Arth Ganga Project: District Etawah

Submitted to:

National Mission for Clean Ganga (NMCG)

Submitted by:

IIM Lucknow

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EXECUTIVE SUMMARY

Etawah is located in the state of Uttar Pradesh. The city is traversed by the rivers, Yamuna and Chambal.

The total geographical area of the district is 2311 km^2. The primary sector showed an average annual growth rate from 2011-12 to 2018-19 is only 0.89%. Thus, its share decreased from 39.12% in 2011-12 to 28.51% in 2018-19. The share of the secondary sector increased from 17.16% in 2011-12 to 20.40% in 2018-19. The sector grew with a significant average annual growth rate of 7.53%. The tertiary sector's share increased from 43.72% in 2011-12 to 51.09% in 2018-19 with a remarkable average annual growth rate of 7.29%. Overall, the district economy grew with an average annual growth rate of 5.02%.

In 2017-18, the net sown area and the gross irrigated area represents 148475 ha and 206767 ha. The cropping intensity of the district is 168.31%. The total actual irrigated area is 135456 ha. Major crop types are wheat, rice, maize, barley, tide, millet, pulses like a variety of gram, black pulse, pigeon pea, lahi mustard, etc. along with sugarcane, potato, pea, etc. The total food grains along with pulses account for the production of 631222 MT. The livestock consists of cattle (indigenous and crossbred), buffalos (indigenous and crossbred), pigs (indigenous and crossbred), sheep; poultry, and fisheries.

The district's percentage of the net and gross irrigated areas have increased over the years with an average of 89.18% and 79.58%, respectively. The share of cultivable wasteland increased from 2.68% in 2010-11 to 4.18% in 2017-18, which is not a good development indicator. Barren and uncultivable land share decreased slightly from 2.92% in 2010-11 to 2.84% in 2017-18. The net sown area has increased over the years, from 60.95% in 2010-11 to 61.80% in 2017-18. The area for non-agricultural use increased slightly over the period from 10.26% to 11.49%. The nitrogen share increased to 66.90%, while the phosphorus share decreased to 29.92%, and the potassium share decreased to 3.18%. The use of nitrogen and Phosphorous is more than the recommended ratio, while potassium is less than the recommended ratio. The overall use of chemical fertilizers has decreased in the district from 207.86 kg/ ha G.S.A. in 2010-11 to 135.39 kg/ ha G.S.A. in 2016-17.

The total forest cover of the district is 251.38 km^2. The share of forest area in the total reported area decreased from 15.03% in 2010-11 to 12.55% in 2017-18. Out of total forest cover, the maximum area is covered by Open Forest (188.63 km^2) and moderately dense forest (62.75 km^2). The share of area under trees and gardens increased from 0.22% in 2010-11 to 0.40% in 2017-18.

Sant Ravindas Nagar is known for its spiritual significance and hosts fair and festivals. The district is well connected through roads and a railway network. In the year 2019, the district received 1363657 domestic tourists and 16 foreign tourists. In 2020, the number of Indian visitors increased yet the number of foreign visitors fell. The district has sites such as Victoria Park, Raja Sumer Singh Fort, Etawah Safari Park, etc. for tourists to visit.

In the district, 57.87% households in the district depend on kerosene for the main source of lightning, followed by 41.08% using electricity and only 0.36% using solar. According to Pugazenthi et. al. 2016, total solar power potential available in the district Etawah is 0.1579. 11 Solar R.O. water plants have been installed in the district and Etawah Safari Park will also be installed with 20 Kw solar panels. Electricity consumption in agriculture has increased significantly from 234.19 KWH in 2014-15 to 405.88 KWH in 2019-20, a net increase of approximately 73.31%. The percentage share of the agriculture sector in the total electricity is around 26.21%. 63% households use firewood as the main cooking fuel, followed by 17% using LPG/PNG, 12% using crop residue and 7% using cow dung cakes.

The total number of wetlands existing in the district is 900 consisting of both Man-made and Natural. Most of them are small or medium-sized and tanks/ponds/lakes and waterlogged. The district's biodiversity data includes various crop production, livestock population, bird species, and forest cover with 369 bird species and 24 threatened/rare species of bird in the district. Biogas potential from animal waste and agricultural waste was calculated approximately as one crore m^3/year and twenty-five crores m^3/year. No hydropower present or plans exist.

Various measures such as eco-tourism, and sustainable tourism, should be taken to improve tourism and enhance the use of renewable energy especially by creating awareness. Maintenance of structures and waste production and handling, hygiene, and sanitation, wetlands, etc. should be taken proper care of. Organizing festivals and fairs and proper advertisement. Strict measures against pollution, exploitation of resources, and forest products along with suggesting alternatives for the same. Agroforestry, use of high-yielding seeds, micro-irrigation, constructing and maintaining harvesting structures, adopting greenhouse farming with organic farming, and encouraging farmers for adapting different crop cultivation and various irrigation methods. Along with focussing on agriculture practices Bee culture, dairy, poultry, fisheries, etc. needs encouragement as they have high economic potential. Also, adapting to advanced technologies, proper monitoring, MIS, Geo-tagging, monthly physical and financial reports, maintenance of places and forests, shifting cultivation, floriculture, etc., are a few measures that might be adopted in the district. Introducing PM Matsya Yojana, payments of ecosystem services, vermicomposting and green manuring, poly house, medicinal crops like tulsi, mentha, commercialization of flower cultivation like Rose, subsidized crop insurance system, resources conservation technologies such as zero-tillage, laser land leveler, mulching, etc.

1. DISTRICT OVERVIEW

1.1 INTRODUCTION

Etawah district is one of the districts in the western portion of Uttar Pradesh state of India. Etawah town is the district headquarters. The district covers an area of 2311 km^2. According to the 2011 census Etawah district has a population of 1,581,810. This gives it a ranking of 316th in India (out of a total of 640). District Etawah is situated in west of the Kanpur division. It is bounded in north by the district Mainpuri and Farrukhabad, on the east by newly created district Auraiya and on the south by Jalaun, on the west by district Agra and Firozabad and the remaining part of the district bounded by the State of M.P. The district lies between 26º21' and 27º1' North altitude and 78º45' and 79º45' East longitude. Total area of the district is 2311.0 sq. km. The district is administratively divided into 05 tahsils namely Jaswantnagar, Saifai, Etawah, Bharthana and Chakarnagar.

The economy of the district is pivoted around agriculture. Nearly 64.99 percent of the workers are engaged in agriculture related works. This clearly shows that majority of the population are dependent on agriculture. The method of cultivation in the district is generally same as those found elsewhere in the Doab. There are usual harvests known as Kharif or autumn, the Rabi or spring and Zaid or extra harvest. The system of double cropping is followed to a considerable extent in the district owing to the facilities for irrigation. The chief Kharif crops are the paddy, bajra, juwar and maize. These are sown either alone or in combination with arahar in the district. Wheat heads the list of Rabi cereals in the districtas far as area and production is concern .A wide range of crops such as wheat, Gram,barley,peas,pulses,patato and mustard in the Rabi. Gram, pea, mustard etc. are the main Rabi crops. Wheat occupies predominant position followed by paddy. The district has a good agriculture base and a reasonably good infrastructure of various facilities but the industrial base is weak, resulting in low income to the district. Industrially the district remained as one of the backward district of the state. Some handloom cloth are woven in a number of villages, situated in the west of Etawah tahsil. In Etawah city, Daris (mat) of good quality were manufactured on small scale

In the total population of the district of Etawah as much as 31.99 per cent are workers and rest of 68.01 per cent are non-worker. Among worker 22.86 per cent are main workers and rest of 9.13 per cent are marginal workers of total population. The extent of workers in rural parts and non-workers in urban parts is higher. In the district among workers 33.76 per cent are cultivators and 30.91per cent other workers. 23.75 per cent of female workers are engaged as cultivators.

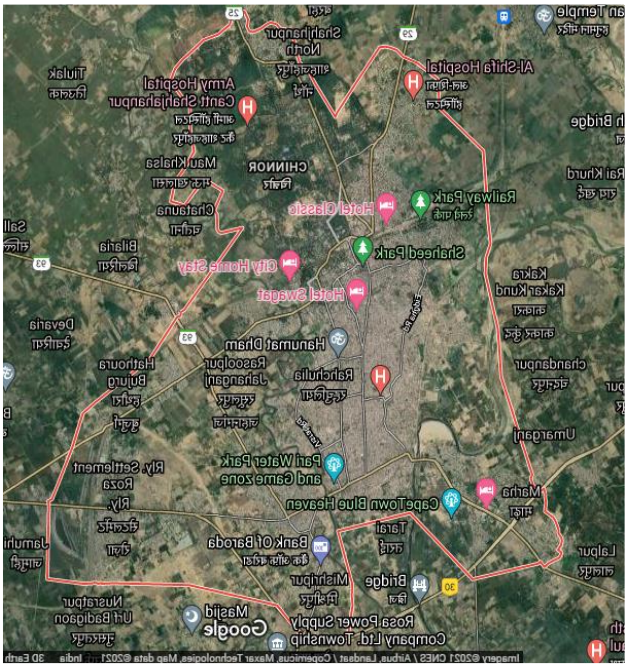


Figure 1 Map of the district

1. DEMOGRAPHIC PROFILE OF ETAWAH

- Geographical Area: 2311 Sq. Km.
- Administrative Divisions:[1]

District Headquarters: Etawah

No of Municipalities: 6

No of Tehsil: 6

No of Blocks: 8

No of Gram panchayats: 471

No. Of Villages: 692

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

- Demographic and socio-economic indicators:[2]

  Population: 15,81,810 (Census 2011)

  Population density (Total persons per sq. km): 685

  Sex ratio: 870Literacy: 78.4%

- Occupation/ other Livelihood source: Agriculture
- Major Rivers: Yamuna and Chambal
- Forest Area: 251.38 Sq. Km.

1.2 ECONOMIC PROFILE OF ETAWAH

The primary sector has a significant impact on the district economy because it contributes, on average, 25% share in the district GDDP. Thus, its share decreased from 25.90% in 2011-12 to 24.8% in 2018-19. The share of the secondary sector increased from 15.2 % in 2011-12 to 16.96% in 2018-19. The sector grew with a significant average annual growth rate of 7.79%. The secondary sector grew with a remarkable average annual growth rate of 26.14%, with its share increasing from 57.13% in 2011-12 to 59.97% in 2018-19. Steps should be taken to increase the productivity of the primary sector so that it can grow at a higher rate. This will improve the growth rate of the overall district economy. The secondary and tertiary sectors have performed better during the study period.

Table1 : GROSS DISTRICT DOMESTIC PRODUCT of district Etawah at constant prices (Base Year 2011-12)

YEAR	2018-19	2011-12	2016-17	2015-16	2014-15	2013-14	2012-13	2019-20
Agriculture, Forestry and Fishing	**1767.89**	**1604.96**	**1786.06**	**1511.95**	**1274.63**	**1574.46**	**1516.83**	**1795.17**
Crops	1194.83	1108.18	1164.14	1029.74	920.99	1095.71	1188.59	1202.77

[2] https://censusindia.gov.in/2011census/dchb/0930_PART_B_DCHB_ETAWAH.pdf

Livestock	509.73	258.29	487.41	373.77	317.51	303.17	287.01	536.08
Forestry and Logging	40.91	234.43	128.63	103.64	31.43	171.17	36.96	32.63
Fishing and Aquaculture	22.42	4.07	5.88	4.80	4.70	4.40	4.27	23.69
Mining and Quarrying	**97.13**	**26.06**	**160.59**	**122.52**	**60.24**	**53.32**	**30.62**	**76.51**
PRIMARY	**1865.02**	**1631.02**	**1946.65**	**1634.47**	**1334.87**	**1627.78**	**1547.44**	**1871.68**
Manufacturing	**397.80**	**131.29**	**328.41**	**318.47**	**167.47**	**269.57**	**188.49**	**359.88**
Electricity, Gas ,Water Supply & Other Utility Services	**111.54**	**82.35**	**93.93**	**95.01**	**96.68**	**91.46**	**87.38**	**113.99**
Construction	**763.52**	**728.46**	**691.79**	**710.54**	**700.91**	**683.91**	**699.59**	**754.04**
SECONDARY	**1272.86**	**942.10**	**1114.13**	**1124.01**	**965.07**	**1044.94**	**975.46**	**1227.91**
Trade and Hotel & Restaurant	**651.93**	**467.24**	**640.36**	**574.48**	**468.05**	**514.27**	**447.89**	**745.15**
Transport, Storage & Communication	**754.90**	**283.90**	**757.94**	**742.88**	**518.15**	**411.16**	**361.22**	**769.68**
Railway	103.15	70.49	84.22	84.69	87.29	86.07	77.52	101.87
Transport by Means Other than Railways	517.95	167.69	476.32	466.47	356.32	265.75	231.80	517.21
Storage	13.37	13.55	14.72	14.59	14.55	15.26	14.95	16.67
Communication & Services Related to Broadcasting	120.43	32.17	182.69	177.14	59.99	44.08	36.95	133.93
Financial Services	**273.67**	**180.70**	**252.24**	**257.73**	**244.62**	**219.21**	**200.02**	**310.06**
Real Estate, Ownership of Dwellings and Professional Services	**1044.21**	**784.52**	**949.85**	**928.38**	**900.95**	**861.09**	**831.05**	**1033.94**

Public Administration	**1395.91**	**249.44**	**979.72**	**849.34**	**821.38**	**805.24**	**487.65**	**1525.80**
Other Services	**555.26**	**459.17**	**531.39**	**484.81**	**450.26**	**403.21**	**377.91**	**577.90**
TERTIARY	**4675.88**	**2424.97**	**4111.50**	**3837.62**	**3403.41**	**3214.18**	**2705.74**	**4962.53**
GROSS DISTRICT VALUE ADDED (At Basic Prices)	**7813.76**	**4998.09**	**7172.28**	**6596.10**	**5703.35**	**5886.90**	**5228.64**	**8062.12**
GROSS DISTRICT DOMESTIC PRODUCT (At Market Prices)		**518**	**747**	**673**	**593**	**584**	**527**	**8499.98**
		209	**254**	**233**	**202**	**211**	**222**	
		5307.08	**7665.23**	**7035.31**	**6094.03**	**6259.46**	**5534.22**	

Table 2: NET DISTRICT DOMESTIC PRODUCT of district Etawah at constant prices (Base Year 2011-12).

ACTIVITY	**YEAR**							
	2011-12	**2012-13**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**
Agriculture , Forestry and Fishing	**1365.57**	**1386.64**	**1143.78**	**1437.22**	**1619.46**	**1525.44**	**1600.51**	**1626.69**
Crops	892.18	1064.22	797.18	966.56	1008.62	950.09	1039.14	1045.60
Livestock	366.45	282.06	311.16	297.29	478.17	480.92	500.57	527.34
Forestry and Logging	102.58	36.58	31.21	169.44	127.31	88.97	40.48	32.28
Fishing and Aquaculture	4.36	3.79	4.24	3.94	5.37	5.46	20.31	21.47
Mining and Quarrying	**106.99**	**26.87**	**52.02**	**46.79**	**140.23**	**242.33**	**86.26**	**67.63**
PRIMARY	**1472.56**	**1413.50**	**1195.8**	**1484.01**	**1759.69**	**1767.76**	**1686.77**	**1694.31**

ARTH GANGA PROJECT: DISTRICT ETAWAH

Manufacturing	254.51	152.67	133.84	222.08	262.45	368.91	344.96	301.69
Electricity, Gas ,Water Supply & Other Utility Services	44.66	50.95	44.8	47.91	42.57	53.77	54.75	55.08
Construction	665.18	663.65	654.28	638.62	647.63	672.26	704.84	682.73
SECONDARY	964.35	867.27	832.92	908.61	952.66	1094.95	1104.55	1039.49
Trade and Hotel & Restaurant	526.84	414.04	430.98	472.90	587.30	567.23	587.08	670.07
Transport, Storage & Communication	637.45	314.87	448.67	358.51	645.03	663.08	628.34	626.11
Railway	61.91	62.55	64.92	71.07	61.57	58.38	70.59	63.22
Transport by Means Other than Railways	426.27	209.31	325.91	238.19	434.06	471.48	467.52	464.23
Storage	12.02	12.91	12.17	12.80	12.13	12.03	10.90	14.93
Communication & Services Related to Broadcasting	137.25	30.10	45.67	36.45	137.26	121.18	79.32	83.73
Financial Services	252.80	196.86	240.43	215.75	247.40	223.04	267.40	302.19
Real Estate, Ownership of Dwellings and Professional Services	760.80	708.43	743.81	720.15	778.39	810.51	838.96	810.56
Public Administration	664.07	374.99	638.34	620.42	778.00	980.66	1126.05	1228.89
Other Services	405.38	330.16	388.22	348.78	440.38	399.99	461.16	458.29
TERTIARY	3247.33	2339.34	2890.47	2736.51	3476.50	3644.5	3908.99	4096.10
NET DISTRICT VALUE ADDED (At Basic Prices)	5684.24	4620.12	4919.2	5129.13	6188.85	6507.21	6700.31	6829.91
NET DISTRICT DOMESTIC PRODUCT (At Market Prices)	672	528	590	582	749	6972.8	7214.73	7265.25
Population (In Lakhs)	233	222	201	210	255	17.25	17.48	17.71
PER CAPITA INCOME (In Rupees)	6122.89	4926.32	5308.37	5500.28	6683.24	40424	41274	41017

District-wise Per Capita Net Income; District- Etawah

2011-12 prices		Current prices	
YEAR		**YEAR**	
2011-12	30275	**2011-12**	30275
2016-17	39266	**2016-17**	54071
2017-18	40639	**2017-18**	56657
2018-19	41492	**2018-19**	63303

The GDDP values have increased from 2011-12 to 2019-2020 for agriculture, livestock, fishing and aquaculture except for forestry and logging and Mining and quarrying (which is good indicator) but it resulted into overall decreased share of primary sector during the district. In the tertiary sector every sub-sector except Real state and railway showed a remarkable growth and secondary sector have not showed any promising increase in values. The NDDP values has increased remarkably for tertiary sector and secondary sector, except in communication subsector and values have showed same trend in primary as that of GDDP.

2. Quantitative Data Analysis

2.1.1 Trend in Land Use Pattern

The total declared area of the district is 2402.70 sq. km². The share of forest area in the total reported area decreased from 15.03% in 2010-11 to 12.55% in 2017-18. The share of cultivable wasteland increased from 2.68% in 2010-11 to 4.18% in 2017-18, which is not a good development indicator. Barren and uncultivable land share decreased slightly from 2.92% in 2010-11 to 2.84% in 2017-18. The share of area under trees and gardens increased from 0.22% in 2010-11 to 0.40% in 2017-18. The current fallow land has also decreased over the years, which is good for the district economy. The net sown area (NSA) has increased over the years, from 60.95% in 2010-11 to 61.80% in 2017-18. The area for non-agricultural use increased slightly over the period from 10.26% to 11.49% (Table 1). Overall, the land use pattern shows that the fallow and uncultivable land area decreased while the NSA increased over the years.

Table 1: Trends in Land-use Pattern in Etawah (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	Area under trees and gardens	Net Sown Area
1	2	3	4	5	6	7	8	9	10	11
2010-11	240270	15.03	2.68	5.48	2.25	2.92	10.26	0.23	0.22	60.95
2011-12	240270	15.03	2.68	4.59	2.41	3.09	10.37	0.23	0.20	61.41
2012-13	240270	15.03	2.66	5.28	2.24	2.89	9.56	0.23	0.21	61.90
2013-14	240270	15.03	3.13	4.43	2.47	2.84	10.41	0.22	0.21	61.27
2014-15	240270	12.54	3.15	4.22	2.28	2.84	10.67	0.22	0.40	63.68
2015-16	240270	12.54	3.15	3.28	4.34	2.84	11.37	0.22	0.39	61.87
2016-17	240270	12.54	3.15	3.28	4.34	2.84	11.37	0.22	0.39	61.87
2017-18	240270	12.55	4.18	3.70	2.82	2.84	11.49	0.22	0.40	61.80
Source: Compiled from http://updes.up.nic.in/spiderreports/intialisePage.action										

2.3.2 Trends in Operational Land Holdings

In Etawah district, the total number of operational farms increased from 210 thousand in 2010-11 to 215 thousand in 2015-16, a net increase of 2.38%. While in the state, their numbers increased from 23,325 thousand in 2010-11 to 23822 thousand in 2015-16, a net increase of 2.13%. Most land positions in the district are marginal and small. These two size categories represented around 89.87% in the district in 2015-16, while the corresponding proportion in the state was 92.81% (Table 2). The two agricultural censuses of 2010-11 and 2015-16 report no significant change in the percentage share across the various categories of landholdings. Marginal land holdings decreased in 2015-16.

Table 2: Distribution of Operational Holdings by Size-categories of farms (in %) in Etawah							
	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.)
Etawah	2010-11	78.64	14.04	5.92	1.34	0.06	210
	2015-16	76.32	13.55	8.72	1.37	0.04	215
							[2.38]
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

2.1

.3.1 The Trend in Cropping Patterns

Rice, Wheat, and Bajra dominate the agriculture of the district. Table 3 shows the area under various crops over the last eight years. In 2017-18, Wheat made up the highest share of GCA (38.17%), followed by Rice (21.23%) and Bajra (15.34%), together these three crops constitute around 74.74% of the GCA. The area shared by the total cereals has decreased from 77.72% in 2010-11 to 77.64% in 2017-18. The main pulses produced are Moong, Chickpeas, and Arhar, while the rest of the pulses are not significantly produced. The total pulse acreage has decreased from 4.60% in 2010-11 to 4.04% in 2017-18. Thus, the food grains cover a majority (average, 81.82%) of the GCA. Mustard is the only major oilseeds crop produced, and the total oilseed acreage has decreased from 6.87% in 2010-11 to 6.33% in 2017-18. The area under Sugarcane is negligible. The area under Potato has increased. In general, there is no significant change in the cropping pattern during the study period, except that the NSA decreased over the years, from 60.97% in 2010-11 to 57.89% in 2017-18. The average cropping intensity in the district is 168.31.

Table 3: Trends in Cropping Pattern (as % GCA) and Cropping Intensity

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	19.53	20.12	20.59	20.05	21.40	21.31	21.31	21.23
Wheat	39.40	38.74	38.73	38.72	38.47	38.30	38.30	38.17
Bajara	15.86	15.01	14.67	15.27	15.46	15.39	15.39	15.34
Other Cereals	2.93	3.03	2.98	3.00	2.93	2.92	2.92	2.91
Total Cereals	77.72	76.90	76.96	77.05	78.27	77.92	77.92	77.64
Moong	1.82	2.03	2.36	2.47	2.29	2.28	2.28	2.27
Chana	0.94	0.81	0.72	0.67	0.59	0.59	0.59	0.59
Arhar	0.98	0.76	0.78	0.70	0.59	0.58	0.58	0.58
Other Pulses	0.87	0.68	0.67	0.72	0.60	0.60	0.60	0.60
Total Pulses	4.60	4.28	4.53	4.56	4.07	4.05	4.05	4.04
Total Foodgrains	82.32	81.18	81.49	81.60	82.34	81.97	81.97	81.68
Mustard	6.29	6.66	6.45	6.24	5.99	5.97	5.97	5.95
Til (Net)	0.54	0.41	0.39	0.33	0.34	0.33	0.33	0.33
Other Oilseeds	0.04	0.03	0.04	0.05	0.05	0.05	0.05	0.05
Total Oilseeds	6.87	7.10	6.88	6.62	6.38	6.35	6.35	6.33
Sugarcane	0.17	0.17	0.15	0.16	0.14	0.14	0.14	0.14
Potato	5.93	6.48	6.43	6.60	6.27	6.25	6.25	6.22
Net Sown Area	60.97	60.89	60.20	59.07	60.14	58.17	58.17	57.89
Gross Sown Area (in 1000 Ha)	240.19	242.34	247.04	249.20	254.41	255.56	255.56	256.46
Cropping Intensity	164.01	164.24	166.10	169.28	166.28	171.92	171.92	172.73

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

2.1.3.2 Trends in per hectare yield of principal crops

Table 4 shows that the yield per hectare of most crops varies from year to year. However, the yield for most of the major crops has increased in the latter years of the study. This can be due to improved irrigation facilities and the availability of better infrastructure. Wheat, Rice and Bajra are the major crops in the district, and their per hectare yield (36.83 qtls, 27.03 qtls, and 21.60 qtls, respectively, in 2017-18) are also high. Per hectare yield of total cereals has increased from 29.23 qtls in 2010-11 to 30.93 qtls in 2017-18.

Similarly, per hectare yield of total pulses increased from 10.74 qtls in 2010-11 to 14.79 qtls in 2017-18. However, the yield of Pulses is less than that of cereals, following which the total production of pulses is less. The yield of total oilseeds has increased from 15.46 qtls in 2010-11 to 18.30 qtls in 2017-18. This can be due to the availability of hybrid seeds in the district. However, the rise in the yield of most of the crops is not uniform. In some years, it has decreased as well, but on average, the yield has increased in the latter years of the study. The yield of Potato is high, average, 245.97. Potato is a high-value crop, it can help to raise farmers' income if proper marketing and infrastructure support are provided. In summary, all crop yields show year-over-year fluctuations, with the lowest in 2014-15. The lack of homogeneity of yields makes farmers' income riskier and more unstable, requiring a solid insurance protection measure.

Table 4: Trends in Per Hectare Yield of Principal Crops in Etawah District (Qtls)

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	25.25	27.14	29.49	29.00	25.85	24.32	25.32	27.03
Wheat	35.08	37.32	39.02	35.94	17.04	33.18	41.96	36.83
Bajara	20.84	20.18	23.77	24.58	19.55	23.10	21.21	21.60
Total Cereal	29.23	30.70	33.09	31.53	20.15	28.40	32.57	30.93
Moong	7.64	7.98	5.21	7.42	7.64	8.66	10.78	8.72
Chana	15.24	15.39	14.02	6.22	4.18	5.97	2.37	20.15
Arhar	14.10	22.76	21.03	10.37	4.94	4.16	50.01	38.85
Total Pulses	10.74	12.27	10.12	7.65	6.44	7.04	22.45	14.79
Total Food Grains	28.19	29.73	31.81	30.20	19.47	27.34	32.07	30.13
Mustard	16.64	15.59	17.13	12.85	6.77	13.42	23.36	19.28
Til (Net)	1.98	2.62	2.00	0.35	0.41	0.44	2.43	2.27
Total Oilseeds	15.46	14.81	16.24	12.20	6.45	12.70	22.51	18.30
Sugarcane	534.23	582.74	606.77	595.96	576.78	366.31	719.39	760.19
Potato	235.49	197.05	278.33	219.18	242.98	211.13	267.84	315.76

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

2.1.3.3 Trends in Production of Principal Crops

Table 5 shows the trends in the production of the main crops over the years. Rice, Wheat, Bajra, and Potato dominate the production. In 2017-18, Rice (147.20 thousand tons), Bajra (84.95 thousand tons), and wheat (360.51 thousand tons) formed a major part of the total cereal

production (615.92 thousand tons). Among pulses, Moong, chickpeas, and Arhar occupied the highest production. Moong, chickpeas, and Arhar had production of 5.08 thousand tons, 3.03 thousand tons, and 5.79 thousand tons, respectively, in 2017-18. Although there has been a significant variation in the production of these pulses over the years, they still represent around 55% of the total pulse production. Mustard production was 29.41 thousand tons, which represented around 99% of the total oilseeds production in 2017-18. Sugarcane production was only 27.37 thousand tons in 2017-18. Potato production has also been significant over the years (504.09 thousand tons in 2017-18). Looking at the annual production data of various crops, we find that their production has increased on average during the period, but at the same time fluctuates year to year, partly due to weather changes and partly due to market conditions. Proper insurance arrangements are the need of the hour to get assured income and take more risk and diversify their production.

Table 5: Trends in Production of Principal Crops in Etawah District (in 1000 Tons)

Crop/Year	2010 -11	2011 -12	2012 -13	2013 -14	2014 -15	2015 -16	2016 -17	2017 -18
Rice	118.47	132.33	150.03	144.94	140.74	132.44	137.91	147.20
Wheat	332.02	350.41	373.35	346.82	166.82	324.77	410.70	360.51
Bajara	79.38	73.41	86.13	93.54	76.90	90.88	83.43	84.95
Other Cereals	15.75	15.96	19.60	20.08	16.69	17.34	16.50	23.25
Total Cereals	545.62	572.11	629.10	605.38	401.15	565.43	648.53	615.92
Moong	3.33	3.93	3.03	4.57	4.45	5.04	6.28	5.08
Chana	3.43	3.01	2.49	1.04	0.63	0.90	0.36	3.03
Arhar	3.33	4.20	4.06	1.80	0.74	0.62	7.46	5.79
Other Pulses	1.79	5.78	5.79	3.09	1.59	1.35	16.60	7.20
Total Pulses	11.87	12.72	11.32	8.70	6.66	7.29	23.23	15.31
Total Foodgrains	557.49	584.83	640.41	614.08	407.81	572.71	671.76	631.22
Mustard	25.14	25.15	27.30	19.98	10.32	20.47	35.63	29.41
Til (Net)	0.26	0.26	0.19	0.03	0.04	0.04	0.21	0.19
Other Oilseeds	0.11	0.07	0.09	0.13	0.12	0.10	0.68	0.08
Total Oilseeds	25.50	25.48	27.58	20.14	10.47	20.60	36.52	29.69
Sugarcane	21.48	24.07	21.78	24.49	20.76	13.19	25.90	27.37
Potato	335.27	309.33	441.85	360.22	387.89	337.05	427.57	504.09

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

2.1.3.4 Variability in the Area, Production, and Yield

To understand the variability across the years (Table 6), we calculated the mean, standard deviation (S.D.), and coefficient of variation (C.O.V.) of the area, production, and yield of the main crops. Among different crops, the lowest variability in the area is observed in Wheat (1.69%), followed by Mustard (2.43%) and Bajara (3.47%), and the highest in Arhar (18.02%). The variability in the area under total pulses (4.17%) is more than the variability in the area

under total cereals (2.99%). Since Rice and Wheat dominate the production, the variability in the area under total food grains is also relatively low (2.72%).

Table 6: 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	51.79	3.06	5.90	138.01	10.21	7.40	26.68	1.84	6.91
Wheat	96.53	1.63	1.69	333.17	72.31	21.70	34.55	7.54	21.84
Bajara	38.26	1.33	3.47	83.58	6.83	8.17	21.85	1.78	8.16
Total Cereal	193.96	5.81	2.99	572.90	77.54	13.53	29.57	4.12	13.92
Moong	5.57	0.60	10.83	4.46	1.04	23.38	8.01	1.56	19.52
Chana	1.71	0.28	16.12	1.86	1.25	67.19	10.44	6.51	62.35
Arhar	1.73	0.31	18.02	3.50	2.41	68.78	20.78	16.32	78.57
Total Pulses	10.67	0.44	4.17	12.14	5.34	44.00	11.44	5.26	46.03
Total Food Grains	204.63	5.56	2.72	585.04	80.96	13.84	28.62	4.03	14.08
Mustard	15.47	0.38	2.43	24.17	7.50	31.02	15.63	4.89	31.31
Til (Net)	0.94	0.16	16.80	0.15	0.10	66.56	1.56	0.98	63.01
Total Oilseeds	16.51	0.39	2.34	24.50	7.69	31.39	14.83	4.71	31.72
Sugarcane	0.38	0.03	6.74	22.38	4.36	19.47	592.80	119.13	20.10
Potato	15.76	0.65	4.12	387.91	65.77	16.95	245.97	39.35	16.00

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

The variability of production depends on the variability of the cultivated area and the variability of the yield. Therefore, the variability in the production of different crops is greater than in the cultivated area of all crops. The highest variability in production is observed in Arhar (68.78%), followed by chickpeas (67.19%), Til (66.56%), Mustard (31.02%), and Moong (23.38%). High variation in the production of pulses and oilseeds is partly due to variation in the land area under them and partly due to the high rate of seeds and non-availability of hybrid seeds. Improvement in crop insurance conditions and better market accessibility can lower this variation. Variability is lowest in Rice (7.40%), followed by Bajara (8.17%) and Potato (16.95%).

In the case of yield, the greatest variability is estimated in Arhar (78.75%), Til (63.01%), and chickpeas (62.35%). Yield variability in total cereals (13.92%) and total food grains (14.08%) is lower as compared to that in total pulses (46.03%). Rice, Bajra, and Potato are the most consistent crops over the years. Several factors, such as climate change, market prices, rainfall patterns, etc., influence the variability in agricultural production.

2.1.4 Trends in Value of Product of Major Crops

Table 7 compares the share of the main crops in the total GCA and their share in the total value of agricultural output (VOP). It is significant to note that total cereals, total food grains, and total oilseeds, on average, have a relatively larger share in GCA than their share in VOP, while,

Potato and Sugarcane have, on average, a greater share in VOP than GCA. Etawah is mainly a food grain production district; therefore, food grains accounted for around 81.82% of the GCA. Similarly, total foodgrains account for nearly 69.69% of the total value of the agricultural product. Three crops - Wheat, Rice, and Potato together accounted for, on an average, around 65.60% of GCA and 81.83% of the total VOP. Overall, the total GCA increased in the latter years of the study (average, 250.09 thousand hectares) and the total value of the product also increased significantly, from Rs.1044.45 Cr. in 2010-11 to Rs.2440.56 Cr. in 2017-18.

Table 7: Share of Principal crops Total G.C.A. and Total Value of agriculture products in Etawah

Crop	% Share in	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Wheat	GCA	39.40	38.74	38.73	38.72	38.47	38.30	38.30	38.17
	VOP	37.03	42.61	30.54	34.05	16.01	29.50	30.74	26.59
Paddy	GCA	19.53	20.12	20.59	20.05	21.40	21.31	21.31	21.23
	VOP	20.98	19.31	18.00	21.34	45.01	38.84	33.03	17.49
Total Cereals	GCA	77.72	76.90	76.96	77.05	78.27	77.92	77.92	77.64
	VOP	66.89	68.82	54.62	63.94	68.19	76.00	69.58	51.64
Total Pulses	GCA	4.60	4.28	4.53	4.56	4.07	4.05	4.05	4.04
	VOP	6.30	5.89	3.88	3.63	3.73	3.68	5.12	5.64
Total Food Grains	GCA	82.32	81.18	81.49	81.60	82.34	81.97	81.97	81.68
	VOP	73.20	74.71	58.50	67.57	71.92	79.68	74.70	57.28
Total Oilseeds	GCA	6.87	7.10	6.88	6.62	6.38	6.35	6.35	6.33
	VOP	7.01	7.31	5.02	5.56	2.81	5.18	7.57	5.15
Potato	GCA	5.93	6.48	6.43	6.60	6.27	6.25	6.25	6.22
	VOP	19.26	17.55	36.14	26.34	24.81	14.87	17.43	37.18
Sugarcane	GCA	0.17	0.17	0.15	0.16	0.14	0.14	0.14	0.14
	VOP	0.53	0.43	0.34	0.53	0.46	0.27	0.30	0.39
Paddy + wheat + potato	GCA	64.86	65.34	65.75	65.37	66.15	65.85	65.85	65.62
	VOP	77.28	79.47	84.67	81.73	85.83	83.22	81.20	81.26
Total Agriculture	GCA (1000 Ha)	240.19	242.34	247.04	249.20	254.41	255.56	255.56	256.46
	VOP (in Cr Rs)	1044.45	1233.64	1834.01	1629.93	1719.64	1926.43	2404.66	2440.56
Per Worker V.O.P. (Rs.1000 at current prices) in **Etawah**		-	40.42	52.86	44.58	44.07	60.49	65.84	75.97
Per Worker V.O.P. (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 7 shows that the total value of agricultural produce per agricultural worker in Etawah district increased from Rs.40.42 thousand in 2011-12 to Rs.75.97 thousand in 2017-18, a net increase of 87.96% at current prices, while in UP it increases from Rs. 40.66 thousand to Rs.69.69 thousand Rs, a net increase of 71.40%. Thus, the total value of agricultural output per agricultural worker was higher in the state as compared to that in the district, but eventually, it exceeded the state average in later years as the growth rate was higher in the district. The ratio of per worker value of the output of the district to the state average increased from 0.9942 in 2011-12 to 1.0901 in 2017-18.

2.1.5 Consumption of Chemical Fertilizers

Table 8 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 63.49% of the total fertilizers used, while the proportions of phosphorus and potassium were 30.29% and 6.22%, respectively. In 2017-18, however, the nitrogen share increased to 66.90%, while the phosphorus share decreased to 29.92%, and the potassium share decreased to 3.18%. The use of nitrogen and Phosphorous is more than the recommended ratio, while 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. The overall use of chemical fertilizers has decreased in the district from 207.86 kg/ ha G.S.A. in 2010-11 to 135.39 kg/ ha G.S.A. in 2016-17, which is a good sign. However, still, the authorities need to take steps to further reduce their consumption as chemicalization of agriculture degrades soils and water resources, requiring the use of organic fertilizers and biofertilizers.

Table 8: Trends in Use of Chemical Fertilizers in Agriculture (Kgs/per ha G.S.A.)

Fertilizer/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Nitrogen	131.98	111.75	116.16	96.43	100.80	92.45	91.90	139.34
Phosphorous	62.95	52.05	46.31	24.93	29.15	34.65	35.97	62.32
Potassium	12.93	8.29	4.51	3.41	5.98	6.40	7.52	6.62
Total	207.86	172.09	166.97	124.77	135.93	133.50	135.39	208.28
Gross Sown Area (Ha)	240191	242336	247035	249196	254407	255564	255564	256462

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

2.1.6 Irrigation Structure and Status

2.1.6.1 Types of Irrigation systems

The types of irrigation systems and the percentage of the net and gross irrigated area to the net and gross cropped area, respectively, are described in Table 9. The length of the canal has remained constant (839 km) over the years. Government tube wells increased from 348 in 2010-11 to 502 in 2018-19. Shallow, medium, and deep tube wells have increased by 7.91%, 90.67%, and 55.12%, respectively, in 2018-19 compared to 2010-11. The district's percentage of the net and gross irrigated areas have increased over the years with an average of 89.18% and 79.58%, respectively.

Table 9: 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 (K.M.)	839	839	839	839	839	839	839	839	839
No. of Govt. Tube wells	348	384	384	384	435	502	502	502	502
Shallow Tube well	40362	40936	41985	42356	42642	43015	43248	43553	43553
Medium Tube well	536	614	719	816	882	942	967	1022	1022
Deep Tube well	127	137	145	145	186	191	191	197	197
% Of NIA	87.03	87.48	87.41	89.94	90.67	89.84	89.84	91.23	-
% Of GIA	77.99	78.91	79.32	79.59	79.75	80.24	80.24	80.62	-
Source: http://updes.up.nic.in/spiderreports/intialisePage.action									

2.1.6.2 Source-wise area under irrigation

Canals and groundwater (GW) are the main irrigation source in the district. The canal's share in the NIA (average, 47.39%) has decreased over the years, and the share of wells and tube wells in NIA (average, 52.50%) has increased over the years. This shows the increased dependency of the district on the groundwater for irrigation purposes, and it can have serious environmental issues if such a pattern continues in the long run.

Table 10: Source-wise Area under Irrigation in Etawah (in %)								
Source/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Canal (surface Irri.)	48.80	45.96	48.67	49.84	49.18	46.96	46.96	42.77
Wells And Tube-wells (GW Irri.)	51.10	53.94	51.27	49.79	50.64	53.02	53.02	57.21
Others	0.10	0.10	0.06	0.38	0.19	0.01	0.01	0.02
NIA (1000 ha)	127.46	129.07	130.00	132.40	138.72	133.55	133.55	135.46
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

2.1.6.3 Crop-wise Irrigated Area

Table 11 shows that a majority area under Rice (average, 100%), Wheat (average, 99.91%), Potato (average, 100%), and Sugarcane (average, 100%) is irrigated. Percentages of the irrigated area under pulses (average, 64.08%) and oilseeds (average, 59.47%) are relatively less.

Table 11: Trends in Crop-wise Irrigated Area in Etawah (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	99.98	100	100	100	100
Wheat	99.81	99.81	99.82	99.82	100	100	100	100
Total Cereal	79.84	80.06	80.38	80.09	80.35	80.35	80.35	80.35

Total Pulses	54.48	60.52	64.49	66.41	66.70	66.70	66.70	66.70
Total Foodgrains	78.42	79.03	79.49	79.32	79.67	79.67	79.67	79.67
Total Oilseeds	53.65	57.05	57.82	61.61	61.40	61.40	61.40	61.40
Sugarcane	100	100	100	100	100	100	100	100
Potato	100	100	100	100	100	100	100	100
Source: http://updes.up.nic.in/spiderreports/intialisePage.action								

2.1.7 Electricity Consumption in Agriculture

Electricity is one of the main energy sources used in agriculture. Table 12 shows that per capita electricity consumption in agriculture has increased significantly from 234.19 KWH in 2014-15 to 405.88 KWH in 2019-20, a net increase of approximately 73.31%. This is a cause of concern as this can result in an increased burden on non-renewable resources and create waste disposal problems. The percentage share of the agriculture sector (average, 26.21%) in the total electricity consumption in the district is quite significant. This indicates the heavy usage of electricity by agricultural farmers. Since electricity consumption has increased over the years, it is very important for the authorities to switch to more sustainable modes of electricity production, such as solar power.

Table 12: Trends in Electricity Consumption in Agriculture

Division/ Year	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Per Capita electricity consumption (K.W.H.)	234.19	220.89	332.73	348.17	396.01	405.88
% Of electricity consumed in Agriculture sector to total consumption	21.32	18.88	31.03	29.88	29.15	27.02
Source: District-wise Development Indicators file.						

2.1.8 Status of Agriculture Market

Table 13 shows the marketing infrastructure in the district. It has three main markets and two sub-markets. The number of regulated mandis per lakh hectare of Net area sown has decreased from 3.41 in 2013-14 to 3.36 in 2018-19, which is a cause of concern as it is very important to increase the number of regulated mandis so that farmers are able to sell their products efficiently.

Table 13: Status of Agriculture Markets in Etawah

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.)	2	2	2	2	2	2	2

Total Markets (No.)	5	5	5	5	5	5	5
No. of Regulated mandis per lakh Ha. of net area sown	3.41	2.08	-	2.02	1.96	3.36	-
Source: District-wise Development Indicators file and District-wise Statistical Report							

2.1.9 Status of Organic Farming

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

As per the PGS India website, only Chakarnagar block of the district have some organic farming groups, such as Chambal Ghati Satat Jaivik Krishak Samuh, GSJKS, RSJKS and Naga Ji Satat Jaivik Krishak Samuh.

A gradual shift of farmers from conventional to the organic farming system is likely to positively impact water quality and soil health along with farming sustainability. However, being a knowledge-intensive system of farming, farmers need proper training to know the practical details of the integrated sustainable farming system. Since economies of scale in both production and marketing matter in organic farming, some institutional framework may be needed in the forms of SHGs/ farm cooperative/PFOs/contract farming, etc. Organic farming could be an economically viable option in the district if the government builds strong marketing

networks linking farmers, processors, and distributors with the easy certification process and minimizes farmers' risk by protecting their farm income through payments of ecosystem services. A long-term system of incentive and regulation needs to evolve to retain the existing farmers and motivate others to move towards the sustainable farming system in the district.

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

1. The major problem of the farmers was poor marketing of the organic products and not being able to fetch a premium.
2. Scaling up of organic production is another problem. The problem of marketing is even more serious in the case of perishable vegetable crops. Contract farming companies and Farmer Producers' companies can be encouraged.
3. Farmers practicing organic farming only on a small part of their land (less than one ha) to get the scheme's benefit.
4. Although organic farming clusters are formed, the farmers allocated a part of their lands to organic farming and practiced conventional farming in the rest of the area, which may contaminate the organic produce and fail the purpose of the cluster approach in organic farming.
5. The knowledge and awareness level regarding practices under organic farming was inadequate among farmers.

2.1.10 Livestock Sector

2.1.10.1 Trends in Livestock Population

Livestock forms an integrated part of the rural economy. From Table 14, we can infer that the number of indigenous male and female cattle has decreased considerably from 59560 in 1997 to 2341 in 2019 and from 80654 in 1997 to 60279 in 2019, respectively. The number of exotic male and female cattle has increased considerably from 1452 in 1997 to 1943 in 2019 and from 2579 in 1997 to 40214 in 2019, respectively. Thus, the total number of cattle decreased only slightly from 144245 in 1997 to 104777 in 2019, thus, a net decrease of 27.36%. The number of male buffaloes has decreased over the years, but at the same time, the number of female buffaloes has increased; thus, a net increase of 80.74% in 2019 as compared to that in 1997 is observed in the total population of buffalo. A significant reduction in the population of indigenous sheep is observed (58.81%) in 2019 as compared to that in 1997. However, during the same period, the population of exotic sheep increased, thus, indicating a net decrease in the total sheep population by 50.05%. The total population of goats increased from 239481 in 1997 to 243429 in 2019, a net increase of 1.64%. The total pig population decreased considerably from 17387 in 1997 to 4029 in 2019.

Table 14: Trends in Livestock population (in numbers) in Etawah

Category		1997	2003	2007	2012	2019
Indigenous Cattle	Total Male	59560	44575	48306	31071	2341
	Total Female	80654	62701	69140	81192	60279
	Total	140214	107276	117446	112263	62620
Exotic Cattle	Total Male	1452	1107	1548	3798	1943

	Total Female	2579	2442	3353	11399	40214
	Total	4031	3549	4901	15197	42157
Total Cattle		144245	110825	122347	127460	104777
Buffalo	Total Male	72527	66495	63135	76730	22859
	Total Female	139831	142113	170156	215953	360960
	Total	212358	208608	233291	292683	383819
Sheep	Total Indigenous Sheep	9924	4449	5041	4916	4087
	Total Exotic Sheep	319	77	45	235	1029
	Total Sheep	10243	4526	5086	5151	5116
Goat	Total	239481	241361	273034	299505	243429
Pig	Total Indigenous Pig	16551	15405	15795	8521	3538
	Total Exotic Pig	836	83	59	501	491
	Total Pig	17387	15488	15854	9022	4029
Total Livestock		628729	586418	652176	735189	-
Total Poultry		37528	34339	28540	88566	-
Source: http://updes.up.nic.in/spiderreports/intialisePage.action And http://dahd.nic.in/animal-husbandry-statistics						

2.1.10.2 Cattle Care Centre

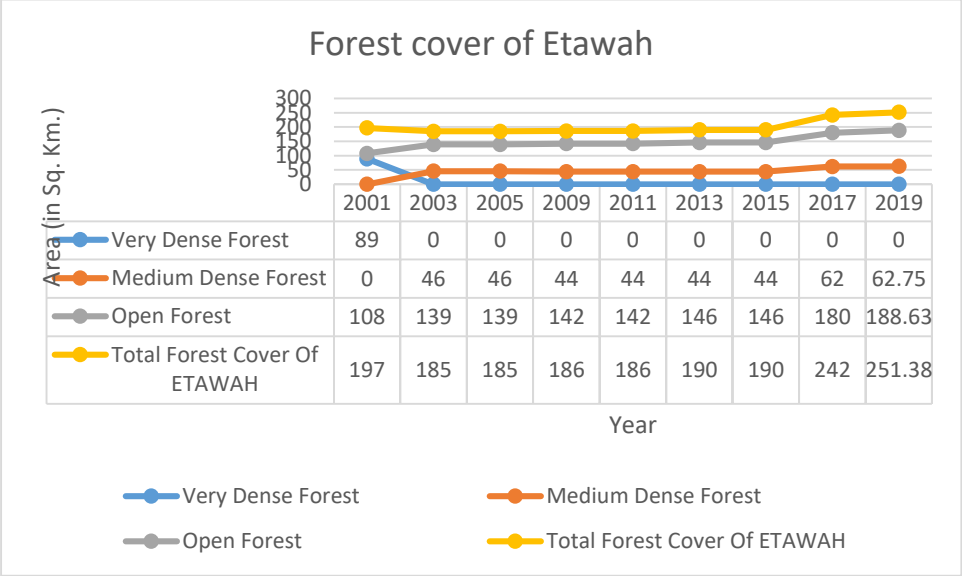
Table 15 shows that the Etawah district has an active network of cattle hospitals and development centres, which are very necessary for the livestock sub-sector to grow. The number of cattle hospitals has increased from 24 in 2010-11 to 26 in 2018-19. The number of cattle development centres (34) has remained constant over the years. The number of man-made reproduction centres increased from 25 in 2010-11 to 51 in 2018-19. There are very few sheep and pig development centres which might be one reason for the declining sheep and pig population in the district.

Table 15: Year-wise number of Cattle Hospitals and Development Centers

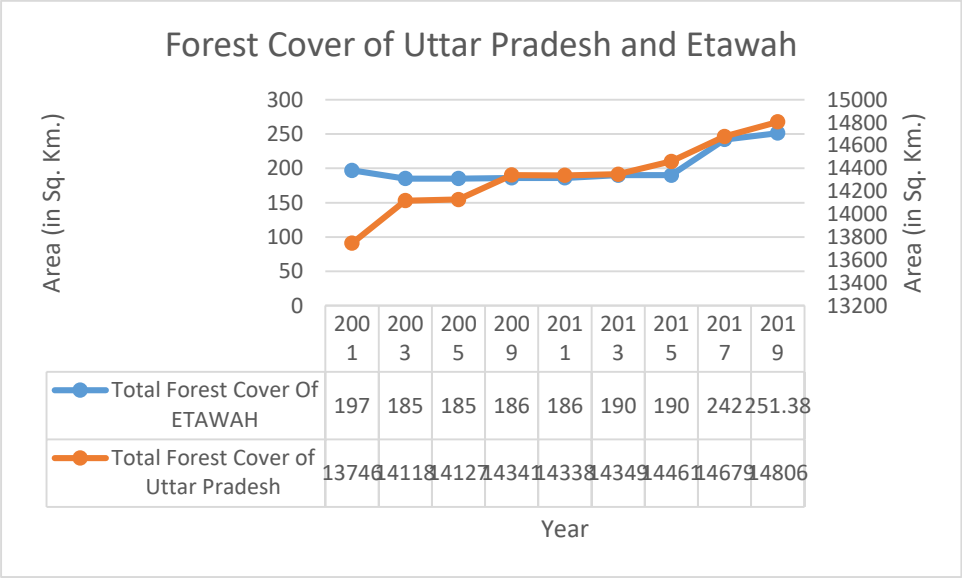
Category	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Cattle Hospital	24	26	26	27	27	27	27	26	26
D- category Cattle Dispensary	2	2	2	2	2	2	2	2	2
Cattle Development Centre	34	34	34	34	34	34	34	34	34
Man-Made Reproduction Centre	25	38	39	39	39	39	53	51	51
Cattle reproduction center	1	1	1	1	1	1	1	1	1
Source: http://updes.up.nic.in/spiderreports/intialisePage.action									

2.2 FORESTRY

1. Baseline Data Analysis/ Quantitative Data Analysis



According to ISFR reports, over the years the forest cover has increased. The forest cover of Etawah is approx.. 251.38 Sq. Km. Majorly, open forest followed by medium dense forest.



The forest cover of Uttar Pradesh has increased over the years, similarly, the forest cover of Etawah has increased significantly.

2.2.1 Biodiversity

ARTH GANGA PROJECT: DISTRICT ETAWAH

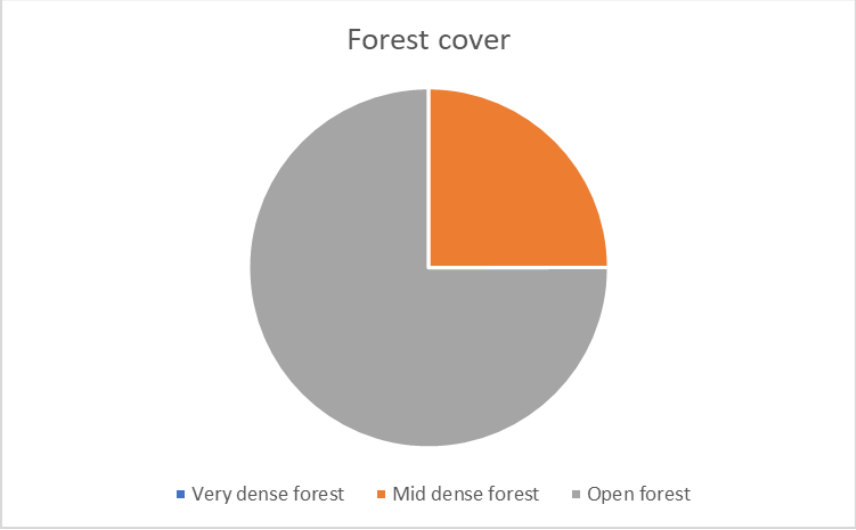
The district's biodiversity data includes various crop production, livestock population, bird species, and forest cover. The crop production trend shows an increase in crop production. Forest data shows that forest cover was increased by 9.38 % in 2019. There are 369 bird species and twenty-four globally threatened species of bird in the district.

Table 1 Bird species recorded in the district.

Number of species	369
Number of rare/accidental species	24

Table 2 Forest cover in a square kilometer.

Geographical area	**Very dense forest**	**Mid dense forest**	**Open forest**	**Total**	**% of Geographical area `**	**Change with respect to 2017 assessment**	**Scrub**
2311	0	62.75	188.63	251.38	10.88	9.38	45.05



2.3 TOURISM

Baseline data/Quantitative Data
Total number of tourists visiting Mirzapur

YEAR	INDIAN	FOREIGN	TOTAL
2018	1113896	9	1113905
2019	1363657	16	1363673
2020	295891	0	295891

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

a. The above-given data table-1 is taken from the Uttar Pradesh tourism website. The data table shows the number of tourists visiting Etawah for tourism from 2016 to 2020. Though the tourist data isn't there on the website of tourism 2016-2017, visits are bifurcated into two different groups – Domestic and Foreign tourists.

b. In the year 2018 Etawah received total **1113905** tourists. Number of Domestic travellers were **1113896** and total international travellers were 9.

c. In the year 2019 Etawah received total **1363673** tourists. Number of Domestic travellers were 1363673 and total international travellers were **16**. The district experienced a total growth of 22.4% in total number of tourists compared to number in the previous year.

d. In the year 2020 Etawah received total **295891** tourists. Total number of Domestic travellers were **295891** and total international travellers were **0**. The district experienced a total growth of -78.4% in total number of tourists compared to number in the previous year.

2.4 WETLANDS

The district has vast wetlands; most of them are tanks/lakes/ponds and waterlogged. Table 1 represents the number of wetlands and their area representation in the district.

Table 1: Wetland Data of Etawah district

Wetland Types	**Total Number of**												
	Wetlands:			**Area (ha)**									**Aquatic Vegetation**
Natural Wetlands	**NRCD**	**NWIA**	**Diff.**	**<2.25**	**<5**	**<10**	**<20**	**<50**	**<200**	**<500**	**<1000**	**>1000**	
Lake/ponds	12	14	2	0	0	2	2	4	4	0	0	0	10
Ox-bow lakes/cut off meanders	3	3	0	0	0	0	1	1	1	0	0	0	2
High altitude Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0

Riverine Wetlands	7	16	9	0	4	2	0	1	0	0	0	0	1
Waterlogged	11	39	28	0	4	2	1	0	3	1	0	0	7
River/Stream	0	33	33	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	16	17	1	0	10	4	0	2	0	0	0	0	8
Waterlogged	91	101	10	0	21	25	24	15	5	1	0	0	38
Salt pans	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (900)	140	223	83	677	39	35	28	23	13	2	0	0	66

Source: National River Conservation Directorate (NRCD), National Wetland Inventory and Assessment (NWIA) Atlas

2.5 ENERGY

2.5.1. Solar

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

According to the 2011 census, 57.87% households in the district depend on kerosene for the main source of lightning, followed by 41.08% using electricity and only 0.36% using solar.

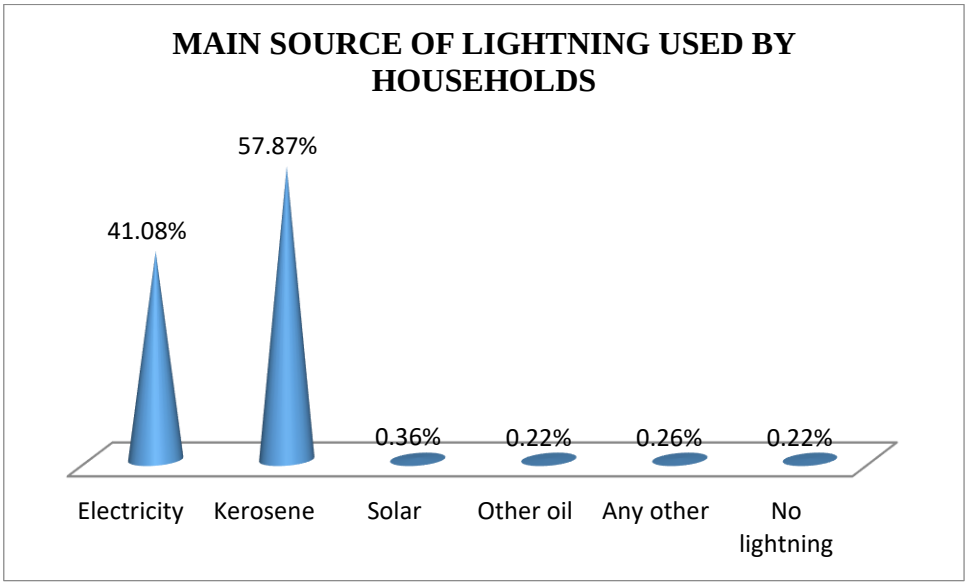


Fig. 1

According to the progress report available on UPNEDA, 11 Solar R.O. water plants have been installed in the district and Etawah Safari Park will also be installed with 20 Kw solar panels.

2.5.2. Biomass

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

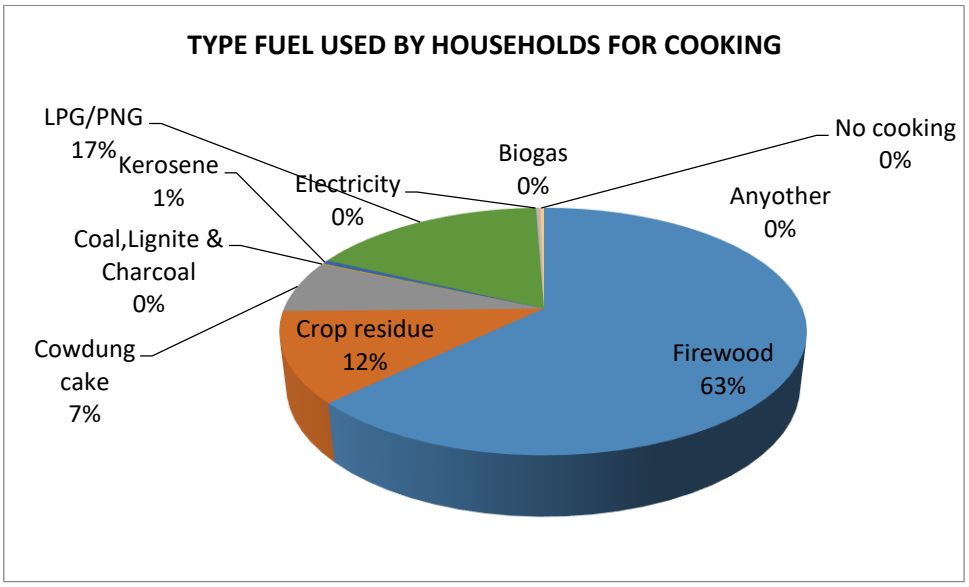


Fig. 1

According to the 2011 census, 63% households use firewood as the main cooking fuel, followed by 17% using LPG/PNG, 12% using crop residue and 7% using cow dung cakes as depicted in Fig. 1.

Majority of population in the district is mainly dependent on agriculture as their primary occupation. Rice, wheat, sugarcane maize, etc. are some of the major crops and enterprises engaged in agriculture.

The net sown area of the district is 147600 ha with the cropping intensity of 164.2%. The area sown more than once a year covers 64800 ha land. The district has a 36100 ha of forest land. A total of 6600 ha of cultivable wasteland is there in the district, with 1100 ha of current fallows.

Table.1 gives an account of productivity of some of the major crops in the district. The productivity of the crops appears to be good consequently a good amount of crop residue would be produced. The district produces 556.8 kT/yr of agricultural biomass and 67.9 kT/yr forest based biomass (Kumar et. al. 2017)

CROP	PRODUCTIVITY (kg/ha)
Wheat	3552
Rice	2752
Millets	1824
Oil Seeds	1480
Pulses	1154
Foodgrain	2906

Table 1

2.5.3. Biogas

Biogas data is not available for the district. Based on the livestock population and agricultural waste biogas potential calculated. Biogas potential from animal waste and agricultural waste was calculated approximately as one crore m^3/year and twenty-five crores m^3/year. This amount of biogas generation can efficiently complete the energy demand of the district.

2.5.4. Hydro Power

No hydropower plant exists in the district. The rivers in Etawah's district includes the Sengar, the Rind, and the Kuwari, in addition to the Chambal and Yamuna. The tributaries of Rind that run through the district include Pandu, Ahenya, and Puraha, while the Sirsa, a tributary of Sengar, also flows through the area. These rivers can generate electricity by constructing the hydropower plant. However, a survey or identification of the site must require for the construction of hydropower plants.

3 QUALITATIVE DATA ANALYSIS

3.1 FORESTRY

To increase forest resources in the country, Ministry of Environment, Forest and Climate Change is implementing a number of Schemes under which financial assistance is provided to State/UT Governments. Some of major schemes of the Ministry are National Afforestation Programme (NAP) and Green India Mission (GIM), Integrated Development of Wildlife Habitat (IDWH), Intensification of Forest Management Scheme (IFMS), Project Tiger and Project Elephant including funds under Compensatory Afforestation Fund Management and Planning Authority (CAMPA).[3]

The use of timber in house construction, furniture and agricultural implements etc. is around 61.38 million cum. By using alternatives we can reduce this which in turn will result in reduction in tree felling. In the context of State of Uttar Pradesh 10.495 million people are using fuel wood from forests. Taking an average family size of 5 persons per family it can be concluded that 2.1 million families are directly dependent on forests for fuel wood. By giving them alternative sources of energy it will be possible to reduce Carbon dioxide to the tune of 2.1 million tonnes annually.[4]

3.2.1. Biodiversity

This city is in the state of Uttar Pradesh, on the banks of the Yamuna River. The picturesque lovers and adventure seekers to its surrounds. The Etawah Valley still supports a diverse range of living forms, which may be seen at the local wildlife sanctuaries, some of which are protected for their uniqueness. The rivers Yamuna and Chambal converge at this city after twisting their way through far and vast areas, making Etawah synonymous with the point of confluence of two rivers. The Chambal Animal Sanctuary's great bio-diversity is the final refuge for some of the country's most endangered wildlife species.

3.2 ENERGY:

As per the data of the year 2013, Etawah district energy consumption is around 915 TJ/year and 3.6 GJ/capita/year. GHG emission of 63,223 Ton CO_2 equivalent and 0.246 Ton CO_2 equivalent/capita has been evaluated for the district.

[3] https://pib.gov.in/newsite/PrintRelease.aspx?relid=148508
[4] State Action on Climate Change, Uttar Pradesh

3.2.1. Solar

Etawah has been fairly progressive in solar energy adoption and if the solar energy potential in the district is utilized wisely, then the district can flourish. According to Pugazenthi et. al. 2016, total solar power potential available in the district Etawah is 0.1579.An article in local daily with the heading 'Solar power submersible pump will run in Samthar Gaushala' mentions -the submersible pump and light will be lit by solar energy in Samthar Gaushala of Taka block in Etawah. Another news article in Hindustan mentions that after major major railway stations, now Etawah Junction will also be illuminated with solar energy soon. The work of installing solar panels has started at Etawah station.

A report by Department of Horticulture & Food Processing Uttar Pradesh describes the success story of Shree Cold Storage in Etawah according to which Shree cold storage Etawah which is approximately 48 years old and is based on old pattern of refrigeration system, is now successfully equipped with the solar panel & modernized refrigeration system with the assistance of NHM. Approximate 600 to 700 units of power are generated perday by solar panels and used by the cold storage for refrigeration purpose.

3.2.2. Biomass

Similar to other districts of Uttar Pradesh, Etawah also deals with the problem of stubble burning. Many of the news articles mention the cases of stubble burning in the district such an article in national daily mentions- As many as 350 incidents of farm fire were reported from several districts of Uttar Pradesh in the last 24 hours contributing to the worsening air quality in the state. The fires are a reflection of the incidents of stubble burning that continue. Farm fires are a major contributor to air pollution in winter and the effect is palpable in the AQI (air quality index) data of the Central Pollution Control Board (CPCB). Chief environmental engineer (UPPCB) VK Singh said the fire incidents were reported from Saharanpur, Meerut, Baghpat, Bijnor, Bulandshahr, Hapur, Etawah, Mainpuri, Unnao, Maharajganj, Bahraich and Gonda districts of Uttar Pradesh, among others. The district is basically agrarian hence produces biomass wastes in large quantities. Rice and Wheat are cultivated in large quantities. There are no proper provisions for utilizing the agricultural wastes that are produced and hence farmers have to ultimately burn it.

3.2.3 Biogas:

As per the authors knowledge, no data of biogas plant is given for Etawah district. There are a total of 106 small and big gaushalas in Etawah, in which about 12400 cows are present. The gaushala waste can be utilised in a biogas plant to produce biogas.

3.2.4. Hydropower:

The State's national-level program runs for hydropower generation, such as the small hydropower project program. The implementation of small hydropower in the State is carried

out by Uttar Pradesh New and Renewable Energy Development Agency. The district is near the upper Ganges or Ganga canal and can generate electricity from it.

3.3 TOURISM

- **HOW TO REACH ETAWAH**

  - **HOW TO REACH ETAWAH BY AEROPLANE**

Etawah is well connected with the other part of country by roads and trains and Aeroplane.The nearest Domestic Airport is Kanpur Airport; roughly Two and half hour drive from the city and is well connected with the cities like Indore, Bhopal, Delhi, Agra, Mumbai, Jaipur and Varanasi etc. The nearest International Airport is Chaudhary Charan Singh Airport, Lucknow, roughly 229 Kms from Etawah. Frequent Flights to various national and international destinations take off from here.

  - **HOW TO REACH ETAWAH BY RAIL**

Etawah has its own Railhead known as Etawah Railway Station and it is well connected with the major cities of state like Lucknow, Kanpur, Agra, Gaziabaad and Banaras. It lies on Delhi-Lucknow line.

  - **HOW TO REACH ETAWAH BY ROAD**

Etawah is 36 Kms from Bhind, 56 Kms from Mainpuri, 125 Kms from Agra, 153 Kms from Kanpur, 183 Kms from Aligarh, 240 Kms from Lucknow, 314 Kms from New Delhi and is connected through Uttar Pradesh State Road Transport Corporation and some private bus operators.

Cities Near Etawah -

- 75 km to Firozabad, India.
- 88 km to Farrukhabad, India.
- 104 km to Gwalior, India.
- 112 km to Agra, India.
- 134 km to Kanpur, India.
- 152 km to Shahjahanpur, India.
- 155 km to Jhansi, India.
- 156 km to Aligarh, India.

ARTH GANGA PROJECT: DISTRICT ETAWAH

Places to see in Etawah -

- **Victoria Park** - Victoria Park Etawah This is one of the very famous tourist place of Etawah, which was very old and built from the period of the British government. The view here is very nice and there is a lot of peace in this place. Those who are living in Etawah, it is hardly possible that Bo has not come here. Now a grand temple of Sai Baba has also been built here. Because of this, the visitor rate here is very good. A fair is also held here every Thursday and now Victoria Park is known by the Pucca Talab.

- **Raja Sumer SinghFort**- Etawah, beins situated on the border line of their ill-defined "spheres of influence" remained for the most part a battle. Etawah, Uttar Pradesh's oldest district headquarters, is located on the Grand Trunk Road on the banks of the Yamuna River and is known as the gateway to the spectacular Yamuna and Chambal ravines. Beyond the city, the terrain is rough and uneven. The VVIP Guest House (Param Vishisht Atithi Grih) is located atop a barren hill on the bank of the Yamuna River, with a panoramic view of the rocky countryside for miles. At some point in history, the location had a fort, but there are no ruins or relics other than the name of the locality, Raja Sumer Singh ka Qila (Fort of Raja Sumer Singh), and a high retaining wall to protect the mound.

- **Etawah Safari Park**- Etawah Safari Park (previously Lion Safari Etawah) is an 8-kilometer-long drive-through wildlife safari park in Etawah, Uttar Pradesh, India. The Lion Safari Etawah will be built on a 350-hectare plot of land. On the outskirts of Etawah City, the Lion Safari and Lion Breeding Center may be found. There are lion, deer, antelope, bear, and leopard safaris in Etawah Safari Park. It also features two Indian Army Vijayanta tanks and a steam locomotive on display, in addition to the safaris. There's also a 4D theatre where you can get up up and personal with animals.

Data analysis

- From the table-1 it is evident that the number of total tourists in Shahjahanpur increased from 2016 to 2020.
- The Etawah tourism encountered highest percentage change in tourists in the year 2019, which was 22.4% increase compared to previous year.
- The growth in the number of total tourists in Shahjahanpur is not constant in these years, although the range lies between -78.4 to 22.4%.

SWOT Analysis

S.No	Strength	Weakness	Opportunities	Threat
• 1.	• Geographically located next to	• Poor promotion of existing	• Proper maintenance of existing	• Covid 19 can be a big threat with

	Agra, Uttar Pradesh. • Religious tourist plans can be clubbed together to propose a spiritual travel plan. • The district is densely fortified with temples like Kali Badi Temple and Shaheed Smarak Samiti.	temples and monasteries. • No maintenance of existing heritage sites in the district.	heritage sites to attract more tourists both local and foreign. . • Creating museums, artistic spaces and collaborative ventures to bring all useful collected heritage and art under one roof.	unpredictable arrival. • Lack of good budget by the government can be a big barrier. .

3.4. WETLANDS:

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. The region has a good amount of potato, wheat, and rice production. The region is known for the large production of potatoes in India. 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:

- Products like oil and finished pulses can be derived from the crops and millets grown in the region.
- The region has a large production of dairy products, which leads to an increase in animal husbandry. Wetlands can support the growth of fodder for the animals in the region.

4 ACTION PLAN DEVELOPMENT

4.1 FORESTRY

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

have minimum support price (MSP) for the timber produced by farmers with buy-back arrangement. This in turn will motivate them to plant more trees, which would benefit the economy as well as the environment.[5]

Projections & Monitoring Matrix

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

4.1.1 Biodiversity –

- The State Level Nodal Agency (SLNA) developed an action plan matrix that took into consideration several variables such as slope percent, soil depth, soil texture, and soil erosion in the region for wasteland, forest land, and agricultural land.
- Regeneration of vegetal cover in forests and on public land Staggered trenching, reforestation.

4.2 TOURISM

- **'Travel Uttar Pradesh' plan-** Shahjahanpur has plethora of spiritual heritage attractions including many temples and a monastery. To provide visitors a better awareness of how humans affect the environment and to instil a greater respect for ecosystems it can be clubbed with a major city like Agra. In the Etawah district, there is a big chance to establish events around river ganga not only on religious grounds but also cultural grounds as well. The project will reduce the detrimental effects of traditional tourism on the environment while also enhancing local people's cultural integrity. This initiative will also increase visitor traffic in the area.
- **Sustainable tourism-**
  Many places in India have been transformed into significant holy sites due to spirituality. As a result, many travel aficionados have begun to flock to these hubs, in addition to the vast number of pilgrims who visit time and again with goals of sustainability in mind and its overall development. The impact of these religious

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

locations is huge not only around the local surroundings but also among the travellers. To grow sustainably at various touch points like temples and monastery must be considered with respect to developing the local trade and involving the local folks.

Different tourists share an equal sense of responsibility for the development of sustainable tourism. Every person is responsible for the factors including many elements. For example, using organic biodegradable stuff is so important for tourists across multiple places in Shahjahanpur to keep it presentable for next tourists to join in.

Projections and Monitoring matrix

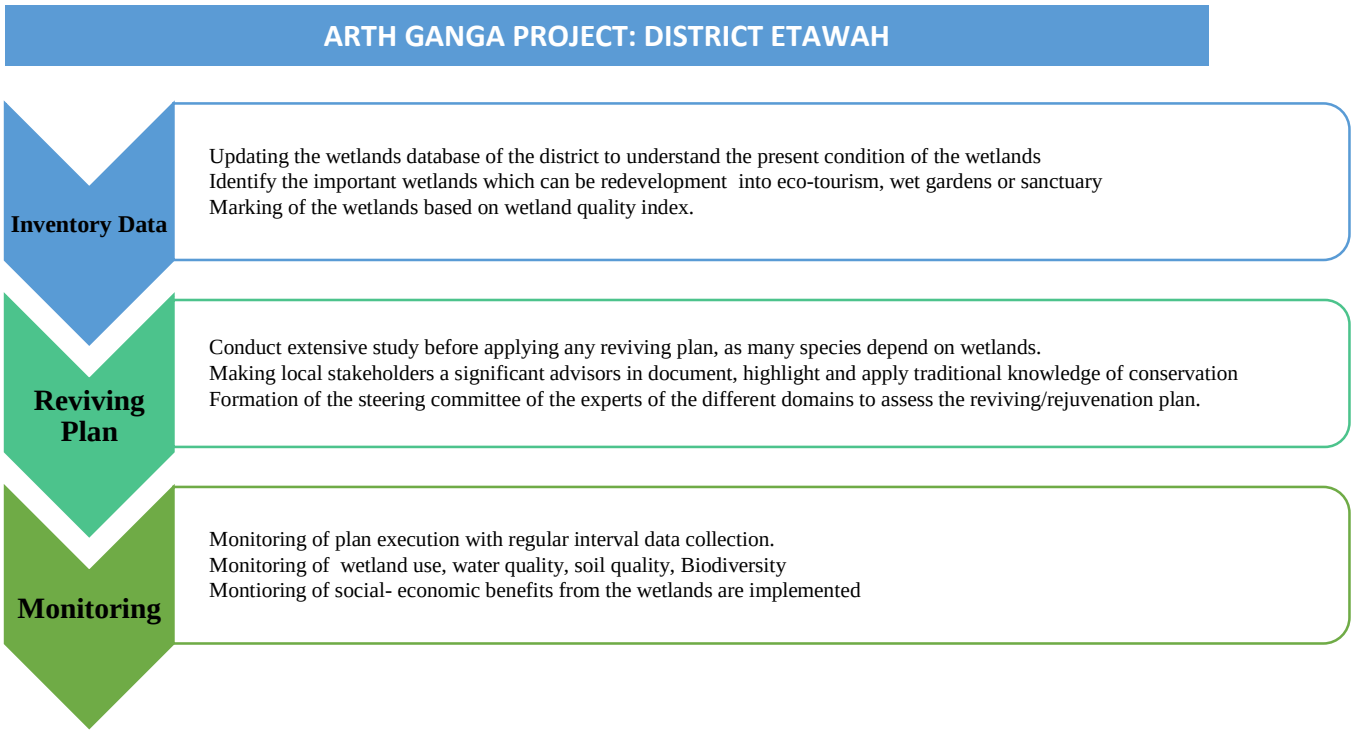
Sector	Intervention	Strategy	Total cost	Expected Outcomes
Tourism	**Research**	• The cause and motive for tourism can be predicted using various data and matrices which available on various government official websites as well as private organizations have done their bit too. It is also feasible to discover the elements affecting tourism in Uttar Pradesh through significant qualitative and quantitative research. • All political pressures and influences must be removed from research to bring as much transparency as one can. • When adding new records, the researchers must ensure that the field data and secondary data are correct and unaltered.		As a reference for other processes, a well-researched document. Tourism in Uttar Pradesh is influenced by a number of factors. Understand multiple factors that influence tourism activity. To be able to understand and work upon all the listed factors and create a need for travel for people within and outside the country! Research and prior lessons will be used to inform the planning process. For a successful implementation, realistic planning is required.
	Planning	• Research and analysis of various data and reports can be used to generate action plans for intervention. • Developing an active action plan is critical because the results are		

		dependent on how it is prepared and later implemented as well. • Planning must take into account the state's social position as well as the impression that tourists have of the country. • Non-practical forecasts should be avoided at all costs. • Making plans for all major festivals and occasions like Ramnavmi. Finding out carious elements of the temples that can be utilized to weave stories in and around Etawah. • Hindu temples can be commercialised. Other involved things like flower vendors, incense sticks, and other worshipping things can be standardized across the state under the umbrella of UP Tourism. Every retailer in the vicinity of the temple does their hardest to make as much money as possible from the pilgrims and guests who come to pay their respects. • This standardization should be incorporated under Brand Manufacturing to increase tourism activity throughout the state. • Organizing various spiritual and religious events which hold meaning and significance. • Complete use of allocated budget.		
	Implementations	• To attract more tourists, various schemes such as tourist packages, sustainable collaborations, and so on can be devised at ground level. • Mahotsavs and fairs will be held to boost the local economy and attract visitors. • Creating spiritual tourism circuits and to implement existing circuits like Buddhism circuit.		To increase total number of tourists and increase tourism earnings from all possible tangents and at every touch point. To boost the state's image while ensuring that no other social issue has an impact on tourism earnings. Create a

		• Establishing a link between tourist and local culture and cuisine. • Advertorial promotion that has an over-all extensive approach to capture the right audience. • A significant amount of branding and marketing which can be clubbed with other cities like Agra and Bareily. • The development of tourist attractions and maintenance of temples in and around Shahjahanpur. • Information about travel packages should be available on government websites and various other touch points like social media channels. • Conducting thorough market research in order to build strong strategies that will work on ground. • Ganga arti culture • Eco-tourism activities boosted by Ganga Festivals which happen. Along with these proper sanitisation, maintaining hygiene on the banks of river Ganga is very important.		flowchart to constantly maintain the set standards of tourism and consider feedback of tourists. This must include major points of sanitation and clean drinking water.
	Impact Assessment of results	• Figuring out where all touchpoints. • The understand the cause of failure and work upon it. • Reasoning to comprehend all the aspects. • Planning for future considering all over aspects of that can be covered.		• To learn the lesson and establish the root cause of success and failure, which will be applied in the future with modifications.

4.3 WETLANDS

Some of the known wetlands in the district need to be taken care and action on different fronts must be taken. The action plan below gives a glimpse of the action and development required to protect, conserve, rejuvenate the wetlands existing and extinct.



4.4 ENERGY

4.4.1. Solar

The district has been plants solar plants at public places but there needs to be penetration of solar energy in the agricultural sector. Since the district is agrarian most of the people in the district depend on agriculture and the farmers should be made aware of the solar energy and the schemes run by government related to solar energy. The administration should pay attention on making people aware about the schemes that are being run by the government to increase the solar energy penetration in the district among the households. Kusum Yojana should be popularized among the farmers. The different components of the Kusum Yojana should be implemented as per the requirement in the villages, on the lines similar to the Maharashtra. In Maharashtra component A of Kusum Yojana has been successfully implemented under Government of Maharashtra's Krishi Vahini Yojana. Government should pay attention on strengthening the infrastructure of the district. This would help in increasing the Solar rooftop panel installations under the National Solar Mission- Phase II.

Provisions for financial assistance in off grid connections used for commercial purposes such as cold storages etc. should also be given a thought.

All these on one hand would increase the job opportunities and on the other hand help the farmers in increasing the farm produce.

4.4.2. Biomass

The district is agrarian and hence the farmers should be made aware of the benefits of biomass energy. This can be done by arranging different campaigns and awareness programs which are in easy reach of the people. The district mainly cultivates rice and wheat, so the best suited

projects for the district can be husk based biomass gasifiers. The husk based biomass plants can be developed on the lines of the Husk Power Systems from Champaran, Bihar. These biomass energy plants should be encouraged to be stated by the new entrepreneurs. The village panchayats can also take up initiative to start up the biomass energy plants.
To promote biomass plants and incline more and more people towards it, the prices of biomass wastes should be fixed so that both the buyers and the sellers are not at loss. A district level survey would be beneficial in deciding the lands suitable for setting up biomass plants and in setting up transportation system to move biomass wastes.

4.4.3. Biogas:

In Etawah districts, the majority of rural and some urban communities lack sewage facilities. As a result, sewage and other home pollutants flow straight into the Yamuna River via open drains. These wastes should be treated by sewage treatment plant and the remaining sludge can be utilised for the production of biogas in anaerobic digestion plant.

4.4.4 Hydropower:

The state government of Uttar Pradesh has also set rules for private engagement in the development of micro/mini/small hydropower projects in power evacuation facilities.

5 RECOMMENDATIONS

5.1 AGRICULTURE AND ALLIED SECTORS

1. Groundwater shares over 57% 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.

2. 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.

3. Food grains constituted, on average, about 82% of the GCA in the district, while their average share in the total value of agricultural output was about 70%. In contrast, Potato comprised, on average only 6.3% share in GCA, but it contributed 24.2% to the total value of agricultural output. This calls for diversification 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. Potato processing units can be set up.

4. Livestock contributed over 26% of agricultural GDP and can be a key driver of rural economy. The number of female cattle and buffaloes has 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. There is need to promote livestock sector through creating an efficient marketing network and setting up dairy and dairy-based processing units. There is also a need to upgradation of local breeds for cattle and buffaloes.

5. 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.

6. 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.

7. 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.

8. About 90% 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 can be promoted to get the benefits of economies of scale in production and marketing and to improve the bargaining power of small farmers in input and product markets.

9. 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, lemongrass, etc. and fruits like papaya, mango, guava, and banana should also be promoted by establishing local market, processing units and cold storage.

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

11. Farmers should encourage aonla or amla and ber orchards in sodic soil and engage in intercropping such as turmeric in orchards.

12. Per capita electricity consumption in the district agriculture increased from 234.19 KWH in 2014-15 to 405.88 KWH in 2019-20, a net increase of approximately 73.31%. Since electricity consumption has increased over the years and more than 26% of total

electricity consumption is in agriculture, there is a need to promote the use of solar energy in agriculture.

13. 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.

5.2 FORESTRY

Shahjahanpur located on the bank of river Ramganga, Garrah and Gomti. According to ISFR 2019, 59.31 Sq. Km. area of Shahjahanpur is covered with forest. No major forest found in the district. As discussed above, the forest cover of Shahjahanpur has decreased as compared to previous assessment of ISFR 2017, there is a wide scope of Afforestation on waste land, trees outside forest (on the sides of the roads, banks of river etc.). Government can promote the afforestation, agroforestry activities by providing output based incentives.

5.2.1 Biodiversity

- Forest and scrublands have opportunities to improve productivity and other services of land cover.
- Water harvesting devices built in forests can increase water supply for wildlife and downstream crops.
- Rainwater conservation in trenches, planting of indigenous fruits, fodder trees, shrubs, grasses, pasture legumes (Stylosanthes hamata), and encouraging cut and carry grasses in place of grazing can improve forest land functions and community service.
- Forest resource productivity should be increased by watershed management and the introduction of fodder trees, shrubs, and grasses to support animal husbandry.

5.3 WETLAND

The wetlands need to be intact, but at the same time, they need to be planned wisely to support the district economically, socially and environmentally, which will lead to indirect relief to 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.

- It is recommended to introduce organic and water-efficient farming techniques for potato production.
- It is recommended to rejuvenate and restore the wetlands under MNREGA schemes.
- It is recommended to diversify cropping culture by introducing vegetables, mushrooms, beekeeping, fruits, medicinal plants, dairy, poultry etc. for nutritional security
- It is recommended for the enhancement and conservation of green fodder for livestock.
- It is recommended to promote animal husbandry in the area.

5.4 ENERGY

5.4.1. Solar

- ❖ People should be made aware about the solar energy and the related schemes.
- ❖ Kusum Yojana should be popularized among the farmers in the district.
- ❖ Solar rooftop installations should be popularized under the National solar Mission-Phase II.
- ❖ Provisions for financial assistance in off grid connections used for commercial purposes should also be given a thought.

5.4.2. Biomass

- ❖ People should be made aware of the biomass energy and how it can help in coming up the problem of stubble burning.
- ❖ Since district cultivates rice and wheat largely, husk based biomass plants are recommended.

5.4.3. Biogas

- It is recommended to connect existing gaushala such as Parauli Raman Gaushala to biogas plant, this will not only help to manage the gaushala waste but also financially help the gaushala.

5.4.4. Hydropower

It is recommended to investigate sites for hydropower potential near the Chakarnagar and sardar tehsil area of the district.

5.5. TOURISM

- **Hygiene and Sanitation**- Many may appear to be conflicted about cleanliness, urinating in public and washing their hands excessively before each meal on the other. Thousands of people have been warned about India's open defecation problem. In India, hygiene can be an issue, but rest assured that new tourist destinations need extremely hygienic and well-kept restrooms and safe drinking water.

Recommended Projects-

- **Spiritual tourism-** To expose oneself to various tangents of spirituality. Temples on the sides of roads, in banks, and even in underground parking garages, small temples and shrines have been very prominent. Every day, it appears as though there is some sort of religious event but to connect it to spirituality can be one move to attract global tourists. In India, people openly practise their religions and value their spiritual beliefs.

- **Ecotourism-**
  Ecotourism provides effective economic incentives for conserving and expanding bio-cultural variety, as well as helping to safeguard our beautiful planet's natural and cultural legacy, by providing market-linked long-term solutions. Ecotourism encourages deeper understanding and appreciation for nature, local society, and culture by emphasising personal experiences and environmental awareness through interpretation of Lion Safari, Etawah.

Monitoring, Evaluation & Impact-

	Broad objectives / recommendations	Key activities / interventions to be planned			Monitoring & Evaluation	Impact
		2022	2023	2024		
1.	To promote Lion Safari on ecotourism grounds. Spiritual tourism- To maintain temples on the sides of roads, in banks and shrines.	Utilising Etawah as an excavation site and promote it as an travel spot. To create travel interest it also needs to be marketed among bus.	To keep a track of ongoing process and take constant tourist feedback.	Improve upon every touch and using technology as an important tool to maintain transparency.	Process tracing, Bradford Hill criteria. Environment Impact Assessment	More tourists visiting by the end of the year. Word of mouth spreading across the country and globe.
2.						

6. Discussion during the Report Presentation

- Etawah is situated at the Yamuna Basin. The DPR and proposal is being prepared for the construction of ghats along the Yamuna Basin with Tourism Department. By the next financial year the ghats will be developed along the Yamuna River.
- A Lion Safari is one the biggest tourist attraction in Etawah. Further, a Yamuna Trail and development of Eco-Tourism will be planned to enhance the tourist footfalls. This way the already tourist influx will be integrated with the conservation and development along the Yamuna Ganga Basin.
- Further, Regular Yamuna Aarti will be planned for the ghats with DGCs.
- The DM, Etawah requested for the detailed report which will be taken up as a base for future DGC meetings.
- 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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6 APPENDICES

AUXILLLARY DATA

Table 3 Biogas potential from animal waste in the district.

Livestock	Residue type	Total population as of 2012	Manure yield * (kg/day)	Total manure generation annually (kg)	Average collection (75%)	Dry manure	Manure for biogas* (kg/m^3)	Biogas potential (m^3/yr)	m3/day	Dry matter per day
Cattle	Manure	127460	10	46,52,29,000	34892175	6978435	25	2791374	7647.6	191190
Buffalo	Manure	292683	15	1,60,24,39,425	120182956	24036591	25	9614636.55	26341.47	658537
Sheep	Manure	5151	1	18,80,115	1410086.25	282017.25	25	11280.69	30.906	772.65
Goat	Manure	299505	1	10,93,19,325	81989493.75	16397898.75	25	655915.95	1797.03	44926
Pig	Manure	9022	2.5	82,32,575	6174431.25	1234886.25	25	49395.45	135.33	3383.3
Poultry	manure	90,702	0.1	33,10,623	2482967.25	496593.45	25	19863.738	54.4212	1360.5
Total		**8,24,523**						**13142466.38**		

Biogas potential from agricultural waste in the district.

Crop	Residue type	Total crop production (tons) (2017-18)	Residue production ratio	Residue amount (tons)	Average collection (70%)	Moisture content	Dry Residue (tons)	Biogas potential [m^3/(tons of dry matter)]	Overall biogas potential (m^3)
Maize	straw	13716	1.5	20574	14401.8	15	12241.53	800	9793224
Wheat	straw	419734	1.5	629601	440720.7	30	308504.49	800	246803592
sugarcane	bagasse	22077	0.33	7285.41	5099.787	80	1019.9574	750	764968.05
Total		**455527**							**257361784.1**