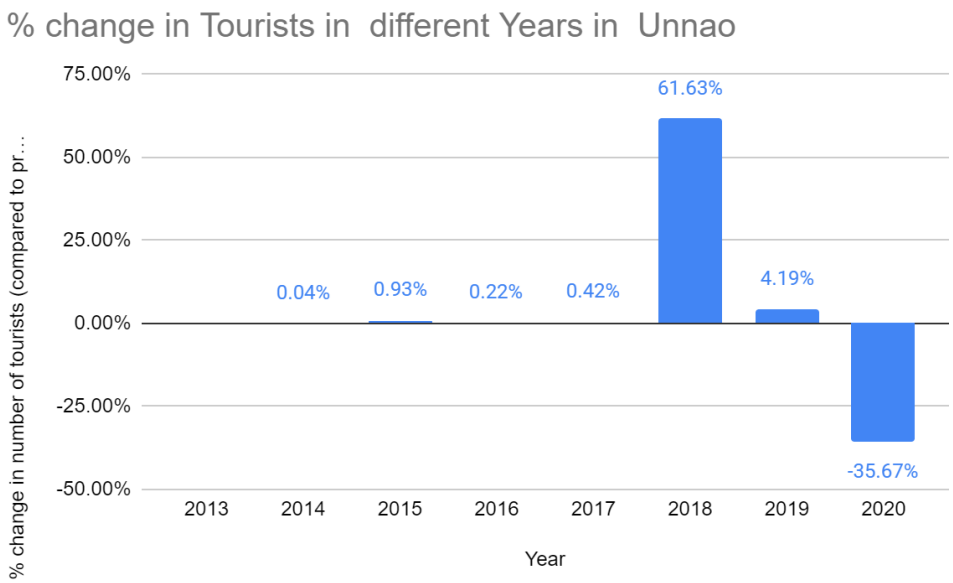
The Indian and Foreign Tourist visits in Uttar Pradesh from 2016 to 2020						
				Percentage increase/ reduce in comparison to the previous year		
Year	**Indian**	**Foreigner**	**Total**	**Indian (%)**	**Foreigner(%)**	**Total**
2016	213544204	3156812	216701016	3.4	1.69	3.37
2017	233977619	3556204	237533823	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-3;Source:Year-wise-statistics2020.pdf (uptourism.gov.in)

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. Unnao follows a similar trend as Uttar Pradesh. In the same year, unnao witnessed a surge in the number of tourists by around 60 %.
c. 2019 was 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. Although the number of tourists did not significantly increase in Unnao during Kumbh Mela 2019.

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

Percentage change in visitors in different years



Graph 1, Source:Year-wise-statistics2020.pdf (uptourism.gov.in)

The above-given graph shows the nominal growth in the number of tourists in Unnao tourism. Till 2017 graph follows similar trend; a nominal growth rate. The in the year 2018, Unnao receives a more significant jump in growth rate to 60%. 2019 can also be said a good year because the year witnessed a positive growth rate. 2020 data is negative because of the Covid-19 scenario.

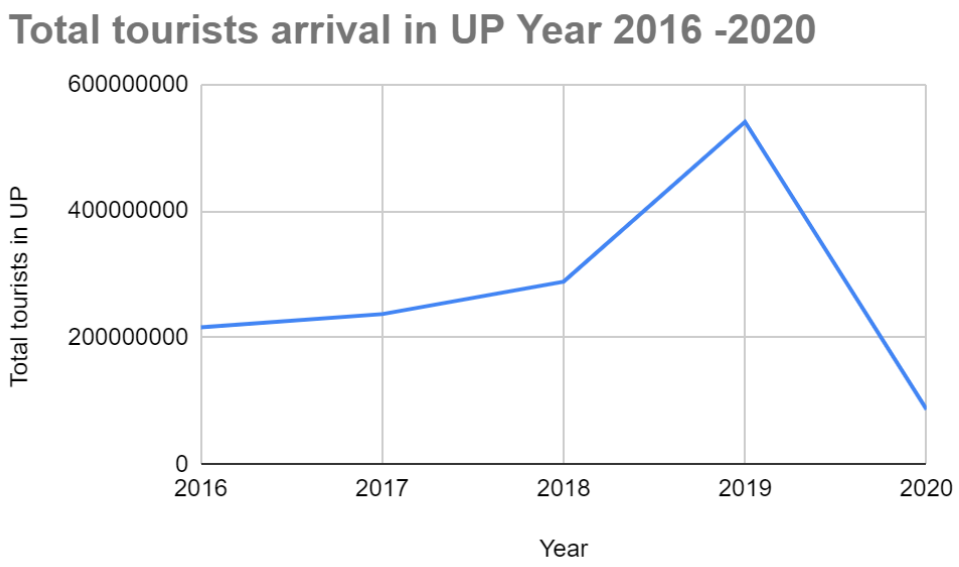
Budget allotted/ Expenditure in different years by tourism dept.

Budget -Department of Tourism, in Different Years		
Year	**Budget in Rupees**	**Per cent 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%

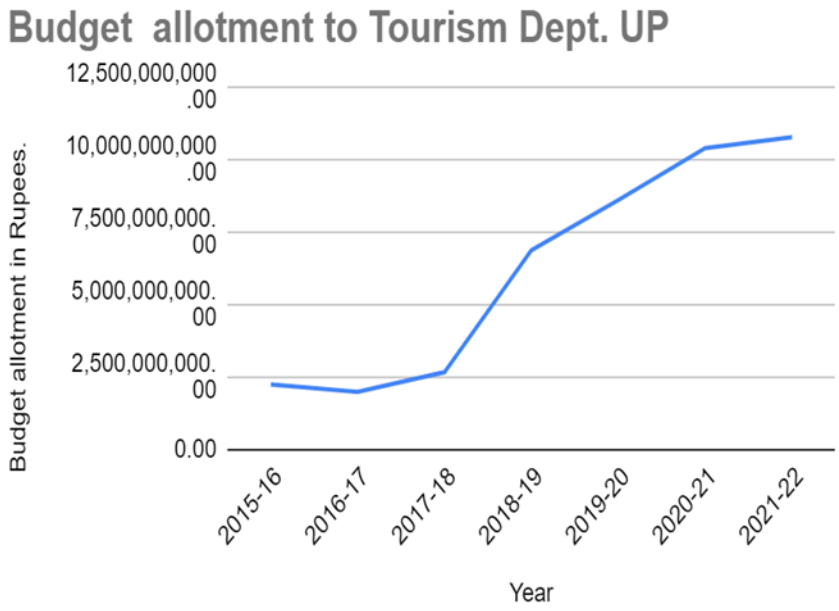
2018-19	6,870,209,000.00	157.21%
2019-20	8,596,205,000.00	25.12%
2020-21	10,382,037,000.00	20.77%
2021-22	10,759,153,000.00	3.63%

Table-4; Source: Dept. of Tourism, Uttar Pradesh Government

The above-given table-4 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.



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



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

The trendlines graphs 2 and 3 above show the budget allotment trend to the Tourism and increase in tourist arrivals. Before 2020 the trendlines follow a similar pattern: the money allotted to the Department is directly proportional to the Tourist arrival in the State. 2020 is an exception during which pandemic seized the tourism activities.

2.5 Wetlands

The district has vast wetlands consisting of lakes and ponds like Basaha Jhil (357 Ha), Basaha Tal (310.75 Ha), Sudesa Tal (182.47 Ha), Raid Tal (167.84 Ha). Table 1 represents the number of wetlands and their area representation in the district. There are around 666 wetlands sized greater than 2.25 Ha and 1895 less than 2.25 Ha areas. The region consists of small and medium-size wetlands only, generally less than 200 Ha in the area, and there are around 2 wetlands with more than 200 Ha.

Table 1: Wetland Data of Unnao District

	Total Number of												
	Wetlands:			Area (ha)									Aquatic Vegetation
Natural Wetlands	**NRCD**	**NWIA**	**Diff.**	**<2.25**	**<5**	**<10**	**<20**	**<50**	**<200**	**<500**	**<1000**	**>1000**	
Lake/ponds	105	108	3	0	14	12	16	38	25	0	0	0	88
Ox-bow lakes/cut off meanders	81	104	23	0	8	11	18	23	19	2	0	0	55
High altitude Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0
Riverine Wetlands	8	17	9	0	1	2	3	2	0	0	0	0	6
Waterlogged	18	19	1	0	3	3	4	5	3	0	0	0	5
River/Stream	0	92	92	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	182	193	11	0	70	71	34	6	1	0	0	0	123
Waterlogged	118	133	15	0	19	20	30	32	17	0	0	0	43

Salt pans	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (2561)	512	666	154	1895	115	119	105	106	65	2	0	0	320

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

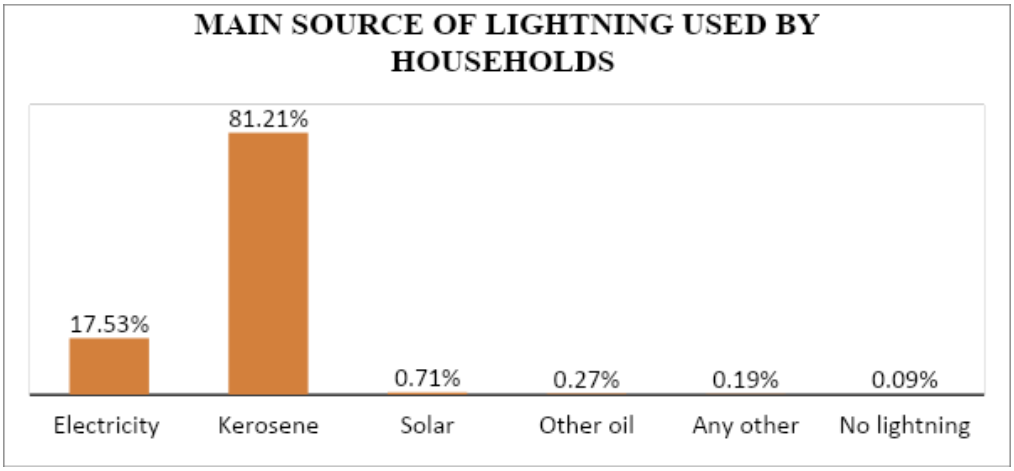
- The district comprises 2561 wetlands; most are waterlogged and lake/ponds/tanks.
- The wetland size is small and medium-sized in general.
- The number of natural wetlands is less than man-made.
- Half of the wetlands (>2.25 ha) have aquatic vegetation.

2.6 Energy

2.6.1. Solar Energy

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. Various capacity solar power plants are being installed for electricity generation from solar energy.

The census 2011, gives an account of the main source of lightning used by households depicted in figure. Majority of them use kerosene, followed by electricity. Only 0.71% households use solar as the main source of lightning.



The annual reports on UPNEDA website mention the various solar plant units installed at the government buildings and other places in the district. Solar Rooftop Systems have been installed at various government offices such as Police Trg. College- 120 kW and BSNL Unnao – 50 kW. Also 10 Solar High Mast Lightning System have been installed in the year 2018-2019 and 111 R.O water plants in the district.

2.6.2.Biomass Energy

Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) is the nodal agency which makes 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.

Biomass-based co-generation in the state sugar mills and rice husk based-electricity generation projects are being encouraged. The district Unnao mainly depends on agriculture and hence produces agricultural residue in large amounts. The main crops of the district are wheat, rice, barley, jowar , etc. Out of the total area of 4496.2 sq km., district's 3090 sq. km. of the area is the net sown area and 170 sq. km. under forest cover. 110 sq. km. of the area is cultivable waste land and 270 sq. km. as fallow land. The cropping intensity of the district is 132.40%. The productivity of various crops in the district has been recorded as- rice: 1853 kg/ha, wheat: 2870 kg/ha, maize: 1119kg/ha, pigeon pea: 1148kg/ha and potato: 21468 kg/ha. According to Kumar et. al. (2017) Unnao has fairly good agro residue potential and forest & wasteland potential as 840.7kT/Yr and 1.9 kT/Yr of biomass is generated in the district respectively. Two co-generation plants have been recorded form the official website of UPNEDA, at Bajaj Kagaj Pvt. Ltd. and Mahavir spin.

The census 2011, gives an account of the percentage of households using different types of fuels for cooking as depicted in figure 1. Majority of households depend on firewood, crop residue and cowdung cake.

The above discussed facts and figures indicate that Unnao has a good potential of biomass energy production, the need is to develop infrastructure and policies in such a way that they encourage setting up of biomass plants.

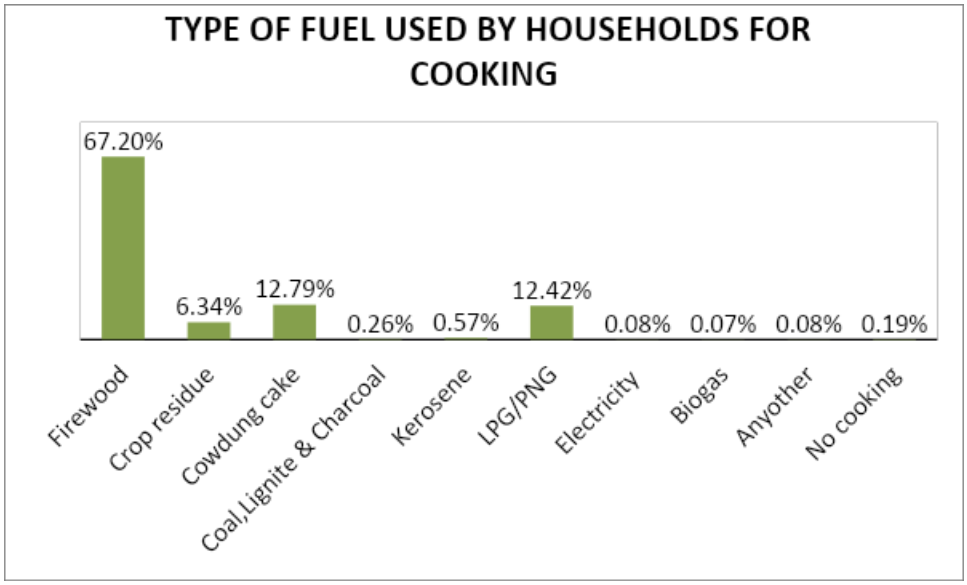


Fig. 1

2.6.3.Biogas Energy

As per the News article 'Amar Ujala' 2014, fifty biogas plant was planned to construct in the district. Two fecal sludge treatment plant exists in the district. Biogas potential has been evaluated by average livestock and agricultural waste production. Biogas potential from animal and agricultural waste calculated approximately as two crore m^3/year and fifty one crore m^3/year

respectively. This amount of biogas generation can efficiently complete the energy demand of the district.

2.6.4.Hydropower Energy

The district is primarily drained by the Ganges and its tributaries Kalyani, Khar, Loni, and Marahai in the western half of the district, and by the Sai river in the eastern part.Available data shows no hydropower plant exists in the district, and no site has been investigated for future projects.

3 QUALITATIVE DATA ANALYSIS

3.1 AGRICULTURE, ALLIED ACTIVITIES,

3.2 FORESTRY

Uttar Pradesh has forest and tree cover of 21720 sq. km, which is 9.01% of its geographical area. The existing flora in Uttar Pradesh can be classified into three categories-

- Wet tropical desiduous forests.
- Dry tropical desiduous forests.
- Tropical throny forests.

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]

3.2.1. Biodiversity : The Shahid Chandra Shekhar Azad Bird Sanctuary promotes recreational and tourism activities, as well as the preservation of local wildlife. It is a birder's paradise, with 25,000 waterbirds reported on a regular basis and 220 permanent and migratory species noted. Among these are the endangered Egyptian vulture (Neophron percnopterus) and Pallas's fish eagle (Haliaeetus leucoryphus), as well as the fragile lesser adjutant (Leptoptilos javanicus) and woolly-necked stork (Ciconia episcopus). The introduction of the golden jackal (Canis aureus) and the jungle cat (Felis chaus) has contributed to expand the general richness of fauna.

[3] https://pib.gov.in/newsite/PrintRelease.aspx?relid=148508

3.3 ENERGY

As per the data of the year 2013, Unnao district energy consumption is around 682 TJ/year and 3.8 GJ/capita/year. GHG emission of 46,360 Ton CO_2 equivalent and 0.261 Ton CO_2 equivalent/capita has been evaluated for the district.

5.5.1. Solar

Not much work has been done on solar energy in the district. An article in The Times of India with the heading 'Unnao may soon boast of solar power plant' reads- The state will soon have a non-conventional source of power generation. Fed by solar energy, a 10 MW power plant is expected to come up in the neighbouring district of Unnao. Another article in Amar Ujala reads- Now the excuse of no electricity or generator failure will not work in the DM office. To deal with the problem, solar power system will be installed in the collectorate at a cost of 20 lakh rupees. For this, the Ministry of Power has asked the DM to send a proposal. On the initiative of the Central Government, the Director of Uttar Pradesh Energy Development Agency, Dr. Kajal has sent a letter to DM Soumya Agrawal asking him to send a proposal for setting up a solar power plant in the Collectorate building. With the installation of a solar plant, the problem of electricity will be solved.

5.5.2. Biomass

Unnao has a good potential of producing biomass energy and can prove its potential if well-planned measures are taken for the district. It seems that not much has been done in the biomass energy sector in the district. Probably because the farmers, mill and cold storage owners are not aware of the biomass energy. Presently the district does not get descent electricity supply. So it becomes important that attention is paid by the local authorities that power production is done on small scale. A news article in Jagran mentions that due to increase in demand of electricity there have been power cutoffs. Another article in Jagran mentions that farmers have been burning parali and there has been no check on them. So the need is that this biomass produced is utilized at smaller scales by setting up small biomass plants by the locals, panchayats, etc.

5.5.3. Biogas

As per the report by Times Now, central government is planning to built 125 compressed biogas plants in forty two districts and Unnao is one of them. The biogas plant will use straw and cow dung as feedstock.

5.5.4. Hydropower

For hydropower generation, the National level program, such as the small hydropower project program, runs in the state. The implementation of small hydropower in the state is carried out by Uttar Pradesh New and Renewable Energy Development Agency and Uttar Pradesh Jal Vidyut Nigam. Neither sites have been investigated so far nor exist at present in the district.

3.4 TOURISM

Places of interest

Historical tourism

Badarga Harbans : The Village of Badarqa Harbans lies about 11 km south of Unnao near Achalganj (near Raibareily bypass). It was established in 1643 AD by King Harbans, a courtier of Shah Jahan, who received a grant of 500 Bighas (a unit of land measurement) from the Emperor in pargana Harha. He erected a fine bungalow here with walls of 500m constructed with limestone blocks covered with turreted walls. For the audience, a hall supported on carved pillars formerly stood here. But in later times, Asaf-ud-daula is said to have taken these pillars to help make Imambara at Lucknow.

Baksar : Baksar, the southmost Village of the Unnoa, lies on the left bank of the Ganga river, about 5 km south of Daundia Khera.. The name of the Village is believed to be derived from the Sanskrit word Bakasram meaning the residence of Baka, a demon, who founded athis village at the exact location. It is believed that Baka was killed by Lord Krishna more than 5000 years ago. It is also said that Raja Abhai Chand, a Bais Rajput conquered the place naming it after the shrine of Bakeshwar Mahadeo and made it it's capital.

Ram Bakhsh Singh, the ruler of Daundia Khera, who took an part in the freedom struggle 1857, was hanged here on a tree over a Temple blown up by the British government. The ruins and remains of the Temple and several broken idols and sculptures are still available in the Village. On the occasion of Kartik Purnima a bathing fair, attended by a large number of people and take a holy dip in Ganga, is annually held here on the full moon day of Kartika.

Religious tourism

Shiv Temple : One of the popular tourist places of Unnao is Shivji ka Mandir or also known as Mahadev Temple. Built about more than a hundred years ago, the infrastructure of this TTemple has unique carvings. The walls of the temples are constructed in an attractive manner. This TTemple is located near the Moti Nagar area, about eight to ten kilometres from Unnao Junction railway station. You can take a local bus or a rickshaw from the station to visit this Temple. It will hardly take about fifteen to twenty minutes to reach the TTemple from the Unnao railway station.

Kalyani Devi Temple : Another famous temple of Unnao is Kalyani Devi Temple. Dedicated to Lord Kalyani. Located two kilometres away from the Unnao railway station, this TTemple attracts a huge crowd. Devotees from cities like Agra, Mathura, Vrindavan, Gorakhpur, Kanpur and Lucknow visit this TTemple regularly to offer their offerings to Goddess Kalyani Devi.

Ecotourism

Shahid Chandra Sekhar Azad Bird Sanctuary : The Nawabganj Bird Sanctuary, renamed in the year 2015 as Shahid Chandra Shekhar Azad Bird Sanctuary, is located in Unnao on the Kanpur-Lucknow highway in Uttar Pradesh, India, consisting of a lakeinside the sanctuary campus. It is

one of the wetlands of North India. The sanctuary protects 250 species of migratory birds and native birds, mostly from European countries; however, the numbers have been inconsistent since the 1990s. One theory also says that most birds relocated to newer cold places in Himachal and Rajasthan. The sanctuary also conserves a deer park, watchtowers and boats.

Data analysis

- The change in the number of domestic tourists is consistent in Unnao. The growth rate follows a trend in growth where the rate is below 1% till the year 2018. In the year 2018 number of tourists increased by 60% compared to the previous year data. The change is very frequent and drastic. In the last few years (2013 to 2017), the growth rate was meagre. There is a need to understand the reason behind such a drastic change in the number of tourists. Also, there is a need to understand why the number of foreign tourists also increased three folds this year.
- It is interesting to note that 2018 not only attracts domestic tourists, but the number of foreign tourists also increased.
- In the year 2019, when the other districts such as Prayagraj in Uttar Pradesh and other cities were receiving a huge number of domestic and foreign tourists, Unnao received a negligible increase in the number of tourists, which is 4%. There may be a gap in the advertisement; Unnao could not attract tourists from these cities.
- Need research to figure out the reason why Unnao failed to attract tourists from cities just 200 kilometres- Allahabad and 50 kilometres -Kanpur
- In 2017 Uttar Pradesh witnessed a 12.6% increase in foreign tourists, whereas Unnao faced a meagre increase in number only 17. There is a need to figure out the reason why Unnao failed to attract foreign tourists in a particular year.
- Till 2019 budget allocation trendline and number of tourists in Uttar Pradesh followed a similar pattern. That is, the number of tourists increased as the budget amount risen from 2106 to 2019. The total number of tourists in Unnao also follows a similar pattern.

3.5 WETLAND

The wetlands are the source of many ecosystems and habitats for various species. The wetlands create a unique ecosystem that supports many species simultaneously like aquatic, terrestrial, and human beings. Local stakeholders directly or indirectly depend on the wetland for their income and small-scale business. These businesses can be a great opportunity can be turned into a large-scale production hub using the right approach. The region is known for the leather industry and leather goods. The district is also known for printing & dyeing for Lihaf (quilts) and mosquito net production. The data collected and analyzed shows the region's production and possible product that can be derived from the raw product. The list of sources and the possible products are mentioned below:

- Pulses, rice, and wheat production are recommended as commercial crops in the region, leading to flour and pluses.
- Unnao has a sizable area under orchards, namely mango
- oil production in the region like mustard, linseed, castor seeds which can turn into a valuable market for oil production in the region.
- The district is famous for its historical values and has ponds like Kundra Samundar, Mawai-Bhari, Kursat, Harial Tal, Barhna tank etc.

4 ACTION PLAN DEVELOPMENT

4.1 AGRICULTURE

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4.2 FORESTRY

The state of Uttar Pradesh announced its new State Forest Policy on October, 2017 in place of State Forest Policy, 1998.

The objectives of State Forest Policy, 2017 are as follows:

- Improvement of existing natural and planted forest by conservation, development and scientific and thoughtful management.
- Formulation and implementation of scheme of afforestation and soil conservation in different types of degraded land of state viz. usar, khadar, ravines and blank forest.
- Special emphasis on forest dweller centric forest management.
- Increase of tree cover by social and agro-forestry plantation on private land.
- To get carbon credits on the plantations which is planted according to international standards.
- To endeavor for the reduction of siltation of water and reservoirs and effects of floods and droughts through controlled measures over soil-erosion.
- To promote plantation over non-forest land.
- To prepare and implement strategies for conservation and improvement of biodiversity and wild life in the state.
- To develop eco-tourism destination.

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.[4]

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.

4.2.1. Biodiversity : Improve the green belt in Unnao district on three to four location, in which 8-12 feet plants should be planted. The Shahid Chandra Shekhar Azad Bird Sanctuary in Unnao is a valuable and essential eco-tourism destination. High-profile utility and eco-friendly facilities should be built.

4.3 TOURISM

5 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 Patna 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 Unnao a new face in tourism. Nawabganj Bird Sanctuary is popular for migratory birds and its vast forest area, which occupies various animals. Sanctuary needs a quick renovation and beautification to attract tourists. Tactics are necessary to keep the place undisturbed for animals despite greater tourist footfalls.

Nawabganj Bird Sanctuary: Hub for Winged Guests

It is a natural paradise for bird-watchers and animal lovers, nature enthusiasts, and those seeking a break from their monotonous city life. The Nawabganj Bird Sanctuary in Unnao, posses a tranquil lush green stretch on 224.6 Hectares. The sanctuary becomes a real haven in winters when too many international and national migratory birds like Garganey Teal, Purple Moorhen, Little Grebe, Mallard, Spoonbill Duck, Red Wattled Lapwing, Intermediate Egret, Wigon and many many more winged guests visit this place.

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

The destination is located on Lucknow Kanpur Highway. There is a cycle track of 2.6 Km long along the placid lake water and experience the species of birds and wildlife and variety of flora. This charming space away from polluted cities ensuring wildlife conservation while serving all lifestyle facilities to its tourists. The campus has a children's park, a cafeteria with an exhaustive menu, an interpretation centre and a motel offered by the Department of tourism government of Uttar Pradesh.

Destination Description

Nawabganj Bird Sanctuary, also known as Panchhi Vihar, is located on NH-25 about 43 Km. away from Lucknow, in Nawabganj Unnao, Uttar Pradesh. The idea was to establish this sanctuary was to conserve birds, native and migratory and their habitat. A famous tale about the lake in the Sanctuary area said that while returning to Ayodhya, Laxman took some rest for a day on this lake. During the winter season, numerous species of native and a large number of migratory birds arrive at this place. With the onset of the spring season (Feb/March), migratory birds start going back. Openbill storks are the signature bird of the Nawabganj Bird Sanctuary.

Climate

The Climate in Unnao is like Gangetic plans; the temperature varies from 48°C in summer to 2°C in winter. Unnao experiences about 900 mm annual rainfall due to North-westerly winds.

- **Sustainable Tourism**

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.

- There is a need to ensure effective and efficient promotion, branding and advertisement of tourists' spots and destinations to attract more tourists from nearby Tourist destinations. Branding and publicity will help attract tourists to Unnao who came to Allahabad, Varanasi, Kanpur, and Agra. One strategy can be the use of instantaneous marketing tactics such as the declaration of a current famous celebrity as Unnao's Brand ambassador. For example, the Uttarakhand government declared hockey player Vandana Kataria the brand ambassador of Uttarakhand's Department of Women Empowerment and Child Development, who participated in the Tokyo Olympics 2020. The benefit of this tactic is that the celebrity has an image in people's mind, celebrity is very famous currently, celebrity has an honour attached with them and a sense of patriotism (in this case) all this consolidates to image formation of the entity with which they are attached (Unnao District Branding).

SN	Strength	Weakness	Opportunity	Threats
	• Located between Lucknow and Kanpur- two major tourist sites of the state. • Rich History and association with freedom fighters and Hindi Literature poets and writers.	• Tanneries – which produces lots of pollution and makes this site a not fir place for tourism. • Underdeveloped Ganga Ghat. • Narrow roads and traffic. • Very less number of tourist arrivals. • Number of foreign tourists is negligible.	• Nawabganj Bird sanctuary can be developed as eco-tourism site to attract more tourism. • Ganga ghats beautification and development for tourism purpose. • Foreign tourist can be attracted in the name of ecotourism.	• Leather tanneries causing pollution. • Climate change is affecting arrival of bords in Nawabganj Bird Sanctuary. • Human interventions had disturbed wildlife in Nawabganj Bird Sanctuary.

Projections and Monitoring matrix

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

		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. ● 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		Realistic planning for successful implementation. .

		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 through modern means to increase tourism activity. ● Organizations of grand events. ● Plan that tanneries in the town do not affect the tourism. ● Conversion of Literature Hub to tourist Literature Hub. ● 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		To attract more tourists and maximize the revenue from tourism.

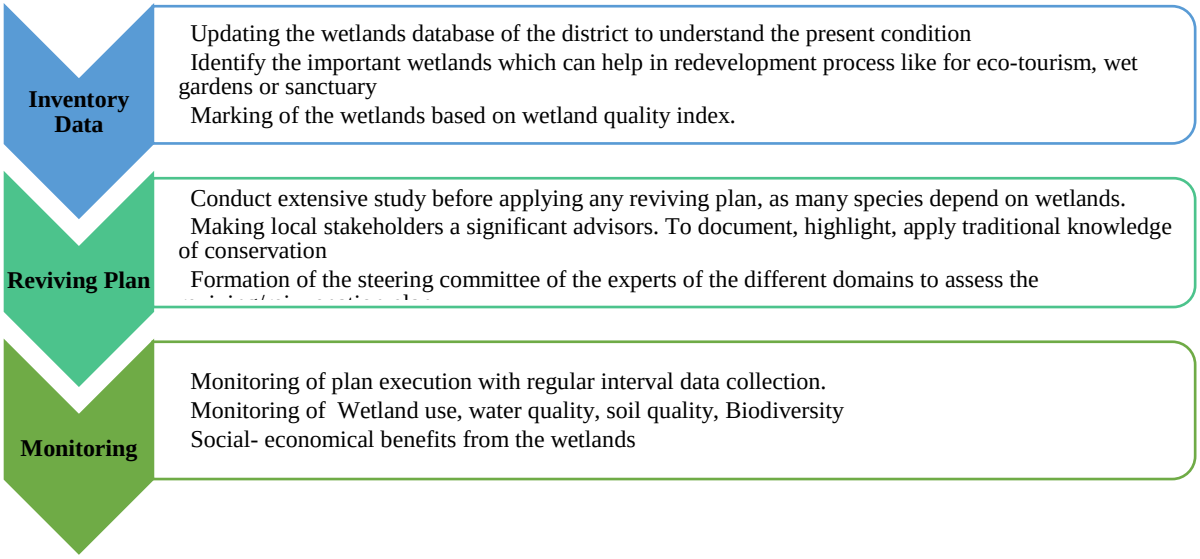
		organized to rejuvenate the local economy and attract tourists. ● Developing tourist circuits ● Developing eateries ● Connecting tourism with local culture and food. ● Extensive marketing for advertisement. Social Media Advertisements ● Bollywood Movies/OTT platforms can promote the town; for example, Mirzapur became very popular after getting a web series on the same name. ● Celebrities as brand ambassadors; especially celebrities coming from the same region ● Famous face as brand ambassador.		To improve the image of the State and not let the other social factor affect the revenue of tourism.

		• Extensive branding and marketing. • Development of tourism spots and heritage sites. • Availability of information on government websites along with tour packages. • Preserving monuments and local culture • Clean city		
	Impact Assessment of results	• Calculating what the touchpoints 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

5.1 WETLANDS

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

gives a glimpse of the action and development required to protect, conserve, rejuvenate the wetlands existing and extinct.



5.2 ENERGY

5.2.1 Solar

Not work has been done in the solar energy sector in the district Unnao. The district needs to make people aware about the solar energy and encourage them to use green and the clean energy. This can be easily done by the self help groups, panchayats and other local self governments. The Kusum Yojana should be promoted among the farmers by making them aware about its different components. When provided with the solar pumps they could irrigate their lands without any interruptions made due to the irregularity in the utility supply. Moreover, if Kusum Yojna is operated in a systematic manner then the farmers can sell the excess electricity to some company or to the cottage industries set up in the nearby areas. This would add to their income. Also the solar feeder segregation technology should be introduced in the required areas. The industries, especially the small scale ones, should be provided with the subsidy and the net metering facility. This will give them returns quickly and they will not have to wait for longer durations to earn profit Other than this the government should install solar plants in government schools, colleges, hospitals and other public buildings. The State government's Minigrid Scheme should be brought to picture. The scheme should encourage the villagers to come together and set up minigrid system rather than the private developers as given in the scheme. The government can provide loan at low rates. This will help the people to become self-reliant and they could get power supply at lower rates.

Projection and monitoring

The first thing which should be done is to make people aware about the solar energy and popularize the schemes relates to solar energy in the district. Next the Kusum Yojana should be popularized among the farmers. Follwed to this should be the requisite infrastructural development

for the solar feeders. Also infrastructure required for the grid connected solar panels should be strenghthened. So that more and more people are incline towards the grid connected solar rooftop panels under the National Solar Mission. The industrial sector should be provided with some benefits if they are using solar energy. Lastly the state government's Minigrid policy should be popularized among the intrepreneurs native to the district. This will create employment oppourtunities in the district. And there would be development in a sustainable manner.

5.2.2 Biomass

The district has the raw materials for the production of biomass energy but the need is to develop a well-knit set of infrastructure and policies specifically for the district. There can be establishments of biomass power plants by village panchayats since at this level the need and the requirement could be understood at the local levels and accordingly actions can be taken. The district has good productivity of potatoes, and hence there are a lot of cold storages for the storing purposes. The power requirement of these cold storages and rice mills should be fulfilled by the biomass based gasifiers. In order to encourage more and more gasifiers, government should provide with subsidies. Also the district cultivates wheat and rice on large scale, which generate a lot of agricultural residues. So, a proper and planned system of providing subsidy should be developed such that gasifiers or the co-generation plants are set up by the local authorities. The price for the agricultural residue should be such that they are feasible for both the sellers and the buyers. The rice mills and the other small industries which produce biomass should be encouraged to have their own biomass plants.

A balanced system needs to be planned, so that the availability of biomass is sustained round the year. This is possible in the district because it cultivates both the rabi and the kharif crops. The rest requirement can be fulfilled from the municipal solid wastes, food wastes, forest wastes etc. The land requirement can be fulfilled from the fallow land available in the district.

Above all a well-developed transportation system is required to be set up for uninterrupted supply to the power plants.

Projection and monitoring

The first thing required is to make people aware and make them believe in bioenergy. This can be done by conducting seminars in schools and colleges, campaigning, etc. Next comes encouraging people to sell the agricultural residues. This can be done by fixing feasible rates of crop residues, such that neither the buyer nor the seller is at loss.

Government should make norms for the cold storage owners, rice mill owners, etc. to have their own biomass plants. If any case it is not affordable, then maybe a group of them can come together and set up biomass plants. This way construction and setting up cost per head can be reduced, which can be an affair of profit to all.

Lastly a well-connected and well-knitted system for transportation should be set up to maintain the supply of biomass from different parts of the district.

5.2.3 Biogas

The district has a total of 152 temporary cow shelters. There are 17 in the city and 135 in rural regions. In addition, a Kanha Gaushala is in operation. The Gaushala is home to 6961 animals in total. These Gaushala should be connected to biogas plant to use dung for producting biogas. More fecal sludge treatment plant should be constructed and should also connected with biogas plants.

5.2.4 Hydropower

The district need to develop small hydro plant to fulfil energy requirement. The district can install about 5 MW electricity through small hydropower plants on Ganga canals in village areas.

6 RECOMMENDATIONS

5.1. Agriculture and allied sectors

- Groundwater shares 80% 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. To reduce groundwater exploration, the district needs to bring more areas under the tank or pond irrigation.

- Farmers should be sensitized to the overuse of fertilizer and pesticides application. They should be trained on the uses of fertilizer and chemical pesticides applications.

- Food grains constituted about 81% of the GCA and 89% the total value of agricultural output. It indicates high concentration of crop sector to only a few crops (Wheat, Rice and Maize). Efforts are required to diversify the agriculture from low-value food grains to towards high-value horticulture and livestock activities. The government can promote micro and small units for horticulture products processing. There is a needs to introduce more horticultural crops, mainly vegetables like cauliflower, cabbage, brinjal, tomato, etc., for more profits.

- The number of indigenous and exotic female cattle increased considerably from 185579 in 1997 to 220734 in 2019 and from 3765 in 1997 to 35854 in 2019, respectively. Similarly, number of female buffaloes increased from 238176 in 1997 to 587517. The share of Livestock in the GDP of agriculture and allied sectors went up 15.01% in 2011-12 to 23.88% in 2018-19, with a remarkable average annual growth rate of 12.23. This indicates that livestock is the emerging sub-sector of agriculture. It needs to be promoted through creating an efficient marketing network and setting up dairy and dairy-based processing

units. The breeds of different Livestock are nondescript, which needs to be upgraded or crossbred by good germplasm of sire through Artificial Insemination.

- Fishery & aquaculture has a huge scope for raising income and livelihood through effective implementation of PM Matsya Yojana.

- 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.

- Training to prepare the Vermicomposting and Green manuring should be organized for the farmers. Moreover, salt-tolerant crops varieties and gypsum application should be promoted in the salt-affected areas.

- Farmers should follow the crop advisory under the drought condition and adopt techniques like drought resistance variety and maintaining moisture of soil by covering the soil.

- About 96% 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. Group farming among the small farmers must be promoted so that they may get the benefits of economics of scale in production and marketing and also improve their bargaining power in the input and product markets.

- 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, chili, onion, garlic, and strawberry, flower like rose and marigold for much returns to the farmers. Medicinal crops like tulsi, mentha, lemongrass, etc. and fruits like papaya, mango, guava, and banana should also be promoted by establishing local market, processing units and cold storage.

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

- Per capita electricity consumption in the district agriculture increased from150.24 KWH in 2011-12 to 275.81 KWH in 2019-20, a net increase of approximately 83.57%. Since electricity consumption has increased over the years, there is a need to promote the use of solar energy in agriculture.

- 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.

- 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.

- 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.

- The district has been frequently suffered from floods in the monsoon season and damages the crops. So, farmers should properly follow crops advisory to not suffer from any losses.

- The farmers adopted high-level machinery such as combine harvesters, happy seeders, supper seeders, and resource conservation methods such as zero tillage and DSR for crop farming; there is still scope for greater agricultural mechanization.

- The area is suffering from the salt problem, so the farmers should be trained for the Gypsum application and leaching method. There is a need to introduce suitable salt-tolerant varieties of Rice, wheat, mustard, barley, sugarcane, and vegetables.

- The district has a huge scope for the cultivation of kalmegh, ashwagandha, lemongrass, tulsi, vetiver, and mentha medicinal plants.

- There is scope for farming shade-loving crops such as elephant foot yam and turmeric cultivation as inter-cropping.

- Malformation in mango is a major problem, which needs to be controlled through IPM. The shade-loving intercrop gave additional income from the mango orchard.

- NFSM, ATMA, SCSP, Skill India, MANAGE (Agri Clinic), OFT, CFLD, FLD, etc., schemes are available for the farmers. Farmers should be informed and encouraged to get the maximum benefits from these schemes.

- The district has been frequently suffered from floods in the monsoon season and damages the crops. So, farmers should properly follow crops advisory so that they will not suffer from any losses.
- The farmers adopted high-level machineries such as combine harvesters, happy seeders, supper seeders, and resource conservation methods such as zero tillage and DSR for crop farming, there is still scope for greater agricultural mechanization.

- Micro-irrigation such as drip and sprinklers should use in the district for horticultural fruits and vegetable cultivation to increase the water efficiency and crop yield.
- The area is suffering from the salt problem so the farmers should be trained for the Gypsum application and leaching method.
- There is a need to introduce suitable salt-tolerant varieties of rice, wheat, mustard, barley, sugarcane, and vegetables.
- There is a need to encourage organic farming, awareness and participation of farmers in organic farming and an emphasis on increasing crop yields.
- The district has a huge scope for the cultivation of kalmegh, ashwagandha, lemongrass, tulsi, vetiver and mentha medicinal plants.
- The district has a scope for the poly house and greenhouse farming for the high revenue crop at a commercial level.
- High revenue crops like capsicum, strawberry, sugarcane, dragon fruits, mushroom should be encouraged to the farmers.
- There is scope for the farming of shade-loving crops such as elephant foot yam and turmeric cultivation as inter-cropping.
- Malformation in mango is a major problem, which needs to be controlled through IPM. The shade-loving intercrop gave additional income from the mango orchard.
- There is a need for an expansion of food processing units.
- Bee keeping could become an additional source of income to the farmers. There is a need for training for the rural youth and farm women to boost the honey production of the district.
- The district has scope for the expansion of fisheries and animal husbandry. The breeds of different Livestock are nondescript which needs to be upgraded or crossbred by good germplasm of sire through Artificial Insemination.
- NFSM, ATMA, SCSP, Skill India, MANAGE (Agri Clinic), OFT, CFLD, FLD etc. schemes are available for the farmers. Farmers should be informed and encouraged to get the maximum benefits from these schemes.

5.2. Forestry

Unnao, located on the bank of river Ganga. According to ISFR 2019, 264.59 Sq. Km. area of Unnao is covered with forest. As discussed above, the forest cover of Unnao has increased significantly as compared to previous assessment of ISFR 2017. Majorly open and moderately dense forest are 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.) and scrub area. Government can promote the afforestation, agroforestry activities by providing output based incentives.

5.2.1. Biodiversity.

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

- Wood mafias are present in many villages of the Pinsa area, Anetha, Bhairampur, and cutting green trees illegally; strict laws should be implemented to remove such groups from the district.

5.3. Tourism

- **Promoting Unnao as a tourist destination**

There is an urgent need to promote Unnao tourism to foreign visitors and all international markets. The tourism ministry should surely pursue aggressive online and other marketing strategies to promote Unnao as a must-visit location through seminars and talk shows, joint marketing programmes and the use of publicity materials. Unnao is known in India for its famous Freedom Fighters and Hindi Literature reformers such as Suryakant Tripathi Nirala, Shiv Mangal Singh' Suman', Jagdambika Pd. Misra, Bhagwati Charan Misra, Pratap Narayan Misra, Dr Ram Vilas Sharma and many more. Taking benefit of the rich heritage and history of the town, tourism can be developed to simultaneously promote literature and patriotism.

- **Create experiences, not just tourist spots**

Steps should be taken to make the tour replete with tourist guides, activities for the children, culinary tours, local Mahotsav to celebrate local achievements and celebrities, interactivity for the tourist with the culture of the place etc.

Renovation of Ghats- Because ghats and river gives rise to lot of economic activities hence ghats can be renovated to expand economic activities at this place and create experience for tourists.

- **Safety and Security**

There is a need to ensure effective implementation of the policies and actions drafted to ensure the safety and security of tourists. ' 'Unnao's image needs to be projected as a safe and secure tourist destination for all tourists. Surveillance at every tourist destination is required to ensure the safety of tourists and spots.

- **Promoting Food trail**

India is known for its diverse cuisine, and there are a lot of food lovers across the world. Promoting Indian cuisine along with tourism can reap benefits in leaps and bounds. Food festivals similar to aam Mahotsava in Lucknow can be organized in Unnao.

- **Appointing Brand Ambassador for endorsement**

Unnao Tourism can be further endorsed by appointing a brand ambassador. It is essential to zcapitalize on their star value and fan following so that UP tourism can get a boost and be well accepted by tourists. Uttarakhand government declared hockey player Vandana Kataria the brand ambassador of Uttarakhand's Department of Women Empowerment and Child Development, who participated in the Tokyo Olympics 2020. The benefit of this tactic is that the celebrity has an image in people's mind, celebrity is very famous currently, celebrity has an honour attached with

them and a sense of patriotism (in this case) all this consolidates to image formation of the entity with which they are attached (Unnao District Branding). Similarly, in Kumbh, veteran actor Amitabh Bachchan came in various advertisements to attract more tourists. Endorsement became more effective because the actor belongs to the same city Allahabad.

- **Upgrading the skills**

The hospitality business should be appropriately groomed and capable of offering the best service possible to tourists. Investing in training schools will assist the young generation in concentrating on their work and acquiring the necessary skills to make the experience worthwhile. Also, training sessions for guides can benefit individual guides and help them earn livelihood and the tourism sector to embrace more tourism. These training sessions can also help know the actual number of available tourists guides in the city. And the same information can be uploaded on the website for customer support.

- Tourists are a source of income for the natives; developing local marketplaces such as specialized malls for locally made handicrafts can give a place to sellers and buyers simultaneously. Usually, local markets (selling original articles) are scattered throughout the city; a specialized marketplace will help the sellers showcase their product at excellent places, and buyers can find a wide variety of ranges at the same site.
- Letting tourists know about community-based initiatives such as women-led Self-Help Groups and Social Enterprises will support tourism and such industries. As it can bring business to enterprises.
- Development of COVID 19 protocol friendly tourism packages to boost the tourism sector economy after the pandemic.
- Ghats can be developed on the verge of international standards to attract more and more foreign tourists.
- Supporting tourism can also help flourish other sectors such as local handicrafts, restaurants and eateries, travel agencies, local vendors and many more as all of these are in a symbiotic relationship.
- Chimney of the tanneries can be installed high so that the atmosphere remains friendly for tourist.
- The waste coming from the leather factories should not dump directly to the river, it needs to be treated well before dumping the wastewater.

5.4. Wetlands

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

- Introduction of improved cultivars and production technologies for pulses and oilseeds.
- Diversification through introducing vegetable, mushroom, beekeeping, fruits, medicinal plants, dairy, poultry etc. for nutritional security
- It is recommended to rejuvenate and restore the water bodies of the district.
- Promotion of fishing and water chestnut industry.
- It is recommended to promote the production of medicinal plants in the region to support the promote ayurvedic medicine, and wetland can support the water supply for the cultivation.
- It is recommended to promote eco-tourism in the region as the region can develop with flower gardens around the wetlands area and biodiversity by creating a market for selling handicrafts nearby.

5.5. Energy

5.5.1. Solar

The district has not witnessed the benefits of solar energy probably due to lack of awareness about the solar energy. The people should be made aware of it. The farmers should be educated about the Kusum Yojana and encouraged to take benefits from it. For industries there should also be a set of policies aiming for their benefit from the solar energy.

5.5.2. Biomass

The district requires awareness about the bioenergy, then only the biomass energy sector will prove to be fruitful. Biomass based gasifier plants are best suited for the district. The cold storages and rice mills should be encouraged to set up biomass plants.This will lead to an overall development in a sustainable manner. As power produced will be clean and green, it will provide power for various purposes in the district by keeping the environment clean.

5.5.3. Biogas

- Kanha cattle shelter should be used to generate biomethane by builting anerobic digestion plant.

5.5.4. Hydropower

- It is recommended to build a multipurpose (electricity and irrigation) canal on river Ganga so that water and electricity (atleast two megawatt) would be available for the farmer throughout the year.

6. Discussion during the Report Presentation

- The trainings are being provided to the farmers on adoption of diversified crop production.
- The promotion of sustainable farming system is being addressed in every meeting/ interactions with NGOs, SHGs etc.
- Unnao being situated near Lucknow or Kanpur, it has a good access to the vegetable markets.
- The farmers are being trained on mushroom and strawberry cultivation. A change has been seen in the cultivation practice of the farmers. The IIML Report for Arth Ganga should be a regular Agenda item for next 6-8 DGC meetings.
- Hon'ble PM during the post-Budget webinar on Tourism had spoken about market potential of destination weddings. It was suggested that suitable Ashrams in Ganga Basin may be identified for such purpose to promote blissful experience, cost reduction, livelihood opportunities and better upkeep.
- Allocate separate space for Namami Gange Awareness and Jalaj Marketing kiosk in Melas/Congregatios/Fairs for providing better marketing opportunities to the Jalaj products.
- As Dilli Haat Centre – Namami Gange Awareness and Marketing Centre – is being launched soon, it was requested that every district to identify niche products with a creative story and link it with Jalaj in their area.
- To identify Arth Ganga Tourist Trails and organize Ganga Guide training
- Promotion of Natural Farming in Ganga Basin and training workshops should be organized on a regular basis. NMCG is supporting this initiative in coordination with MoA& FW and NCOF.
- Make plans for reuse of treated waste water for agriculture, industrial etc. purpose and also the sludge.
- Training of volunteers for Ganga awareness & Aarti workshops to promote regular aartis on Ghats.

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7 APPENDICES

Table 2 Crop production in the district.

Crop/Year	2015-16	2016-17	2017-18
Non-grain crops (Metric Tonne)	35315	43368	52335
Grain crops (Metric Tonne)	710629	1025245	1070330
Sugarcane (Metric Tonne)	40774	55799	47790
Potato (Metric Tonne)	175371	174630	177654

Table 3 Livestock population in the district.

Livestock	2003	2007	2012
Cattle (Cow)	406213	388370	381206
Buffalos	418463	508236	505587
Sheep	38855	34858	16155
Goat	314625	376734	367779
Pigs	73429	78076	26464
Chicken	185990	161696	280702
Other Poultry	5643	155786	2691
Horses and Ponies	2781	907	1877

Table 4 Biogas potential from animal waste.

Livestock	Residue type	Total population as of 2012	Manure yield* (kg/day)	Total manure generation annually (kg)	Average collection (75%)	Dry manure after removing Moisture content	Manure required for biogas* (kg/m^3)	Biogas potential (m^3/yr)
Cattle	Manure	381206	10	1,39,14,01,900	1043551425	208710285	25	8348411.4
Buffalo	Manure	505587	15	2,76,80,88,825	2076066619	415213323.8	25	16608532.95
Sheep	Manure	16155	1	58,96,575	4422431.25	884486.25	25	35379.45
Goat	Manure	367779	1	13,42,39,335	100679501.3	20135900.25	25	805436.01
Pig	Manure	26464	2.5	2,41,48,400	18111300	3622260	25	144890.4
Poultry	manure	2,83,393	0.1	1,03,43,845	7757883.375	1551576.675	25	62063.067

Total		**15,80,584**						**26004713.28**

Table 5 Biogas potential from agricultural waste.

Crop	**residue type**	**Total crop production (tons) (2017-18)**	**Residue production ratio**	**Residue amount (tons)**	**Average collection (70%)**	**Moisture content**	**Residue amount after removing moisture (tons)**	**Biogas potential [m3/(tons of dry matter)]**	**Overall biogas potential (m3)**
Maize	straw	65622	1.5	98433	68903.1	15	58567.635	800	46854108
Wheat	straw	798318	1.5	1197477	838233.9	30	586763.73	800	469410984
Sugarcane	Bagasse	47790	0.33	15770.7	11039.49	80	2207.898	750	1655923.5
Total		**911730**							**517921015.5**