Arth Ganga Project: District Chandauli

Submitted to:

National Mission for Clean Ganga (NMCG)

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EXECUTIVE SUMMARY

Chandauli, a district in Uttar Pradesh is bestowed with nature's aesthetics and rich morphology. The district is traversed by Ganga, Karmanasa, and Chandraprabha rivers.

The total geographical area of the district is 2541 Km^2. The tertiary sector occupies around 54.10% share in the district economy with an average annual growth rate of 4.13%, with its share increasing from 52.87% in 2011-12 to 54.66% in 2018-19. The district economy grew with an average annual growth rate of 3.56%. The average annual growth rate of the primary sector from 2011-12 to 2018-19 was 2.18% reflecting a decrease from 29.61% in 2011-12 to 26.84% in 2018-19.

In 2017-18, the net sown area was 127772 ha while the actual irrigated area is 117037 ha. The cropping intensity of the district is 182.34%. The net sown area increased from 53.44% in 2010-11 to 50.43% in 2017-18 whereas the area for non-agricultural use increased over the period from 10.26% to 11.33%. The share of cultivable wasteland and barren and uncultivable land decreased from 0.44% and 1.10% in 2010-11 to 0.41% and 0.89% in 2017-18. The district's net and gross irrigated areas have decreased over the years with an average of 93.08% and 88.97%, respectively. The major crop types are rice, wheat, tide, millet, pulses like black pulse, pigeon pea, etc, sugarcane, potato, mustard, linseed, etc. The total food grains along with pulses account for the production of 750588 MT. In 2017-18, the nitrogen share increased to 76.91%, while the Phosphorus share decreased to 20.46%, and the Potassium share decreased to 2.63%. The overall use of chemical fertilizers has reduced in the district from 205.38 kg/ ha GSA in 2010-11 to 189.03 kg/ ha GSA in 2017-18. The livestock consists of cattle (indigenous and crossbred), buffalos (indigenous and crossbred), pigs (indigenous and crossbred), sheep; along with poultry and fisheries.

Agriculture including the horticulture sector grew at a low average annual growth rate of 1.93% from 2011-12 to 2018-19 with its share increasing from 68.63% in 2011-12 to 69.47% in 2018-19 whereas the share of the livestock subsector increased from 23.46% to 25.12% with an average annual growth rate of 2.47%. The fishery and aquaculture subsector share is around 2.66% in 2018-19, with an average annual growth rate of 2.20% from 2011-12 to 2018-19. Mines and quarrying recorded a remarkable average annual growth rate of 22.86%

The total forest cover of the district is 565.26 km^2. Out of total forest cover, the maximum area is covered by Open Forest (366.26 km^2) followed by moderately dense forest (192 km^2) and very dense forest (7 km^2). The share of forestry and logging in the total agriculture and allied sector is small, around 2.75% in 2018-19, as it grew with a negative average annual growth rate of 1.70%. The share of area under trees & gardens decreased slightly from 0.46% in 2010-11 to 0.44% in 2017-18. There are numerous tourist attractions in the city. The district is well connected through roads and railways and is known for unpopular greener attractions such as Chandraprabha Wildlife Sanctuary and Dam, Rajdari, and Devodari waterfalls along with tombs and temples. The roads in the Chandraprabha Mountains are well built & wide curved. In the year 2019, the district witnessed 660820 domestic visitors and 1007 foreign visitors.

In the district, 67.71% of households depend on kerosene as the main source of lightning, followed by 31.02% using electricity and only 0.48% using solar. According to Pugazenthi et. al. 2016, the total solar power potential available in the district is 0.2150. In the year 2021-22, 728 solar street lights were installed in different villages of the district. Also, UPSICL issued a tender for the installation of 112 nos 2.7 kW solar PV system off-grid in the district. Electricity consumption in agriculture has increased significantly from 213.78 KWH in 2014-15 to 341.7 KWH in 2019-20, a net increase of approximately 59.84%. The percentage share of the agriculture sector, on average, is 20.04% of the total electricity consumption in the district. The total number of wetlands existing in the district is 1213 consisting of both Man-made and Natural. Most of them are small or medium-sized and tanks/lakes/ponds and waterlogged. The district's biodiversity data includes various crop production, livestock population, bird species, and forest cover with 330 bird species and 3 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 thirty-one crores m^3/year. As of 2021 news, biogas plants will be installed in nine animal shelters across nine blocks. No hydropower present or plans exist.

Active measures should be taken to support and promote sustainable development. The district has a high scope of improving its overall development, etc. Various measures should be taken to increase green cover/ forest in the state such as plantation, afforestation, wetlands improvement, agroforestry along with eco-tourism, use of wasteland, checking overexploitation of forest products, condemn water, soil and air pollution, etc. Farm mechanization, use of drip and sprinkler irrigation, commercialization, cooperative and organic farming, vermicomposting, green manuring, poly house, and greenhouse, condemn overuse of fertilizers and over-exploitation of groundwater by introducing alternatives, proper monitoring, and maintenance of places and forests, etc. would improve the agricultural scenario in the district. The monitoring and maintenance of industrial wastes is the need of the hour. Creating awareness and strict implementation of laws along with the use of technologies, training, marketing needs, and advisory services and conducting the research could aid in sustainable development. Diversification of cropping patterns, creating an institutional framework for providing technical, human, and financial resources, and monitoring of the project should be periodically done through MIS, Geo-tagging, monthly physical and financial reports, etc.

1 DISTRICT OVERVIEW

1.1 INTRODUCTION

Chandauli district is a district of Uttar Pradesh state of India, and Chandauli town is the district headquarters. Chandauli district is a part of Varanasi Division. Chandauli became a separate district for the first time on 20 May 1997. Geographically the district lies at 25º27'N latitude, 83º27E' longitude and

39 m altitude. In the year 2019 there was a total 22.25% forest area of the total geographical area. Administration wise the district is divided into 3 tehsils namely Chandauli, Sakaldeeha and Chakia. There are 1 Lok Sabha seat and 5 Assemble constituencies in the district. Moreover the district comprises 11 towns and 1629 villages.

According to the 2011 census Chandauli district has a population of 1,952,756. This gives it a ranking of 238th in India (out of a total of 640). The district has a population density of 768 inhabitants per square kilometre (1,990/sq mi).

Agriculture is the backbone of the economy of the district. Most of the lands in the district are used for agriculture purposes. More than 70% of the population is based upon agricultural produces. The climate pattern of the district is quite suitable for agricultural cropping pattern and other purposes. The three harvests of the district are known by their usual names, Rabi, Kharif & Zaid. The main crops of the kharif is paddy and of Rabi is wheat. Other main Kharif crops are Maize, Jwar, Bazra & Arhar and other main Rabi crops are Barley Gram peas and Masoor. Sugarcane, Potatto, Lahi/Sarson Alsi are cash crops. The largest area under individual crops is occupied by paddy which is cultivated over are area of more than 102240 hect. Except the paddy remain other crops area are less than, last year under the Kharif, and in Rabi except the Moong, the other crops area were also less than last year. The carpet and Dari are exported to other district. Jari and Jardosi, Embroidary, Bokad, Wooden and stone's artistic toys are exported to the country and as well as in foreign countries. The sand and stones are also exported to the other districts. The handy crafts items are the main trading material in the districts.

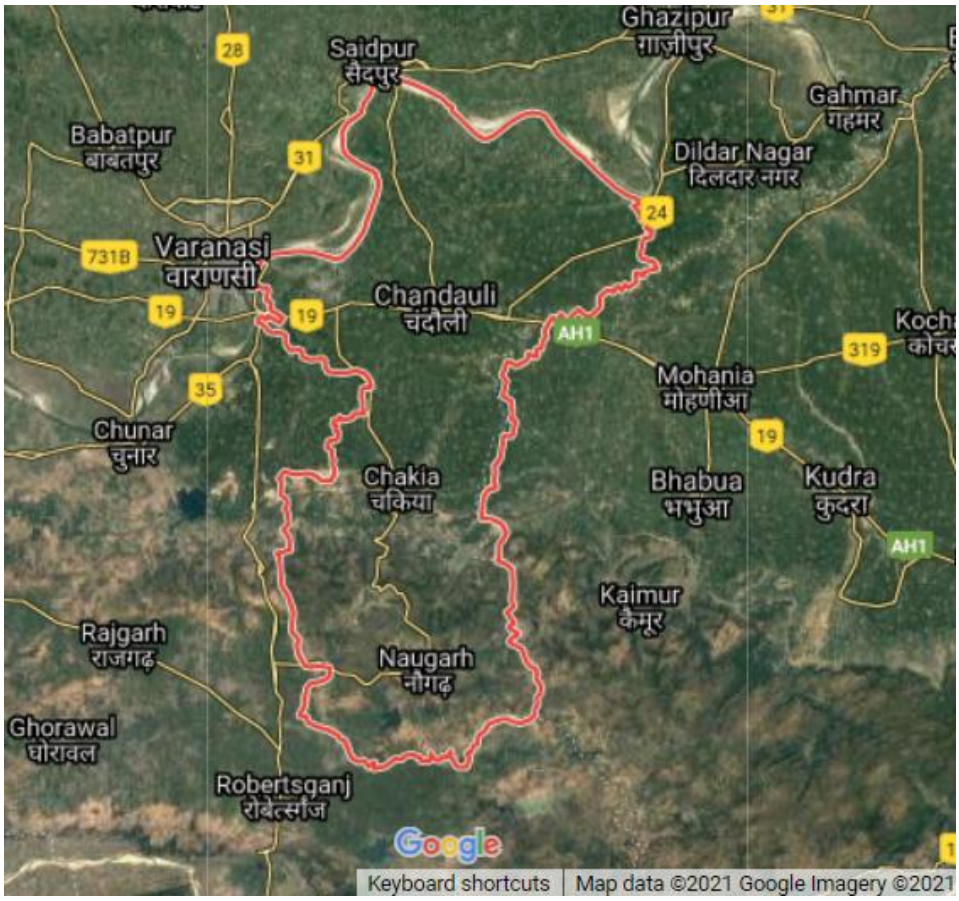


Figure 1 Map of the district

1.2 DEMOGRAPHIC PROFILE OF CHANDAULI

1. Economy and Livelihoods

- Geographical Area: 2541 Sq. Km.
- Administrative Divisions:

District Headquarters: Chandauli

No of Municipalities: 4

No of Tehsil: 5

No of Blocks: 9

No. Of Villages: 1651

- Demographic and socio-economic indicators:

  Population: 1952756 (Census 2011)

  Population density (Total persons per sq. km): 769

  Sex ratio: 918

  Literacy: 60.2%

- Occupation/ other Livelihood source: Agriculture Sector
- Major Rivers: Ganga, Karmanasa and Chandraprabha

  Forest Area: 565.26 Sq. Km. (ISFR 2019)

1.3 ECONOMIC PROFILE OF CHANDAULI

The primary sector has a significant impact on the district economy because it contributes, on average, 29.14% to the district GDP. However, the average annual growth rate in this sector from 2011-12 to 2018-19 is only 2.18%. Thus, its share decreased from 29.61% in 2011-12 to 26.84% in 2018-19. The share of the secondary sector increased marginally from 17.52% in 2011-12 to 18.50% in 2018-19. It grew with an average annual growth rate of 5.13%. The tertiary sector occupies, on average, 54.10% share of the district economy. It grew with an average annual growth rate of 4.13%, with its share increasing from 52.87% in 2011-12 to 54.66% in 2018-19. Overall, the district economy grew with an average annual growth rate of 3.56%. Although overall growth of the district economy has been quite low, the growth in the primary sector is much less than the other two sectors. Steps should be taken to increase the productivity of the primary sector so that it can grow at a higher rate. The secondary and tertiary sectors have also performed relatively poor when compared to the state average.

Table 1: Trends in Gross District Domestic product in Chandauli 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	1404.72	831.13	2507.74	4743.58	-	-	-	-
	(29.61)	(17.52)	(52.87)	(100)				
2012-13	1537.58	652.32	2404.10	4594.00	9.46	-21.51	-4.13	-3.15

	(33.47)	(14.20)	(52.33)	(100)				
2013-14	1425.68	733.20	2515.99	4674.87	-7.28	12.40	4.65	1.76
	(30.50)	(15.68)	(53.82)	(100)				
2014-15	1421.87	717.41	2735.42	4874.70	-0.27	-2.15	8.72	4.27
	(29.17)	(14.72)	(56.11)	(100)				
2015-16	1473.99	840.30	2960.99	5275.27	3.67	17.13	8.25	8.22
	(27.94)	(15.93)	(56.13)	(100)				
2016-17	1459.87	955.73	2863.24	5278.83	-0.96	13.74	-3.30	0.07
	(27.66)	(18.10)	(54.24)	(100)				
2017-18	1569.50	1086.73	2960.18	5616.41	7.51	13.71	3.39	6.39
	(27.94)	(19.35)	(52.71)	(100)				
2018-19	1618.51	1115.24	3295.45	6029.19	3.12	2.62	11.33	7.35
	(26.84)	(18.50)	(54.66)	(100)				
Average Growth Rate					2.18	5.13	4.13	3.56
Source: UPDES Note: Figures in Parentheses are percentage share in the total GDDP								

We further break down the primary sector GDP to find out which subsector is lagging and which is driving the primary sector growth. Table 2 shows that agriculture, including the horticulture sector, grew at a low average annual growth rate of 1.93% from 2011-12 to 2018-19. However, its share increased from 68.63% in 2011-12 to 69.47% in 2018-19. Similarly, the share of the livestock subsector increased from 23.46% to 25.12% in the same period as it grew, with an average annual growth rate of 2.47%. This shows the importance of livestock in Chandauli District and the increased dependency of citizens on livestock products. The share of forestry and logging in the total agriculture and allied sector is small, around 2.75% in 2018-19, as it grew with a negative average annual growth rate of 1.70%. The fishery and aquaculture subsector share is very minimal, around 2.66% in 2018-19, as it also grew with a negative average annual growth rate of 2.20% from 2011-12 to 2018-19. Mines and quarrying recorded a remarkable average annual growth rate of 22.86%. This high growth in this subsector can have serious environmental issues like deforestation, soil erosion, etc., with long-term effects on the health of local citizens. Overall, the Primary sector performed below expectations during the study period as the majority of the subsectors have not done well. More work can be done on improving the agriculture (including horticulture) sub-sector as it has the most significant impact on the primary sector.

Table 2: Gross District Domestic Product Trends from Agriculture and allied activities in Chandauli 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	940.29	321.47	48.02	60.40	1370.17	34.54	1404.72
	(68.63)	(23.46)	(3.50)	(4.41)	(100)		
	-	-	-	-	-	-	-
2012-13	1073.62	333.60	41.13	63.29	1511.62	25.96	1537.58
	(71.02)	(22.07)	(2.72)	(4.19)	(100)		
	[14.18]	[3.77]	[-14.35]	[4.79]	[10.32]	[-24.85]	[9.46]
2013-14	935.40	357.69	39.65	65.25	1398.00	27.68	1425.68
	(66.91)	(25.59)	(2.84)	(4.67)	(100)		
	[-12.87]	[7.22]	[-3.59]	[3.10]	[-7.52]	[6.62]	[-7.28]
2014-15	907.79	378.60	39.44	69.75	1395.57	26.30	1421.87
	(65.05)	(27.13)	(2.83)	(5.00)	(100)		
	[-2.95]	[5.84]	[-0.53]	[6.89]	[-0.17]	[-4.97]	[-0.27]
2015-16	962.32	364.95	34.81	71.21	1433.29	40.70	1473.99
	(67.14)	(25.46)	(2.43)	(4.97)	(100)		
	[6.01]	[-3.61]	[-11.74]	[2.10]	[2.70]	[54.73]	[3.67]
2016-17	922.19	350.49	35.02	87.16	1394.87	64.99	1459.87
	(66.11)	(25.13)	(2.51)	(6.25)	(100)		
	[-4.17]	[-3.96]	[0.62]	[22.40]	[-2.68]	[59.69]	[-0.96]
2017-18	971.84	363.58	37.29	85.87	1458.59	110.92	1569.50
	(66.63)	(24.93)	(2.56)	(5.89)	(100)		
	[5.38]	[3.74]	[6.47]	[-1.48]	[4.57]	[70.66]	[7.51]
2018-19	1048.73	379.23	41.48	40.19	1509.63	108.88	1618.51
	(69.47)	(25.12)	(2.75)	(2.66)	(100)		
	[7.91]	[4.30]	[11.24]	[-53.20]	[3.50]	[-1.84]	[3.12]
Average Growth Rate	1.93	2.47	-1.70	-2.20	1.53	22.86	2.18

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 74.43% in 2018-19. The share has increased over the years as the average annual growth in this sector is 6.42%. The share of the electricity, gas, and water supplies subsector has decreased from 8.12% in 2011-12 to 7.65% in 2018-19. Moreover, this subsector grew with a low average annual growth rate of 3.57%. The share of the construction sub-sector decreased from 20.20% to 17.92% in the same period as the average annual growth rate is low (2.66%).

Table 3: Trends in percentage share of non-agriculture sub-sectors in DGDP in Chandauli 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	71.68	8.12	20.20	100	14.73	19.14	7.55	29.24	23.95	5.39	100
2012-13	65.31	10.50	24.18	100	19.31	18.59	9.60	32.16	14.44	5.91	100
2013-14	68.31	10.26	21.43	100	21.08	18.85	10.16	31.69	12.16	6.05	100
2014-15	66.79	10.66	22.55	100	22.30	18.42	11.20	30.11	11.93	6.05	100
2015-16	72.16	8.78	19.06	100	24.97	18.46	11.40	27.72	11.42	6.04	100
2016-17	72.63	8.54	18.83	100	27.85	19.82	11.80	28.88	2.19	9.45	100
2017-18	74.60	8.15	17.26	100	28.22	19.97	10.60	29.21	2.24	9.76	100
2018-19	74.43	7.65	17.92	100	29.73	19.91	11.57	26.92	2.21	9.65	100
Average Growth Rate	6.42	3.57	2.66	5.13	15.15	4.71	11.02	2.78	-15.67	13.89	4.13
Source: Compiled from district statistical handbooks											

Within the tertiary sector, the transport, storage, and communication subsector made up the highest share (29.73%) in 2018-19, followed by the real estate (26.92%), Trade & Hotel (19.91%), and financial services (11.57%). Average annual growth is observed highest in transport, storage and communication (15.15%), financial services (11.02%), followed by trade and hotels (4.71%) and lastly lowest in real estate (2.78%). More work needs to be done to improve Construction and public administration subsectors. Transport and communication, trade & hotel, and financial services are the major contributors to the growth of the Tertiary sector.

3. 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 2533.74 sq. km². Forest area represents 30.55% of the total reported area. The share of cultivable wasteland decreased from 0.44% in 2010-11 to 0.41% in 2017-18, which is a good development indicator. Barren and uncultivable land share decreased from 1.10% in 2010-11 to 0.89% in 2017-18. The share of area under trees & gardens decreased slightly from 0.46% in 2010-11 to 0.44% in 2017-18. The current and other fallow land has increased over the years, which is not good for the district economy. The net sown area (NSA) has decreased over the years, from 53.44% in 2010-11 to

50.43% in 2017-18. The area for non-agricultural use increased slightly over the period from 10.26% to 11.33% (Table 4). Overall, the land use pattern shows that the uncultivable land and the NSA have decreased over the years while the area for non-agricultural use has increased.

Table 4: Trends in Land-use Pattern in Chandauli (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	Pasturelan d	The area under trees and gardens	Net Sown Area
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
2010-11	253374	30.55	0.44	3.07	0.67	1.10	10.26	0.01	0.46	53.44
2011-12	253374	30.55	0.46	3.81	0.64	1.00	10.91	0.01	0.49	52.12
2012-13	253374	30.55	0.44	2.96	0.67	1.09	10.17	0.01	0.45	53.65
2013-14	253374	30.55	0.44	2.11	0.59	0.90	10.94	0.01	0.45	54.01
2014-15	253374	30.55	0.38	2.43	0.63	0.90	10.98	0.01	0.43	53.69
2015-16	253374	30.55	0.37	4.55	1.41	0.90	11.18	0.00	0.43	50.61
2016-17	253374	30.55	0.41	4.69	1.30	0.90	11.28	0.01	0.42	50.44
2017-18	253374	30.55	0.41	4.18	1.76	0.89	11.33	0.01	0.44	50.43

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

2.1.2 Trends in Operational Land Holdings

In Chandauli district, the total number of operational farms increased from 191 thousand in 2010-11 to 201 thousand in 2015-16, a net increase of 5.24%. 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 94.42% in the district in 2015-16, while the corresponding proportion in the state was 92.81% (Table 5). The two agricultural censuses of 2010-11 and 2015-16 report no significant change in the percentage share across the various categories of landholdings. Marginal land holdings increased in 2015-16.

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

	Agri, Census	Marginal (0-1 ha)	Small (1-2 ha)	Semi-Medium (2-4 ha)	Medium (4-10 ha)	Large (10 & above, ha)	Total ('000 No.)
Chandauli	2010-11	84.29	9.63	4.48	1.52	0.08	191
	2015-16	84.96	9.46	4.26	1.25	0.08	201
							[5.24]
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 and Wheat dominate the agriculture of the district. Table 6 shows the area devoted to various crops over the last eight years. In 2017-18, Rice made up the highest share of GCA (47.31%), followed by wheat (41.04%); together, these two crops constitute around 88.35% of the GCA. The area shared by the total cereals has increased from 89.62% in 2010-11 to 91.02% in 2017-18. The main pulses produced are Masoor and Arhar, while the rest of the pulses are not significantly produced. The total pulses acreage has decreased from 6.89% in 2010-11 to 5.94% in 2017-18. Thus, the food grains cover a majority (average, 96.86%) of the GCA. Linseed is the only major oilseeds crop produced, and the total oilseed acreage has decreased from 0.46% in 2010-11 to 0.34% in 2017-18. The areas under Sugarcane and Potato have decreased over the years. In general, there is no significant change in the cultivation pattern during the study period, except that the NSA has decreased over the years, from 57.01% in 2010-11 to 52.47% in 2017-18. The average cropping intensity reported in the district is 182.34.

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	46.31	45.81	46.87	45.77	47.31	47.31	47.31	47.31
Wheat	40.42	41.65	40.91	42.04	41.04	41.04	41.04	41.04
Bajara	2.06	2.07	1.99	2.03	2.00	2.00	2.00	2.00
Other Cereals	0.82	0.77	0.74	0.72	0.67	0.67	0.67	0.67
Total Cereals	89.62	90.30	90.51	90.55	91.02	91.02	91.02	91.02
Masoor	4.17	3.81	3.79	3.79	3.47	3.47	3.47	3.47
Arhar	1.23	1.27	1.21	1.12	1.22	1.22	1.22	1.22
Other Pulses	1.49	1.47	1.35	1.37	1.25	1.25	1.25	1.25
Total Pulses	6.89	6.56	6.35	6.29	5.94	5.94	5.94	5.94
Total Foodgrains	96.51	96.86	96.87	96.83	96.96	96.96	96.96	96.96
Linseed	0.28	0.29	0.22	0.21	0.21	0.21	0.21	0.21
Other Oilseeds	0.18	0.13	0.13	0.11	0.13	0.13	0.13	0.13
Total Oilseeds	0.46	0.42	0.35	0.32	0.34	0.34	0.34	0.34
Sugarcane	0.30	0.27	0.26	0.27	0.27	0.27	0.27	0.27
Potato	0.38	0.21	0.33	0.33	0.32	0.32	0.32	0.32
Net Sown Area	57.01	56.13	55.57	57.07	55.87	52.66	52.49	52.47
Gross Sown Area (in 1000 Ha)	237.47	235.26	244.65	239.81	243.50	243.50	243.50	243.50
Cropping Intensity	175.40	178.14	179.96	175.23	178.99	189.90	190.52	190.57

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

2.1.3.2 Trends in Per Hectare Yield of Principal Crops

Table 7 shows that the yield per hectare of most crops varies across years. However, the yield for most crops increased in the latter years of the study. This can be due to improved irrigation facilities along with the availability of better infrastructure. Wheat and Rice are the major crops in the district, and their per hectare yield (37.70 qtls and 30.57 qtls respectively, in 2017-18) are also high. Per hectare yield of total cereals increased from 26.13 qtls in 2010-11 to 33.19 qtls in 2017-18. Similarly, per hectare yield of total pulses increased from 7.97 qtls in 2010-11 to 10.36 qtls in 2017-18. However, the yield of Pulses is less than that of cereals, following which the total production of pulses is less.

The yield of total oilseeds increased from 7.39 qtls in 2010-11 to 10.86 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 decreased as well, but on average, the yield increased in the latter years of the study. The per hectare average yield of Sugarcane is 550.89 qtls. Similarly, the average yield of Potato is 169.98 qtls/ha. In summary, all crop yields show year-over-year fluctuations. The lack of homogeneity of yields makes farmers' income riskier and more unstable, requiring a solid insurance protection measure.

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

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	27.50	27.18	28.14	26.92	29.44	30.51	27.70	30.57
Wheat	25.42	25.45	30.12	24.86	14.71	18.74	28.25	37.70
Bajara	13.08	15.43	12.63	10.35	14.89	13.92	9.79	9.80
Total Cereals	26.13	26.02	28.60	25.51	22.36	24.72	27.48	33.19
Masoor	6.39	9.48	5.97	6.73	5.67	4.86	7.96	9.95
Arhar	7.73	9.02	10.62	11.01	9.53	8.27	7.83	9.54
Total Pulses	7.97	10.16	7.99	7.78	6.90	6.57	8.49	10.36
Total Foodgrains	24.83	24.95	27.25	24.35	21.41	23.61	26.31	31.79
Linseed	4.71	4.33	5.95	1.93	5.90	1.04	3.62	7.45
Total Oilseeds	7.39	7.02	8.16	4.77	6.57	2.07	9.11	10.86
Sugarcane	445.44	497.36	516.74	552.81	577.83	621.04	532.29	663.65
Potato	178.10	179.58	170.85	164.61	202.69	166.26	212.32	85.43

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

2.1.3.3 Trends in Production of Principal Crops

Table 8 shows the trends in the production of the main crops over the years. Rice and Wheat dominate the production. In 2017-18, Rice (352.16 thousand tons) and Wheat (376.68 thousand tons) formed a major part of the total cereal production (735.60 thousand tons). Among pulses, Masoor and Arhar occupied the highest production. Masoor had a production of 8.40 thousand tons, and Arhar had a production of 2.84 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 75% of the total pulses production. Pulses production in the

district was quite low, indicating that pulses are not an important part of the district's agriculture. Improvement in irrigation conditions can improve production.

Linseed production was 0.39 thousand tons, representing around 43% of the total oilseed production in 2017-18. Sugarcane, which has miniscule share in the GCA, has a production of 44.13 thousand tons in 2017-18). Potato production has also been significant over the years (6.69 thousand tons in 2017-18). Looking at the annual production data of various crops, we find that their production has increased, on average, during the period, but at the same time fluctuates year to year, partly due to weather changes and partly due to market conditions. Proper insurance arrangements are the need of the hour to get assured income and take more risk and diversify their production.

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

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	302.52	292.92	322.71	295.48	339.12	351.45	319.14	352.16
Wheat	243.98	249.40	301.47	250.58	146.96	187.31	282.31	376.68
Bajara	6.39	7.52	6.16	5.03	7.25	6.78	4.77	4.77
Other Cereals	3.12	2.94	2.95	2.75	2.26	2.26	2.75	1.99
Total Cereals	556.01	552.78	633.29	553.84	495.59	547.80	608.96	735.60
Masoor	6.33	8.50	5.53	6.12	4.79	4.10	6.72	8.40
Arhar	2.26	2.70	3.15	2.97	2.84	2.46	2.33	2.84
Other Pulses	4.45	4.48	3.74	2.64	2.37	2.94	3.24	3.76
Total Pulses	13.04	15.68	12.42	11.73	9.99	9.50	12.28	14.99
Total Foodgrains	569.05	568.46	645.71	565.57	505.58	557.30	621.25	750.59
Linseed	0.31	0.29	0.32	0.10	0.31	0.05	0.19	0.39
Other Oilseeds	0.50	0.40	0.38	0.27	0.24	0.12	0.56	0.51
Total Oilseeds	0.81	0.69	0.70	0.37	0.54	0.17	0.75	0.89
Sugarcane	31.76	31.43	32.45	35.44	38.43	41.30	35.40	44.13
Potato	15.94	8.89	13.81	13.15	15.87	13.02	16.63	6.69

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, we calculated the mean, standard deviation (SD), and coefficient of variation (COV) in the area, production, and yield of the main crops. Table 9 shows that among different crops, the lowest variability in the area is observed in Bajra (0.19%), followed by Wheat (1.57%) and Rice (2.78%), and the highest in Potato (15.13%). The variability in the area under total pulses (4.69%) is more than the variability in the area under total cereals (1.88%). Since Rice and wheat

dominate the production, the variability in the area under total food grains is, therefore, also relatively low (1.53%).

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	112.88	3.14	2.78	321.94	23.93	7.43	28.49	1.47	5.17
Wheat	99.32	1.56	1.57	254.84	69.83	27.40	25.66	6.97	27.17
Bajara	4.87	0.01	0.19	6.08	1.11	18.19	12.49	2.27	18.15
Total Cereals	218.79	4.10	1.88	585.48	73.50	12.55	26.75	3.19	11.93
Masoor	8.87	0.54	6.06	6.31	1.57	24.82	7.13	1.83	25.72
Arhar	2.94	0.10	3.38	2.69	0.31	11.68	9.19	1.22	13.29
Total Pulses	15.03	0.70	4.69	12.45	2.16	17.32	8.28	1.37	16.58
Total Foodgrains	233.83	3.59	1.53	597.94	74.70	12.49	25.56	3.06	11.98
Linseed	0.56	0.07	12.44	0.24	0.12	48.31	4.37	2.14	48.97
Total Oilseeds	0.87	0.11	12.25	0.61	0.24	39.43	6.99	2.68	38.36
Sugarcane	0.66	0.03	4.08	36.29	4.65	12.82	550.89	69.55	12.63
Potato	0.77	0.12	15.13	13.00	3.53	27.19	169.98	38.20	22.47

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 Linseed (48.31%), followed by Wheat (27.40%), Potato (27.19%), Masoor (24.82%), and Bajra (18.19%). 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 (7.43%), followed by Arhar (11.68%) and Sugarcane (12.82%).

In the case of yield, the greatest variability is estimated in Linseed (48.97%), followed by Wheat (27.17%), and Masoor (25.72%). Yield variability in total cereals (11.93%) and total food grains (11.98%) is lower as compared to that in total pulses (16.58%). Rice, Arhar, and Sugarcane are the most consistent crops over the years. Several factors, such as climate change, market prices, rainfall patterns, etc., influence the variability in agricultural production.

2.1.4 Trends in Value of production of major crops

Table 10 compares the share of the main crops in the total GCA and their share in the total value of agricultural output (VOP). It is significant to note that Wheat and total oilseeds, on average, have a relatively larger share in GCA than their share in VOP, while total cereals, total food grains, Potato, and Sugarcane have, on average, a greater share in VOP than GCA. Chandauli is mainly a food grain production district; therefore, food grains account for around 96.86% of the gross area of the crops.

Similarly, total foodgrains account for nearly 97.45% of the total value of the agricultural product. Three crops - Wheat, Rice, and Potato together accounted for, on an average, around 88.21% of GCA and 91.68% of the total VOP. Overall, the total agricultural GCA has increased in the latter years of the study (average, 241.40 thousand hectares), and the total value of the product has also increased significantly, that is, 894.01 Cr. Rs. in 2010-11 to 1682.58 Cr. Rs in 2017-18.

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

Crop	% Share in	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Wheat	GCA	40.42	41.65	40.91	42.04	41.04	41.04	41.04	41.04
	VOP	30.92	30.73	34.27	32.13	21.78	25.72	36.41	40.01
Paddy	GCA	46.31	45.81	46.87	45.77	47.31	47.31	47.31	47.31
	VOP	57.76	57.76	56.34	57.63	67.47	65.34	54.84	52.74
Total Cereals	GCA	89.62	90.30	90.51	90.55	91.02	91.02	91.02	91.02
	VOP	89.74	89.56	91.57	90.68	90.35	92.31	92.16	93.37
Total Pulses	GCA	6.89	6.56	6.35	6.29	5.94	5.94	5.94	5.94
	VOP	7.60	8.42	5.99	6.74	5.77	5.10	5.07	5.14
Total Food Grains	GCA	96.51	96.86	96.87	96.83	96.96	96.96	96.96	96.96
	VOP	97.33	97.98	97.56	97.42	96.12	97.42	97.23	98.51
Total Oil seeds	GCA	0.46	0.42	0.35	0.32	0.34	0.34	0.34	0.34
	VOP	0.28	0.21	0.21	0.14	0.20	0.07	0.29	0.23
Potato	GCA	0.38	0.21	0.33	0.33	0.32	0.32	0.32	0.32
	VOP	1.53	1.02	1.54	1.45	2.62	1.42	1.66	0.32
Sugarcane	GCA	0.30	0.27	0.26	0.27	0.27	0.27	0.27	0.27
	VOP	0.85	0.79	0.70	0.99	1.06	1.09	0.83	0.94
Paddy + wheat + potato	GCA	87.11	87.67	88.11	88.14	88.67	88.67	88.67	88.67
	VOP	90.21	89.51	92.14	91.22	91.86	92.49	92.91	93.07
Total Agriculture	GCA (1000 Ha)	237.47	235.26	244.65	239.81	243.50	243.50	243.50	243.50
	VOP (in Cr Rs)	894.01	1055.85	1231.60	1107.37	1197.79	1195.69	1411.18	1682.58
Per Worker VOP (Rs.1000 at current prices) in **Chandauli**		-	28.89	31.51	31.20	34.27	37.16	38.65	50.67
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: Compiled from http://updes.up.nic.in/spiderreports/intialisePage.action
And District-wise Development Indicators file.

Table 10 shows that the total value of agricultural produce per agricultural worker in Chandauli district increased from Rs. 28.89 thousand in 2011-12 to Rs. 50.67 thousand in 2017-18, a net increase of

75.43% at current prices, while in UP it increases from Rs. 40.66 thousand to Rs.69.69 thousand, a net increase of 71.40%. The per worker value of agricultural output is much lower in the district than in the state. However, the growth rate per worker value of output in the district is more than in the state. The ratio of per worker value of the output of the district to the state average has increased from 0.7104 in 2011-12 to 0.7271 in 2017-18.

2.1.5 Consumption of Chemical Fertilizers

Table 11 shows the trends in the use of chemical fertilizers in agriculture. The recommended nitrogen to phosphorus and potassium ratio is 4:2:1, which is not maintained in the district. For example, in 2010-11, Nitrogen represented 68.14% of the total fertilizers used, while the proportions of Phosphorus and Potassium were 24.45% and 7.41%, respectively. In 2017-18, however, the nitrogen share increased to 76.91%, while the Phosphorus share decreased to 20.46%, and the Potassium share decreased to 2.63%. The use of Nitrogen is more than the recommended ratio, while the Phosphorous and Potassium ratio is less than the recommended ratio. The table also shows that fertilizer consumption varies across years, which can be due to several factors, including rainfall patterns, cultivation patterns, etc. The overall use of chemical fertilizers has decreased in the district from 205.38 kg/ ha GSA in 2010-11 to 189.03 kg/ ha GSA in 2017-18, which is a good sign. However, still the authorities need to take steps to further reduce their consumption as chemicalization of agriculture degrades soils and water resources, requiring the use of organic fertilizers and biofertilizers.

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

Fertilizer/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Nitrogen	139.95	116.30	106.48	101.28	105.54	104.15	100.32	145.38
Phosphorous	50.21	30.84	36.03	25.07	30.16	38.97	38.68	38.67
Potassium	15.22	6.97	3.51	3.48	6.09	6.97	8.38	4.98
Total	205.38	154.11	146.02	129.83	141.79	150.09	147.38	189.03
Gross Sown Area (Ha)	237474	235262	244647	239811	243501	234283	233536	233485

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

2.1.6 Irrigation Structure and Status

2.1.6.1 Types of Irrigation systems

The types of irrigation systems and the percentage of the net and gross irrigated area to the net and gross cropped area, respectively, are described in Table 12. The length of the canal has remained constant (534 km) over the years. The number of ground-level pump sets has increased from 286 in 2010-11 to 374 in 2018-19. The number of government tube wells increased from 246 in 2010-11 to 304 in 2018-19. The number of wells increased from 431 in 2010-11 to 585 in 2017-18. Shallow, medium, and deep tube wells increased by 5.16%, 220%, and 25.88%, respectively, in 2018-19 compared to 2010-11. The district's percentage of the net and gross irrigated areas have decreased over the years with an average of 93.08% and 88.97%, 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)	534	534	534	534	534	534	534	534	534
No. of Govt. Tube wells	246	246	272	272	272	293	303	304	304
No of Wells	431	431	585	585	585	585	585	585	585
No. of Ground-level Pump set	286	286	374	374	374	374	374	374	374
Shallow Tube well	14996	15518	15552	15582	15582	15582	15582	15700	15770
Medium Tube well	5	5	5	5	5	5	5	5	16
Deep Tube well	85	99	107	107	107	107	107	107	107
% Of NIA	96.45	90.89	93.84	94.28	94.02	91.62	91.93	91.60	-
% Of GIA	88.51	88.94	89.34	89.37	89.86	88.78	88.48	88.46	-
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 sources in the district. The canal's share in the NIA (average, 85.47%) has increased over the years, and the share of wells and tube wells in NIA (average, 12.22%) has decreased over the years. This shows that the district's dependence on surface water is higher than the groundwater for irrigation.

Table 13: Source-wise Area under Irrigation in Chandauli (in %)								
Source/Year	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
Canal (surface Irri.)	83.20	84.96	82.75	81.02	85.53	88.49	88.49	89.31
Wells And Tube-wells (GW Irri.)	13.22	14.88	15.76	14.94	13.01	8.68	8.68	8.62
Others	3.58	0.17	1.49	4.04	1.46	2.82	2.82	2.07
NIA (1000 ha)	130.59	120.03	127.57	129.02	127.90	117.49	117.49	117.04
Source: Compiled from http://updes.up.nic.in/spiderreports/intialisePage.action								

2.1.6.3 Crop wise irrigated area

Table 14 shows that the most cultivated areas under Rice (average, 99.98%), Wheat (average, 99.89%), Potato (average, 99.98%), and Sugarcane (average, 100%) are irrigated. Percentages of the irrigated area under pulses (average, 1.91%) and oilseeds (average, 3.48%) are quite less.

Table 14: Trends in Crop-wise Irrigated Area in Chandauli (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	99.92	100	100	100	100
Wheat	99.93	99.93	99.93	99.93	99.85	99.85	99.85	99.85
Total Cereal	96.90	96.95	97.07	97.03	97.13	97.13	97.13	97.13
Total Pulses	1.66	1.83	1.81	2.08	1.98	1.98	1.98	1.98
Total Foodgrains	90.10	90.51	90.83	90.86	91.30	91.30	91.30	91.30
Total Oilseeds	3.12	3.37	3.86	3.52	3.41	3.53	3.53	3.53
Sugarcane	100	100	100	100	100	100	100	100
Potato	100	100	99.88	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 15 shows that per capita electricity consumption in agriculture has increased significantly from 213.78 KWH in 2014-15 to 341.7 KWH in 2019-20, a net increase of approximately 59.84%. It is a concern as it can result in an increased burden on non-renewable resources and create waste disposal problems. The percentage share of the agriculture sector, on average, is 20.04% of the total electricity consumption in the district. Though, electricity intensity in the agriculture is relatively low, it has increased over the years. Efforts are required to switch to more sustainable modes of electricity production, such as solar energy.

Table 15: Trends of Electricity consumption in Agriculture

Division/ Year	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Per Capita electricity consumption (KWH)	213.78	222.65	288.52	323.53	350.47	341.7
% Of electricity consumed in Agriculture sector to total consumption	22.68	22.19	20.25	19.6	16.99	18.55

Source: Compiled from District-wise Development Indicators file and Statistical Reports.

2.1.8 Status of Agriculture Market

Table 16 shows the marketing infrastructure in the district. It has one main market and four sub-markets. The number of regulated mandis per lakh hectare of NSA decreased from 3.65 in 2013-14 to 0.78 in 2018-19, which is a cause of concern as it is very important to increase the number of regulated mandis so that farmers can sell their products remuneratively.

Table 16: Status of Agriculture Markets in Chandauli

Category/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Main Markets (No.)	1	1	1	1	1	1	1
Submarkets (No.)	4	4	4	4	4	4	4
Total Markets (No.)	5	5	5	5	5	5	5
No. of Regulated mandis per lakh Ha. of net area sown	3.65	1.97	-	0.78	0.74	0.78	-

Source: Compiled from District-wise Development Indicators file.

2.1.9 Status of Organic Farming

To promote sustainable agricultural practices and improve the farmers' livelihood, the Government of India launched PKVY and Namami Gange schemes. Under these schemes, farmers are incentivized to form groups to do organic farming and sell their products with PGS certification. Under the programme, the beneficiary farmers get Rs.12000, Rs. 10000, and Rs.9000 per hectare, respectively, in the first, second, and third years of the conversion period. It is significant to note that the Ministry of Agriculture and farmers Welfare, Government proposed a Natural Farming Scheme with an estimated cost of Rs.2500 crores. If implemented properly, it may go a long way to make the agriculture ecological more sustainable, economically viable and socially responsive.

The transition period for the full conversion from conventional to organic is considered three years. During this period, crop yield, on average, is expected to decline by 10—15 percent. However, after three years, it may reach its original level. Financial assistance received by the beneficiary farmers seems to be adequate to compensate for the yield losses and motivate them to do organic farming. There is a need to set up an integrated processing unit for organic products. Monitoring 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 in the absence of the regulatory framework, the beneficiary farmers may revert to conventional farming. 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.

Table 17 shows the details of the establishment of organic clusters under the Paramparagat Krishi Vikas Yojana and Namami Gange schemes in the district. The district has 96 groups in four development blocks, of which 52 are under PKVY scheme, and 44 are under the Namami Gange scheme. The highest number of groups are in Dhanapur (50), followed by Chahniya (32), Niyamatabad (11), and Chandauli (3). Significantly high variation can be seen in the number of farmers per group in the district. It is reported that the maximum limit of land under a cluster per farmer is 2.00 hectares. Hence, the majority of the beneficiary farmers are small and marginal.

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

S. No.	Block	Scheme	No. of groups	No. of farmers in groups			
				Total	Average	Median	SD
1	Chahniya	PKVY	19	808	42.52	47	9.9
		Namami Gange	13	500	38.46	38	7.24
2	Chandauli	PKVY	3	70	23.33	26	5.5
3	Dhanapur	PKVY	24	834	34.75	35	9.43
		Namami Gange	26	937	36.03	38	8.52
4	Niyamatabad	PKVY	6	280	46.66	47	5.39
		Namami Gange	5	191	38.2	39	6.22
5	District Total	PKVY	52	1992	38.3	40.5	10.61
		Namami Gange	44	1628	37	38	7.86
		Total	96	3620	37.7	39	9.43

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

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

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

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

2.1.10 Livestock Sector

2.1.10.1 Trends in Livestock Population

Livestock forms an integrated part of the rural economy. Table 18 shows that indigenous and exotic male cattle decreased considerably from 57947 in 1997 to 5928 in 2019 and from 4810 in 1997 to 3560 in 2019, respectively. On the other hand, indigenous and exotic female cattle, respectively, increased considerably from 85059 in 1997 to 172046 in 2019 and from 12749 in 1997 to 156859 in 2019. Thus, the total number of cattle increased from 160565 in 1997 to 338393 in 2019, thus, a net increase of 110.75%. 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 148.50% in 2019 compared to that in 1997 is observed in the total population of buffalo. A significant reduction in the indigenous sheep population is observed (34.83%) in 2019 compared to that in 1997. During the same period, the population of exotic sheep increased, but the total sheep population still decreased by 28.59%. The total population of goats decreased from 89805 in 1997 to 89091 in 2019, a net decrease of 0.79%. The total pig population decreased considerably from 10680 in 1997 to 3907 in 2019.

It is significant to note that the number of female cattle and buffaloes has substantially increased over the period, indicating the growth of livestock products, including milk. The substantial decline in the number of male cattle and male buffaloes also shows the rising farm mechanization and declining relevance of animal power, mainly because of the high maintenance cost of livestock. The livestock subsector has around 24.86% share in the agriculture and allied activities sector and grew at a significant average annual growth rate of 2.47% from 2011-12 to 2018-19.

Table 18: Trends in Livestock Population (in numbers) in Chandauli

	Category	1997	2003	2007	2012	2019

Indigenous Cattle	Total Male	57947	58233	69012	45424	5928
	Total Female	85059	98144	97581	117168	172046
	Total	143006	156377	166593	162592	177974
Exotic Cattle	Total Male	4810	5041	6910	9919	3560
	Total Female	12749	12162	12569	32365	156859
	Total	17559	17203	19479	42284	160419
Total Cattle		160565	173580	186072	204876	338393
Buffalo	Total Male	28151	38742	53875	51746	6006
	Total Female	101873	117300	135777	169980	317111
	Total	130024	156042	189652	221726	323117
Sheep	Total Indigenous Sheep	22986	23723	24368	25045	14978
	Total Exotic Sheep	943	0	0	5275	2109
	Total Sheep	23929	23723	24368	30320	17087
Goat	Total	89805	86744	90700	98838	89091
Pig	Total Indigenous Pig	8806	6989	6087	7326	3854
	Total Exotic Pig	1874	510	307	972	53
	Total Pig	10680	7499	6394	8298	3907
Total Livestock		418177	450439	498832	566041	-
Total Poultry		201995	184353	151151	342206	-
Source: http://updes.up.nic.in/spiderreports/intialisePage.action						

2.1.10.2 Cattle Care Centre

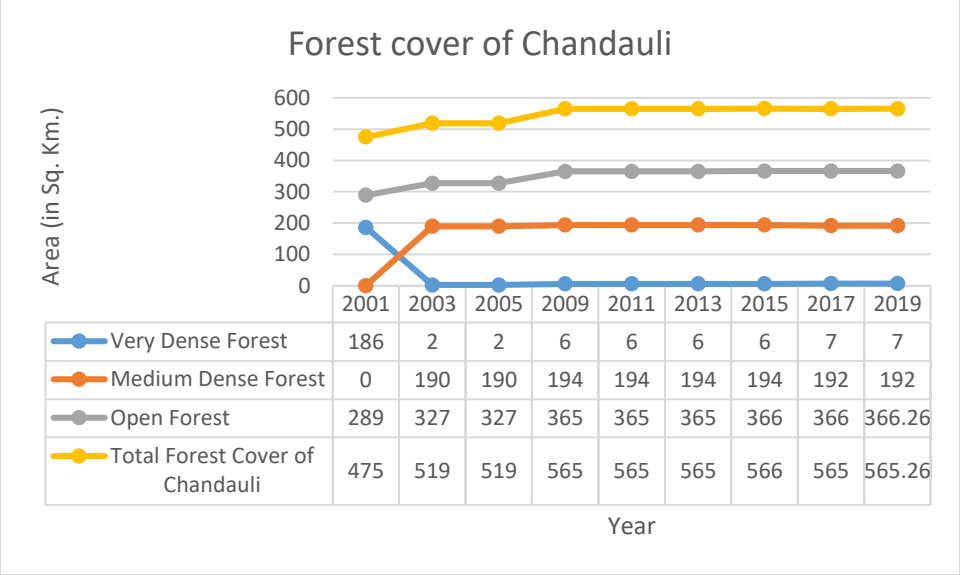
Table 19 shows that the Chandauli district has an active network of cattle hospitals and development centres, which are very necessary for the livestock sub-sector to grow. The number of cattle hospitals increased from 17 in 2010-11 to 18 in 2018-19. The number of cattle development centres (21) has remained constant over the years. The number of man-made reproduction centres decreased from 40 in 2010-11 to 38 in 2018-19. There are very few sheep (11) and pig development centres (3) which might be one reason for the declining sheep and pig population in the district.

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

Category	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Cattle Hospital	17	17	17	17	18	18	18	18	18
Cattle Development Centre	21	21	21	21	21	21	21	21	21
Man-Made Reproduction Centre	40	35	35	35	36	37	37	37	38
Sheep Development Centre	11	11	11	11	11	11	11	11	11
Pig Development Centre	3	3	3	3	3	3	3	3	3
Source: http://updes.up.nic.in/spiderreports/intialisePage.action									

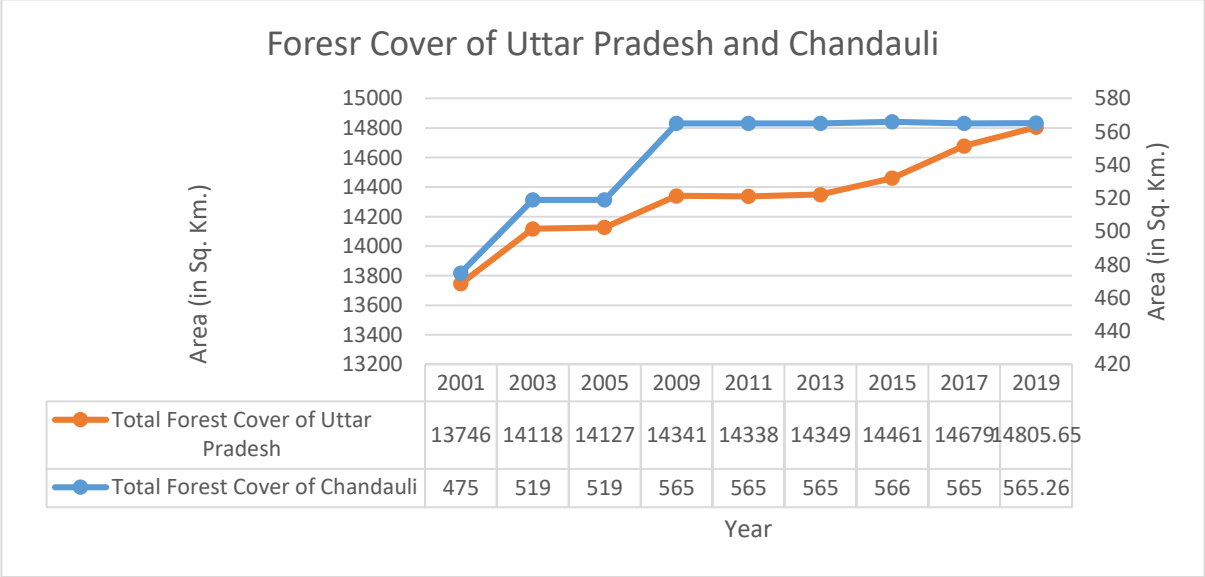
2.2 FORESTRY

Baseline Data Analysis/ Quantitative Data Analysis



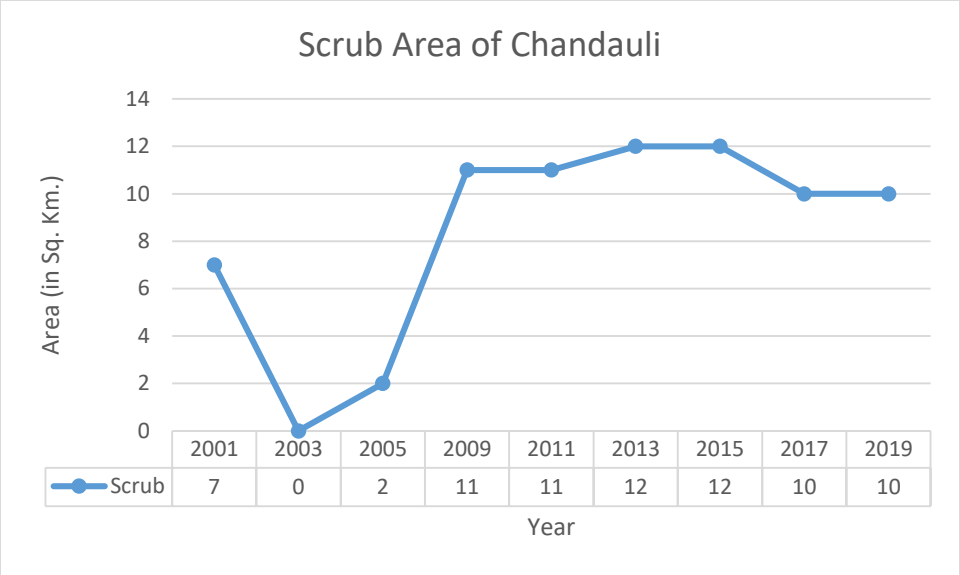
	2001	2003	2005	2009	2011	2013	2015	2017	2019
Very Dense Forest	186	2	2	6	6	6	6	7	7
Medium Dense Forest	0	190	190	194	194	194	194	192	192
Open Forest	289	327	327	365	365	365	366	366	366.26
Total Forest Cover of Chandauli	475	519	519	565	565	565	566	565	565.26

According to ISFR 2019, the total forest cover is 565.26 Sq. Km.. Majority of the forest cover is open forest, followed by moderately dense, and very dense forest.



	2001	2003	2005	2009	2011	2013	2015	2017	2019
Total Forest Cover of Uttar Pradesh	13746	14118	14127	14341	14338	14349	14461	14679	14805.65
Total Forest Cover of Chandauli	475	519	519	565	565	565	566	565	565.26

Between 2001 and 2019, the forest cover of chandauli has increased from 475 Sq. Km. to 565.26 Sq. Km.. The forest cover of Uttar Pradesh has also increased.



The scrub are of chandauli has increased since 2003 to 10 Sq. Km.

2.2.1 Biodiversity

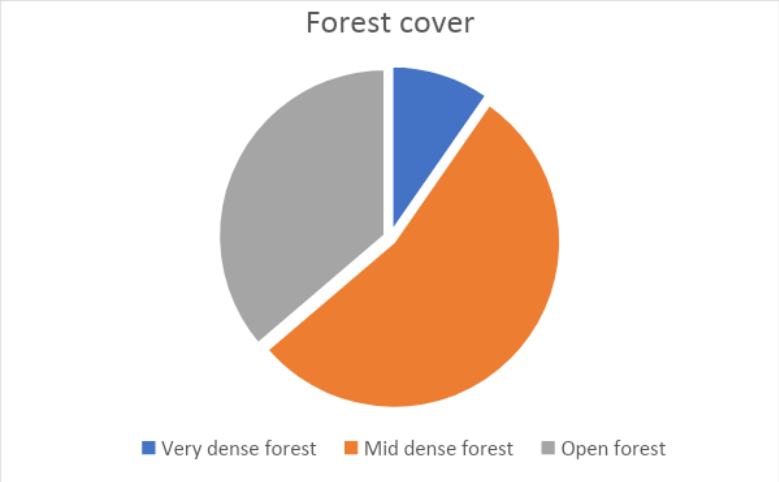
The district's biodiversity data includes various crop production, livestock population, bird species, and forest cover. The crop production trend shows a reduction in the non-grain crop but increases in all other crops. Forest data shows that forest cover was decreased by 0.26% in 2019.

Table 3 Bird species recorded in the district.

Number of species	330
Number of rare/accidental species	3

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
2541	7	192.00	366.26	565.26	22.25	0.26	10.00



2.3 TOURISM

Baseline data/Quantitative Data

Total number of tourists visiting Chandauli -(2018-2020)

YEAR	INDIAN	FOREIGN	TOTAL
2018	662131	964	663095
2019	660820	1007	661827
2020	240372	303	240675

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

- The above-given data table-1 is taken from the Uttar Pradesh tourism website. The data table shows the number of tourists visiting Chandauli for tourism from 2018 to 2020. The tourist visits are bifurcated into two different groups – Domestic and Foreign tourists.

a. In the year 2018 Chandauli received total **663095** tourists. Total number of Domestic travellers were 662131and total international travellers were 964.

b. In the year 2019 Chandauli received total **661827** tourists. Total number of Domestic travellers were 660820 and total international travellers were 1007. The district experienced a total growth 1.9% in total number of tourists compared to number in the previous year.

c. In the year 2020 Chandauli received total **240675** tourists. Total number of Domestic travellers were 240372 and total international travellers were 303. The district experienced a total decline of -63% in total number of tourists compared to number in the previous year.

2.4 WETLANDS

The district is known for large number of small and medium wetlands. This district is known for some of the large man-made reservoir like NAUGARH Reservoir (1681.94 Ha), Reservoir Chandraprabha (693.62 Ha), Munsakhand (613.4 Ha). The data in Table 6 represent the number of wetlands and their area representation in the district. There are around 485 wetlands sized greater than 2.25 Ha and 285 less than 2.25 Ha areas. The region consists of small and medium size wetlands only, generally less than 200 Ha in area and there are around 6 wetlands with size for than 200 Ha, 3 above 500 Ha and 1 above 1000 Ha

Table 6: Wetland Data of Chandauli 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	11	13	2	0	5	3	1	1	0	1	0	0	2
Ox-bow lakes/cut off meanders	0	0	0	0	0	0	0	0	0	0	0	0	0
High altitude Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0
Riverine Wetlands	3	5	2	0	0	1	0	0	1	1	0	0	1
Waterlogged	27	37	10	0	17	6	0	3	0	1	0	0	5
River/Stream	0	45	45	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	78	109	31	0	19	20	16	12	7	0	3	1	8
Tanks/ponds	9	10	1	0	7	2	0	0	0	0	0	0	2
Waterlogged	105	124	19	0	26	21	16	24	15	3	0	0	60
Salt pans	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (1213)	**233**	**343**	**110**	**870**	**74**	**53**	**33**	**40**	**23**	**6**	**3**	**1**	**78**

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

- District comprises 1213 wetlands; most of them are waterlogged and reservoir.
- The wetland size is small and medium sized in general.
- The number of natural wetlands is less than man-made.
- Many wetlands both man-made and natural are waterlogged and large size one are of reservoir type.
- Many wetlands have aquatic vegetation.

2.5 ENERGY

2.5.1. Solar

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

According to the 2011 census, 67.71% households in the district depend on kerosene for the main source of lightning, followed by 31.02% using electricity and only 0.48% using solar.

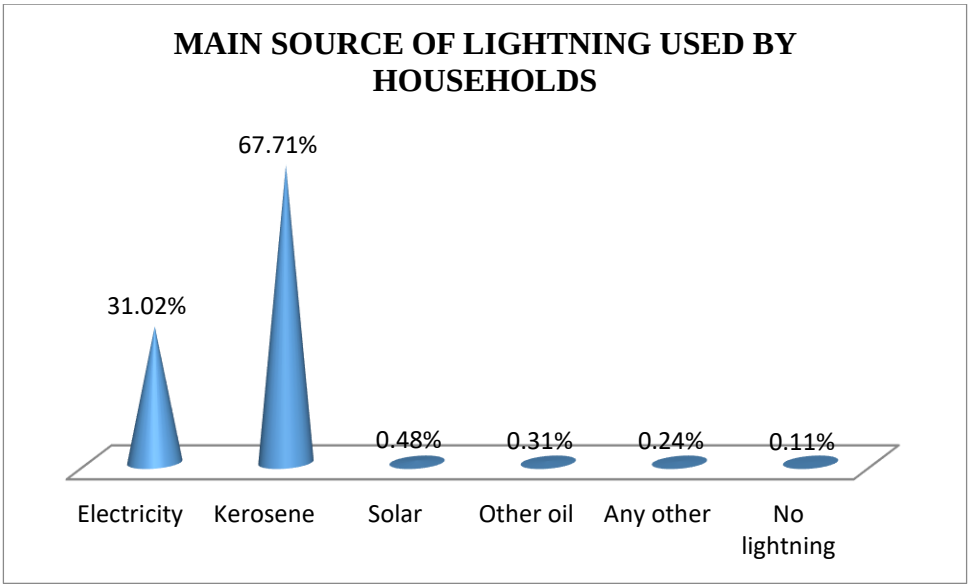


Fig. 1

2.5.2. Biomass

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

According to the 2011 census (Fig. 1), 62.12% households use cowdung cake as cooking fuel, followed by 19.87% using firewood, 11% using LPG/PNG and 3% using crop residue.

Majority of population in the district is mainly dependent on agriculture as their primary source of income. Rice, pearl millet, pigeon pea, wheat, etc. are some of the major crops cultivated in the district.

The net sown area of the district is 135595 ha with the cropping intensity of 187%. A total of 1125 ha of cultivable wasteland and 7719 ha of current fallows is there in the district. The district produces 539.4 kT/Yr of agricultural biomass and 156.2 kT/Yr of forest based biomass (Kumar et. al. 2017).

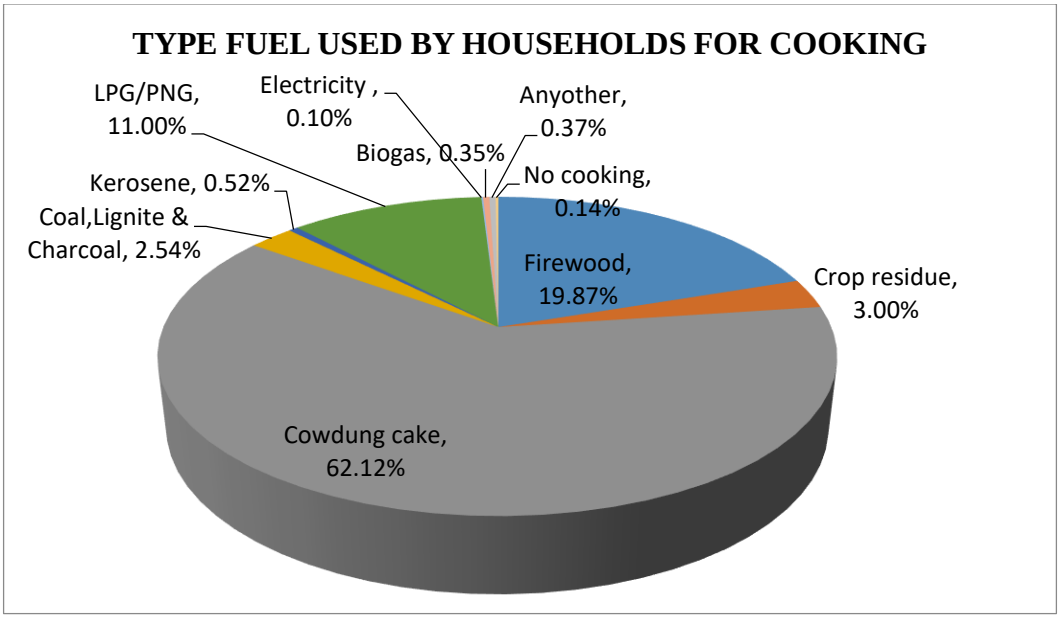


FIG. 1

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

CROPS	PRODUCTIVITY (kg/ha)
Rice	2450
Pearl millet	1282
Pigeon pea	2.914
Wheat	187.262
Pea	3.1052
Lentil	7.033

Table 1

In the district Chandauli at some of the places biomass gasifies have been installed such as Suman rice mill, Sitaram rice mill, Shri nath ji solvents, Dojanti rice mill and Ashok rice mill.

2.5.3. Biogas

As existing biogas plant data is unavailable for the district, biogas potential has been evaluated by average livestock and agricultural waste production. Biogas potential from animal waste is calculated as approximately one crore m^3/year and thirty-one crores m^3/year. This amount of biogas generation can efficiently complete the energy demand of the district.

2.5.4. Hydro Power

Available data shows that no hydropower plant exists in the district, and no site has been investigated for future projects. The main river in the district is Ganga (north-east part) and then Kali and Ishan river. Ganga canal present in the district can serve the purpose of electricity generation by constructing small 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).[1]

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.[2]

3.2.1. Biodiversity

The Chandra Prabha Wildlife Sanctuary is part of the Kashi Wildlife Division and is located in the Chandauli district of Uttar Pradesh. In 1957, a total area of 9600 hectares was identified as a forest area and established as the Chandra Prabha Wildlife Sanctuary to resist organic and man-made pressure on wildlife in the form of human encroachment and industrial growth, along with an increase in the population. Under the Kashi Forest Division core region, an extra buffer area of 66000 hectares has been set aside as forest land. Blackbucks, Chital, Sambar, Nilgai, Wild Boar, Bear, Leopard, Porcupine, Chinkara, Gharial (small crocodile), and Python are among the wild creatures found here. Around 150 kinds of birds may be seen in the park.

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

[2] State Action on Climate Change, Uttar Pradesh

3.2 ENERGY:

As per the data of the year 2013, Chandauli district energy consumption is around 72 TJ/year and 3.1 GJ/capita/year. GHG emission of 5128 Ton CO_2 equivalent and 0.223 Ton CO_2 equivalent/capita has been evaluated for the district.

3.2.1. Solar

The district has a good potential of solar energy and if used properly it can generate solar power in large amounts. According to Pugazenthi et. al. 2016, total solar power potential available in the district is 0.2150. An article in Jagran, mentions that whether there is electricity or not, there are many such lanes in the villages of the district, which do not get dark, but are illuminated with solar energy. Before the year 2021, there used to be darkness in these streets. Under the grant of the district plan, in the financial year 2021-22, 728 solar street lights were installed in different villages of the district.

Another article in solarquater with the heading 'UP Small Industries Corporation Ltd Issues Tender for Installation of 112 2.7 kW Solar PV System Off Grid in District Chandauli' mentions that UP Small Industries Corporation Ltd (UPSICL) issues tender for installation of 112 nos 2.7 kW solar PV system off grid in District Chandauli, Uttar Pradesh. The tender value is Rs 34,28,400 and Earnest Money Deposit (EMD) from bidders is Rs 34, 300. The bid opened on January 9 and the closing date for submission of bids is January 16, 2020. A tender fee of Rs. 1,180 was charged by UPSIC.

3.2.2. Biomass

The district Chandauli is known as the rice bowl of Uttar Pradesh producing paddy and resultantly biomass in large amounts. The district deals with the problem of stubble burning. As reported in Jagran, despite all the efforts of the administration in the paddy bowl, there is no ban on stubble burning. Crop residues are being burnt in the field in the dark of night. In the agriculturally dominated district, the farmers are engaged in the work of sowing wheat along with harvesting of paddy. The work of sowing wheat in the current Rabi season has been lagging behind due to non-compliance with the weather. Despite this, 60 to 70 percent of wheat has been sown. Barring small and medium farmers, big farmers are unable to sow wheat due to stubble in the fields. Although, along with running awareness campaign to destroy stubble by the Agriculture Department, a solution has been suggested to destroy the residue of paddy crop with decomposer, but due to the time taken, the measure is not proving effective. In such a situation, farmers are being forced to burn stubble so that wheat can be sown on time. Due to fear of action, stubble is not being burnt during the day but crop residue is being burnt in the dark of night. By burning stubble, the fertility of the soil is being destroyed, the micro elements are also getting destroyed. This will worsen the health of the soil in the coming days.

The other problem faced by the district is frequent power cut offs. As reported by ABP live in an article, Chandauli district, which is called the bowl of rice, is not untouched by unannounced power cuts. There is tremendous power cut in rural areas of the district. Naxal-affected areas are also troubled by power cuts. Due to which a lot of resentment is being seen among the people.

3.2.3. Biogas:

In animal shelters, biogas plants will be constructed, and organic fertiliser will be accessible with electricity. Biogas plants will be installed in nine animal shelters across nine blocks. (Amar Ujala, 10th September 2021). The district has a high potential to generate biogas from agricultural, animal, and human waste. A national program such as the New national Biogas and organic manure program (NNBOMP) and Biogas power generation and thermal energy application program (BPGTP) are running by State and should be applied to this district generation decentralized energy source.

3.2.4. 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.

3.3 TOURISM

- **HOW TO REACH CHANDAULI-**

The district of Chandauli is well connected by train and road.

Using the Rail

The region has access to both the northern and eastern trains. Mughalsarai junction is only about 15 kilometres from the district headquarters. Mughalsarai is the largest railway yard in India and serves as a terminus for railways heading in various directions around the country. Within the district, 14 railway stations are linked by 101 kilometres of wide gauge railway tracks. Passengers can travel by rail to various locations and directions throughout the country from the Mughalsarai railway junction.

By road-

In terms of road transportation, the district has 1206 km of metalled road, of which 36 km are paved. National highways are more than 100 kilometres long, whereas state highways are only 42 kilometres long. lengthy. The G.T road also runs through the district. The main district road is 89 kilometres long, and the other district and country roads are 559 kilometres long, with a total length of 578 kilometres administered by local bodies (49 kilometres) and the forest. The PWD government constructs and maintains 726 kilometres of road. Private bus services are available in the district for both urban and rural locations.

Places to see in Chandauli-

1) Rajdari & Devdari Waterfalls

The Rajdari & Devdari waterfalls are found near the Chandraprabha Wildlife Sanctuary, in the Chandauli District, Uttar Pradesh, India, Asia, and it is one of the popular places to visit in chandauli. These waterfalls are situated approximately 30 KM far from the main Varanasi city of Uttar Pradesh state, India. The crystal clear waters, gurgling over the rocks present a breathtaking sight. The scenic,

tranquil surroundings lend a sense of mysticism to the experience. The flow of waterfalls is quite impressive & feels cold at the same time. Best time to visit: June to September during Indian monsoon season.

2) Chandraprabha Dam

Chandraprabha Dam is situated in the area of Chandraprabha Wildlife Sanctuary near Rajdari & Devdari Waterfalls, Chandauli, Uttar Pradesh, India, Asia. The Dam is situated on the left side of both the waterfalls. The Dam is also called as Wat Land Dam of Chandauli. The Dam is situated on the Chandraprabha River that control it's water flow. The rear end area of the Dam gives you the full scenic view of Chandraprabha River covered with mountains, while the front end area is the main section of the Dam. People can explore the whole Dam by going downside as there are stares on both the left & right hand side of the Dam. Best time to visit: June to September during Indian monsoon season.

3) Chandraprabha Mountains

Chandraprabha Mountains have well covered the complete Chandauli district in its surrounding. These mountains are well greened & people can do trekking in these to reach on the top. Many mountains have well-built natural footpaths as the easiness for the pedestrians. The roads are well built & wide curved in these mountains. The weather is also remains quite chilled in these mountains. During evening you might feel cold in between these mountains. The best season to visit in these mountains are the monsoon season in between month of June to September & yes there is not any kind of landslide occurs in this area.

4. Chandraprabha Wildlife Sanctuary-

It is one of India's lesser-known sanctuaries, although it is home to a variety of intriguing animals, birds, and flora. It keeps its pure charm away from mass visitors. It was created to protect Asiatic lions, and while their numbers have dwindled, the sanctuary also houses a variety of other animals and birds

Data analysis

- From the table-1 it is evident that the number of total tourists in Chandauli increased from 2018 to 2019.
- The Chandauli tourism encountered highest percentage change in tourists in the year 2019, which was 1.9% increase compared to previous year.
- The growth in the number of total tourists in Chandauli is not constant in these years, although the range lies between -60-1.9%

SWOT Analysis

S.No	Strength	Weakness	Opportunities	Threat
1.	• Geographically located next to Prayagraj in Uttar Pradesh. • Religious tourist plans can be clubbed together to propose a spiritual travel plan. • The district is densely fortified with temples like Kara Dham Sheetla temple and the Prabhosa Jain temple. • Archaeologists from Allahabad University, IIT-K excavating Ghositarama monastery	• Poor promotion of existing temples and monasteries. • No maintenance of existing heritage sites in the district.	• Proper maintenance of existing heritage sites to attract more tourists both local and foreign. • By utilising cutting-edge technology, such as laser induced for excavation of Ghositarama monastery. • Creating museums, artistic spaces and collaborative ventures to bring all useful collected heritage and art under one roof.	• Covid 19 can be a big threat with unpredictable arrival. • Lack of good budget by the government can be a big barrier. .

3.4 WETLANDS

The wetlands are the source of many ecosystems and habitats for a variety of species. The wetlands create a unique ecosystem that supports many species simultaneously like aquatic, terrestrial, and human beings. The district has many potential sources and opportunities to harness valuable products using the scheme and start the pilot project. Local stakeholders directly or indirectly depend on the wetland for their income and small-scale business. These businesses can be a great opportunity can be turned into a large-scale production hub using the right approach. The region has a good amount of production of wheat, rice. The region is known for the large waterfalls 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:

- Rice and wheat production is recommended as commercial crops in the region, leading to products like product related like flour and finished product.
- Introduction of improved cultivars and production technologies of oilseeds.
- India Govt. has proposed a mission like India's Millet Mission, which creates an opportunity for the district to become a production hub. The district stats show a good amount of finger millet, pearl millet, in the region, which can be promoted in the scheme.
- Also, products like oil, finished pulses can be derived from the crops and millets grown in the region.
- Also, this region is a belt of large varieties of oil production in the region like mustard seeds which can turn into valuable market for oil production in the region.
- The district is famous for its waterfalls and large reservoir.
- The region has a large production of dairy products, which lead 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

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

	Target for 20 Years	**Target per year**
Plantation by Forest Department	514,500 ha	52725 ha

Plantation by Private Land Owners	540,000 ha	27000 ha

Figure 5 Targets to increase forest and agro-forestry plantation
Source: State Action on Climate Change, Uttar Pradesh

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

Projections & Monitoring Matrix

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

4.1.1 **Biodiversity -** The areas where ungulate populations are found to be high, such as Burhan, Baliyari, Gardi, and Simaria beats, should be strictly closed to forest resource collection, while the rest of the beats, such as Chandraprabha and Bhaisora, should be open to local use and they should be involved in the management of these beats under joint forest management.

4.2 Tourism

- **'Travel Uttar Pradesh' plan-**. 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 Varanasi. A specific niche, spiritual tourism, has grown in popularity. The government has been pushing spiritual tourism for the entire year, which may have contributed to the growth in this specialty. The Delhi government resumed the **'Mukhyamantri Tirth Yojana'** in November of the previous year, allowing elderly inhabitants of Delhi to go on an all-expense-paid pilgrimage to various temples around the country. The Prime Minister of India, Narendra Modi, also launched the **INR 9 billion Kashi Vishwanath project,** which has piqued the interest of devotees and made travel to Varanasi, Uttar Pradesh, easier.
- **Sustainable tourism-**
  When people visit an area for its authenticity, it is critical that they do not jeopardise that same authenticity. The secret to a successful tourism business is to come up with innovative ideas, even if they are simply old-fashioned ones. Innovative approaches to revive the business while safeguarding local communities must be considered in Chandauli.

- **Ecotourism-**
  Chandauli has Chandraprabha Wildlife Sanctuary with its immense extent, cannot satisfy one's appetite for exploration in a single visit, but due to the Site Seeing Trip, it can! The journey includes the famed Devdari and Rajdari waterfalls, as well as the Rock Shelter, cave paintings,

parks, watchtowers, the sun set point, forest communities, and more! It is also home to indigenous tribes who live in complete harmony with nature. They make a living by performing traditional dances and songs that tell the tribes' unwritten stories. An evening spent here will relax the mind into a primordial rhythm.

Projections and Monitoring matrix

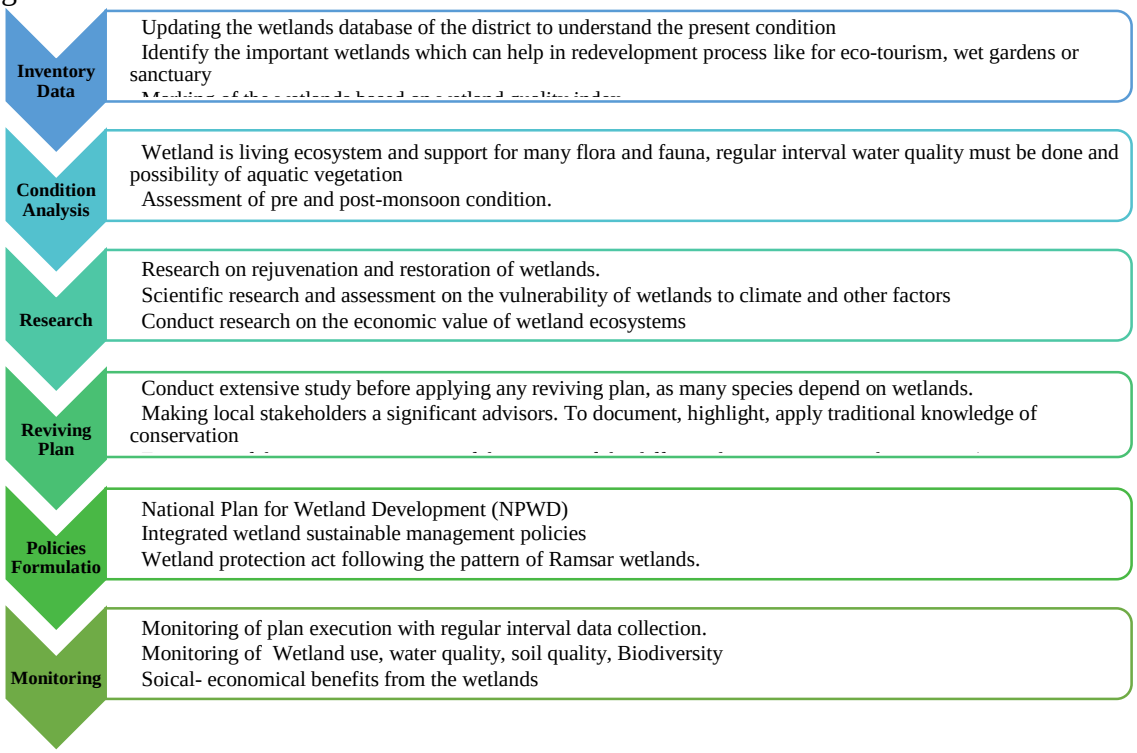
Sector	Intervention	Strategy	Total cost	Expected Outcomes
Tourism	**Research**	● The cause and motive for tourism can be predicted using various data and matrices which available on various government official websites as well as private organizations have done their bit too. It is also feasible to discover 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. This would be specific prizes to the competition's winners. Hundreds of players competed in numerous international competitions, including the Olympics and Para Olympics. The players have returned to India with medals, setting new records. Developing the Khelo India Centre and an international class indoor gymnastics stadium in the area. It is necessary to enlist the help of unbiased researchers.		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. • Tour Assistance India is a multi service organization offering the following activities in Chandraprabha Wildlife Sanctuary: • a) Tourism & Travel Services • b) Events Management • c) Tours (Customized & Cultural Tours) • d) crafts • e) Cultural Entertainment (dancers, drama, • f) Business Consultancy & Motivational Speaking (in Tourism Businesses) • 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. • 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 Varanasi. • The development of tourist attractions and maintenance of temples in and around Chandauli. • 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.		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 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.

		• Ganga arti culture • Eco-tourism activities boosted by Chandrapabha Wildlife Sanctuary.		
	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

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



4.5 ENERGY

4.5.1. Solar

Work related to solar energy has been done in the district at public places. 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.

4.5.2. Biomass

In the district Chandauli at some places biomass gasifiers have been installed. But there are two major problems persisting in Chandauli, i.e. stubble burning and frequent power cutoffs can be dealt with introduction of renewable energy in the district. The agricultural biomass waste can be used in electricity production, especially husk based, which will also divert people away from burning agricultural waste. The husk based biomass plants can be developed on the lines of the Husk Power Systems from Champaran, Bihar. The plant uses rice husk as the main raw material, provide employment to the naitive people, the power produced is sold to the locals at cheaper rates. Community based biomass plants should be encouraged in the district, so that the investment is divided among the the group of people.
There is a need to develop awareness among people about the biomass energy, this responsibility should be given to those who can connect directly on one to one basis to the people such as village self-help groups, panchayats, etc. A proper transportation system should be developed so that there is easy transportation of the biomass wastes to the plants. The authorities responsible should make an easy business environment in the district, so that more and more people are attracted to it. Biofuel projects should also be established in the district.

4.5.4. Biogas:

- Only one cow shelter is present in the Vishnupura village in the district, more no. of cow shelter can be constructed with biogas plant connected to it.

4.5.5 Hydropower:

- Villages on the banks of the Ganges are Bhupauli, Derwa, Mahdaura, Kanwar, Pakri, Mahuaria, Vishupur, Mahuari Khas, Sarai, Balua, Derwakala, Mahuar Kala, Hardhan Juda, Gangapur, Purabijayi, Puraganen, Chakra, Sonbarsa, Tandagakala, Mahmari, are badly affected by the increased water level in Ganga. To prevent floods a dam can be constructed near these villages and can further be used to produce electricity.

5 RECOMMENDATIONS

5.1 AGRICULTURE AND ALLIED SECTORS

- Surface water shares about 85% of NIA in the district. Water-use efficiency of canal is quite low when compared to groundwater, particularly the drip and sprinkler irrigation systems. Conjunctive irrigation system can be promoted to improve farm productivity and encourage the farmers towards non-food grain crops.

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

- Food grains constituted about 96% of the GCA in the district, indicating that the district agriculture is dominated relatively less remunerative. There is need to diversity the agriculture from low-value food grains to high-value non-food grains crops to enhance agricultural GDP and farm income,

- 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.

- It is significant to note that the Ministry of Agriculture and Farmers Welfare, Government proposed a Natural Farming Scheme with an estimated cost of Rs.2500 crores. If implemented properly, it may go a long way to make the agriculture ecological more sustainable, economically viable and socially responsive

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

- About 94% of farmers in the district are small and marginal with landholdings less than two hectares. They can contribute substantial to livestock, vegetables and other labour-intensive allied farm activities. Diversification of cropping pattern from food grains to high-value livestock, and horticulture crops can improve their income and livelihood.

- Poly house and greenhouse could be commercially used for the high revenue crops for much returns to the farmers.

- Per capita electricity consumption in the district agriculture increased over the period, there is a need to promote the use of solar energy.

- 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.

5.2 FORESTRY

Chandauli located on the bank of river Ganga, Karmanasa and Chandraprabha. According to ISFR 2019, 656.26 Sq. Km. area of Chandauli is covered with forest. As discussed above, the forest cover of Chandauli has decreased slightly 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

It is recommended to apply strict laws for local resource collection from the conservative forest.

5.3 WETLAND

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

- ✓ Other crop except wheat and rice like oilseeds, chick pea needs to turn into finished products.

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

- ✓ Production enhancement and conservation of green fodder for livestock

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

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

- ✓ Development waterfalls and wildlife sanctuary into eco-tourism hotspot while conserving water bodies in the area.

5.4 ENERGY

5.4.1. Solar

- ❖ People should be made aware of the solar energy and the schemes related to it.
- ❖ Kusum Yojana should be popularized among the farmers of the district.
- ❖ Solar rooftop installations should be popularized under the National solar Mission- Phase II.

5.4.2. Biomass

- ❖ People should be made aware of the biomass energy and the policies government has made to take the biomass mass energy forward.
- ❖ Husk based biomass gasifier and the bagasse based biomass plants should be promoted in the district.

  The administration should promote biofuel production in the district.

5.4.3. Biogas

It is recommended to construct more cow shelters with biogas plants connected to them.

5.4.4. Hydropower

- Construction of small hydropower plant of capacity 1MW to 5 MW near villages Bhupauli, Derwa, Mahdaura, Kanwar, Pakri, Mahuaria, Vishupur, Mahuari Khas, Sarai, Balua etc.

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-

- **Lateef Shah Mela-** Held every year at Lateef shah Mazaar (tomb) to expose oneself to various tangents of spirituality. Situated on the banks, 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.

Monitoring, Evaluation & Impact-

	Broad objectives / recommendations	Key activities / interventions to be planned			Monitoring & Evaluation	Impact
		2022	2023	2024		
1.	To attract tourists who love nature and Chandraprabha dam.	Hakiya Kali Mandir and Baba Latifshah Tomb are two of the several tourist attractions in Chandauli. Its greatest claim to fame, is the Chandraprabha Wildlife Sanctuary..	To keep a track of ongoing process and take constant tourist feedback along with adding Chandrabha Wildlife Sanctuary.	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.	Spiritual tourism- To maintain temples on the sides of roads, in banks and shrines.					

6. Discussion during the Report Presentation

- Chandauli is popularly known as “Rice Bowl” Of Uttar Pradesh
- Famous for Rajdari & Devdari waterfalls are found near the Chandraprabha Wildlife Sanctuary.
- Promotion of Vetiver farming & informed about use of vetiver in a phytoremediation
- Scope of eco-tourism
- The IIML Report for Arth Ganga should be a regular Agenda item for next 6-8 DGC meetings.
- Hon’ble PM during the post-Budget webinar on Tourism had spoken about market potential of destination weddings. It was suggested that suitable Ashrams in Ganga Basin may be identified for such purpose to promote blissful experience, cost reduction, livelihood opportunities and better upkeep.
- Allocate separate space for Namami Gange Awareness and Jalaj Marketing kiosk in Melas/Congregatios/Fairs for providing better marketing opportunities to the Jalaj products.
- As Dilli Haat Centre – Namami Gange Awareness and Marketing Centre – is being launched soon, it was requested that every district to identify niche products with a creative story and link it with Jalaj in their area.
- To identify Arth Ganga Tourist Trails and organize Ganga Guide training
- Promotion of Natural Farming in Ganga Basin and training workshops should be organized on a regular basis. NMCG is supporting this initiative in coordination with MoA& FW and NCOF.
- Make plans for reuse of treated waste water for agriculture, industrial etc. purpose and also the sludge.
- Training of volunteers for Ganga awareness & Aarti workshops to promote regular aartis on Ghats.

7 REFERENCES

- *https://www.nativeplanet.com/chandauli/#overview*
- *https://chandauli.nic.in/how-to-reach/*
- *http://www.uptourism.gov.in/pages/top/about-up-tourism/year-wise-tourist-statistics*
- *https://chandraprabhawildlife.com/*
- *https://www.researchgate.net/publication/295863538_Replication_and_scaling-up_of_isolated_mini-grid_type_of_off-grid_interventions_in_India*
- *https://www.indiastatdistricts.com/uttarpradesh/chandauli-district*
- *https://www.jagran.com/uttar-pradesh/chandauli-the-remaining-streets-of-the-village-will-be-illuminated-with-solar-energy-22676076.html*
- *https://solarquarter.com/2020/01/13/up-small-industries-corporation-ltd-issues-tender-for-installation-of-112-nos-2-7-kw-solar-pv-system-off-grid-in-district-chandauli/*
- *https://public.knoema.com/pteweie/indian-households-by-main-source-of-lighting-census-2011?location=1031310-chandauli*
- *https://www.researchgate.net/publication/295863538_Replication_and_scaling-up_of_isolated_mini-grid_type_of_off-grid_interventions_in_India*
- *https://www.indiastatdistricts.com/uttarpradesh/chandauli-district*
- *https://www.jagran.com/uttar-pradesh/chandauli-the-remaining-streets-of-the-village-will-be-illuminated-with-solar-energy-22676076.html*
- *https://solarquarter.com/2020/01/13/up-small-industries-corporation-ltd-issues-tender-for-installation-of-112-nos-2-7-kw-solar-pv-system-off-grid-in-district-chandauli/*
- *https://public.knoema.com/pteweie/indian-households-by-main-source-of-lighting-census-2011?location=1031310-chandauli*

6 APPENDICES

6.2 AUXILLLARY DATA

Table 1 Crop production in the district.

Crop/Year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Non-grain crops (Metric Tonne)	15136	13849	16368	13118	12094	10528	9671	13032	15886
Grain crops (Metric Tonne)	397047	556006	552782	633292	553836	495589	547798	608964	735595
Sugarcane (Metric Tonne)	31282	31760	31433	32451	35435	38426	41299	35397	44133
Potato (Metric Tonne)	19457	15940	8889	13805	13152	15871	13018	16625	6689

Table 2 Livestock population in district.

Livestock	2003	2007	2012
Cattle (Cow)	173580	186072	204876
Buffalos	156042	189652	221726
Sheep	23723	24368	30320
Goat	86744	90700	98838
Pigs	7499	6394	8298
Chicken	184353	151151	342206
Other Poultry	29032	239708	65308
Horses and Ponies	125	84	462
Others	2726	1562	1521

Table 5 Biogas potential from animal waste.

Livestock	Residue type	Total population as of 2012	Manure yield* (kg/day)	Total manure generation annually (kg)	Average collection (75%)	Dry manure after removing Moisture content	Manure required for biogas * (kg/m^3)	Biogas potential (m^3/yr)
Cattle	Manure	2,04,876	10	74,77,97,400	560848050	112169610	25	4486784.4
Buffalo	Manure	2,21,726	15	1,21,39,49,850	910462387.5	182092477.5	25	7283699.1
Sheep	Manure	30,320	1	1,10,66,800	8300100	1660020	25	66400.8

Goat	Manure	98,838	1	3,60,75,870	27056902.5	5411380.5	25	216455.22
Pig	Manure	8,298	2.5	75,71,925	5678943.75	1135788.75	25	45431.55
Poultry	manure	4,07,514	0.1	1,48,74,261	11155695.75	2231139.15	25	89245.566
Total		971572						1,21,88,017

Table 6 Biogas potential from agricultural waste.

Crop	**residue type**	**Total crop production (tons) (2017-18)**	**Residue production ratio**	**Residue amount (tons)**	**Average collection (70%)**	**Moisture content**	**Residue amount after removing moisture (tons)**	**Biogas potential [m3/(tons of dry matter)]**	**Overall biogas potential (m3)**
Maize	straw	116	1.5	174	121.8	15	103.53	800	82824
Wheat	straw	376676	1.5	565014	395509.8	30	276856.86	800	221485488
Sugarcane	Bagasse	44133	0.33	14563.89	10194.723	80	2038.9446	750	1529208.45
Total		420925							223097520