Arth Ganga Project: District Ballia

September 2021

Submitted to

National Mission for Clean Ganga (NMCG)

Submitted by:

IIM Lucknow

IIT Roorkee

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Ballia is situated in the northeastern part of Uttar Pradesh. The district has a good agricultural base and reasonably good infrastructure of various facilities, but the industrial base is weak, resulting in a low economic return.

Cereal crops dominate the district agriculture, of which Wheat constitutes the highest share in total agricultural production followed by rice and maize. In the district, the agricultural land holdings have been declined significantly. The majority of land holdings in the district are marginal and small. There is a lack of consistency in the yield of various crops, making the returns to farmers riskier and more unstable, which calls for a solid insurance protection measure. Fertilizers and pesticides are over used in agricultural lands and toxic chemicals pose a threat of biomagnification of toxicants. However, to fight this threat district has converted 1200 hectares of cropped area under organic farming and 155 acres (62.30 hectares) under zero budget farming.

Agroforestry is the second most common land use after agriculture. It has the capability to increase marginal farmers' earnings and increase their quality of life (by providing services like medicinal plants, shade, timber, fodder, protection against erosion) while helping the environment in

additional carbon sink. The systematic pattern in tree planting needs to be improved for the region. The unawareness of rules discourages farmers from adopting agroforestry widely at a large level.

The district has potential to attract tourists by promoting the Dadri festival – the second-largest cattle festival of India and developing eco-tourism such as Surha Tal Sanctuary, a site of migratory birds can become an international tourist spot.

The district is comprising of some of the healthy and wealthy wetland ecosystems. It consists of 1694 wetlands; most of them are lakes, meanders and waterlogged. The wetland size is small in general. Various activities can be developed on these wetlands, such as Water sports, bird watching, boating, diving etc.

Ballia has a tremendous capacity for solar power, but presently there is negligible production. Although the data shows, that district is installing biomass energy plants. The district is not able to utilize organic solid waste to generate adequate electricity. Hence the need in the district is to manage the agricultural production and crop residue rationally in order to utilize biomass to its maximum capacity.

1 DISTRICT OVERVIEW

1.1 INTRODUCTION

Ballia is situated in extreme north-eastern part of Uttar Pradesh. It is surrounded by Mau on the west, Deoria in the north, Bihar in the north eastern part and Ghazipur in the south western part. Ballia city is in an irregular shape and has one of its corners or boundaries at the confluence of two major rivers; Ganga and Ghagra. These rivers separate the city from other neighboring district Like River Ganges separate Ballia from Bihar and River Ghagra separate Ballia from Deoria. The city is just 135 KM away from the well-known city of Varanasi[1].

Two legends tell us more about the origins of Ballia. One relates it to the Ramayan's Rishi Valmiki (Balmiki), hence the name Ballia. Another ties back to the sandy soil (Balua). Consequently, the economic identity of Ballia is related to agriculture (given its name referring to soil; agriculture employing the majority of the population) and the cultural identity is associated with writers like Hazari Prasad Dwivedi, Parshuram Chaturvedi etc. The district has a rich history dating back to the Kosala kingdom and its legacy continues to the modern era with its enormous contribution to the freedom struggle.

The local language of the people in Ballia is Hindi; however, the origin of the dialect is Bhojpuri. Some of the most notable personalities from the district include freedom fighter Mangal Pandey, former prime minister Chandra Shekhar Singh, and Janeshwar Mishra.

[1] Ballia, Uttar Pradesh https://ballia.nic.in/about-district/

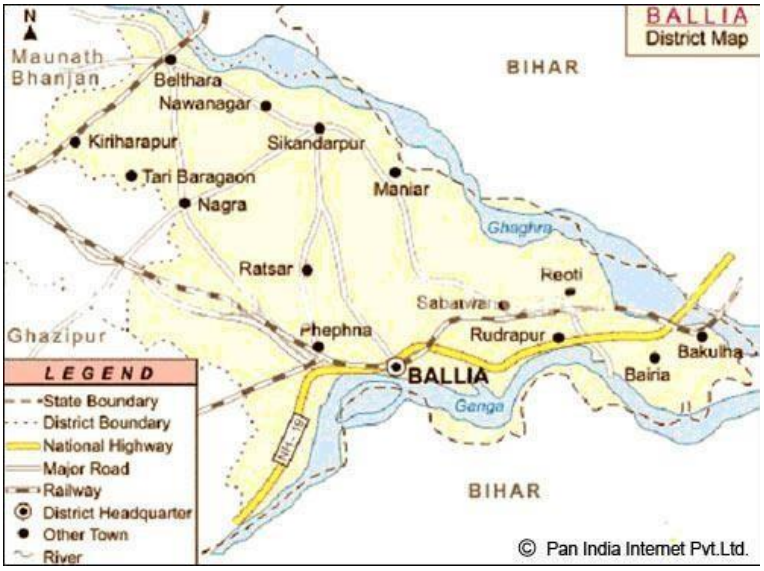


Figure 1 Map of the district

1.2 DEMOGRAPHIC PROFILE OF BALLIA[2]

Ballia has a population of 32,39,774, with a population density of 1087 people per square km. The sex ratio is 937 females per 1000 males. Average literacy rate is 73.94 which is 4 percent points higher than the national average. Majority of Ballia is a rural populace, urban dwellers are less than 10 percent of total population.

Area	1981 sq. km
No. of blocks	17
No. of Municipalities	10
No. of gram panchayats	1069
No. of Villages	1681
Population	3239774

Table 1 City Demographics 2019-20

The Schedule Castes population makes 15% of the total population and schedule tribe population is 3%. The total working population is 10,19,483. Workforce participation rate is 31.5% (43% for males and 18% for females). Most workers are connected with farming.

	Cultivators	Agricultural laborers	Household Industrial workers	Other work

[2] https://ballia.nic.in/about-district/

Persons (%)	29.0	30.37	5.90	34.81
Male (%)	31.11	27.79	4.74	36.50
Female (%)	22.26	38.40	9.79	29.76

Table 2 Working population 2019-20

1.3 AGRO CLIMATIC PROFILE OF THE DISTRICT

Ballia experiences very hot climate during the summer months from March to June. The temperature goes as high as 45 degrees in the day time. However, the winters here are cool and pleasant. The temperature falls till 17 degrees during a pleasant day.

The district is characterized by semi dry medium moisture with average precipitation of 400 to 600 mm. About 30 per cent area of the district is affected every year by floods, which cause miseries to animals and human population.
Based on the availability of irrigation and type of soil, the district is divided into 5 agro-ecological situation (AES) regions as per soil quality and irrigation study of local KVK:

AES	Characteristic (Soil + irrigation)	Area	Block
AES 1	Clay loam irrigated (Karail)	36.8	Sohaon
AES 2	Loam irrigated	23.69	Sear
AES 3	sandy loam irrigated	17.41	Dubahar
AES 4	water logged	13.34	Maniar
AES 5	flood prone	19.68	Maniar

Table 3 Agro Ecological Situations in District Source: District Agricultural Profile: KVK Ballia

1.4 ECONOMIC PROFILE OF BALLIA

Ballia is a low-income district with per capita net income as per the year 2015-16 being Rs. 20,349; the Gross District Domestic Product is Rs. 9263.23 Cr.

The district has a good agricultural base and reasonably good infrastructure of various facilities, but the industrial base is weak, resulting in a low economic return to the district. Kisan Sahkari Chini Mill Ltd. Rasra is the only large-scale unit in the district. Another Mill U.P. Yarn Company Ltd., Rasra (weaving mill) has been closed for some time now.

Among medium and small-scale industries there are units of Bindi making, offset press, cold storage, rice mill, leather products, glass and ceramics, wood work, brick kiln, readymade garments and building materials. Among village and cottage industries, gur making, handloom, leather shoe making, blanket weaving, edible oil extraction and pottery are the main goods produced in the industrial units.

Sectoral distribution of GDDP shows that the primary sector has significant contribution to the district economy, though share went down from 30.66% in 2011-12 to 26.85 in 2018-19. On average it grew at the rate of 2.18% annually, higher than the secondary sector, which increased only by 1.63% annually. It is significant to note that the share of secondary sector also declined from 16.11% in 2011-12 to 10% in 2018-19. The tertiary sector's share went up from 53.23% to 63.15% during the same period, with an annual growth rate of 6.44%. Overall, the district economy grew at a much low rate of only 4.03 percent per year during the period. The data show that the district economy is driven by the tertiary sector, followed by the primary sector. The secondary sector seems to be the growth laggard.

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

Year	Sector-wise GDDP (Rs. Crore)				Annual Growth Rates			
	Primary	Secondary	Tertiary	Total	Primary	Secondary	Tertiary	Total
2011-12	2051.12	1077.57	3560.13	6688.82	-	-	-	-
	(30.66)	(16.11)	(53.23)	(100)				
2012-13	2003.79	725.48	3733.89	6463.16	- 2.31	- 32.67	4.88	- 3.37
	(31.00)	(11.22)	(57.77)	(100)				
2013-14	1821.56	789.56	3871.28	6482.41	- 9.09	8.83	3.68	0.30
	(28.10)	(12.18)	(59.72)	(100)				
2014-15	1787.39	658.78	4050.26	6496.43	- 1.88	- 16.56	4.62	0.22
	(27.51)	(10.14)	(62.35)	(100)				
2015-16	1771.78	1072.36	4394.47	7238.61	- 0.87	62.78	8.50	11.42
	(24.48)	(14.81)	(60.71)	(100)				
2016-17	2111.37	1269.12	4772.13	8152.61	19.17	18.35	8.59	12.63
	(25.90)	(15.57)	(58.53)	(100)				
2017-18	2169.04	817.16	4837.09	7823.29	2.73	- 35.61	1.36	- 4.04

	(27.73)	(10.45)	(61.83)	(100)				
2018-19	2332.60	868.74	5485.67	8687.01	7.54	6.31	13.41	11.04
	(26.85)	(10.00)	(63.15)	(100)				
Average Growth Rate					2.18	1.63	6.44	4.03
Source: compiled from: http://updes.up.nic.in /esd/reports_publication_copy(ELib_Reports).htm Note: Figures in Parentheses are percentage share in the total GDDP								

Table 2 shows agriculture, including horticulture, increased only by 0.66 percent per year during 2011-12 and 2018-19. Consequently, the share of the agriculture sector went down approximately from 71.18% to 63.36% during the period. Contrary to this, the share of livestock marginally rose from 24.06% to 24.86% during the same period. Livestock evinces a growth rate of 2.32% per year. Share of forestry and logging increased substantially from 4.43% to 6.64% during the same period, with an annual average growth rate of 10.95%. Though Fishery has a negligible share in the total GDP of agriculture and allied sectors, it is the highest growing subsector in the district economy as it grew at the rate of 151.07% per year. Its share went up from 0.37% in 2011-12 to 5.80 percent 2018-19. Thus, livestock, forestry & logging and Fishery (allied activities) are the growth drivers of the agriculture. Mining & Quarrying also recorded a remarkable yearly growth of 22.84 percent.

Table 2: Trends in Gross District Domestic product from Agriculture and allied activities in Ballia 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	1435.94	484.46	89.41	7.41	2017.22	33.90	2051.12
	(71.18)	(24.02)	(4.43)	(0.37)	(100)		
	-	-	-	-	-	-	-
2012-13	1390.35	507.60	71.45	7.77	1977.16	26.63	2003.79
	(70.32)	(25.67)	(3.61)	(0.39)	(100)		
	[-3.17]	[4.78]	[-20.09]	[4.78]	[-1.99]	[-21.44]	[-2.31]
2013-14	1128.55	536.27	117.82	8.00	1790.64	30.92	1821.56
	(63.02)	(29.95)	(6.58)	(0.45)	(100)		
	[-18.83]	[5.65]	[64.91]	[3.04]	[-9.43]	[16.11]	[-9.09]
2014-15	1046.19	555.43	124.63	8.56	1734.81	52.58	1787.39

	(60.31)	(32.02)	(7.18)	(0.49)	(100)		
	[-7.30]	[3.57]	[5.78]	[6.95]	[-3.12]	[70.04]	[-1.88]
2015-16	1068.66	479.00	137.04	8.74	1693.44	78.34	1771.78
	(63.11)	(28.29)	(8.09)	(0.52)	(100)		
	[2.15]	[-13.76]	[9.96]	[2.10]	[-2.38]	[49.00]	[-0.87]
2016-17	1358.86	490.94	155.93	10.70	2016.44	94.92	2111.37
	(67.39)	(24.35)	(7.73)	(0.53)	(100)		
	[27.16]	[2.49]	[13.78]	[22.50]	[19.07]	[21.16]	[19.17]
2017-18	1361.84	435.13	198.33	11.75	2007.04	161.99	2169.04
	(67.85)	(21.68)	(9.88)	(0.59)	(100)		
	[0.22]	[-11.37]	[27.19]	[9.76]	[-0.47]	[70.66]	[2.73]
2018-19	1422.09	543.32	148.99	130.21	2244.61	87.99	2332.60
	(63.36)	(24.21)	(6.64)	(5.80)	(100)		
	[4.42]	[24.86]	[-24.88]	[1008.34]	[11.84]	[-45.68]	[7.54]
Av. Growth Rate	0.66	2.32	10.95	151.07	1.93	22.84	2.18
Source: Compile from: http://updes.up.nic.in/esd/reports_publication_copy(ELib_Reports).htm Note: 1. Figures in () are percentage share in the total agriculture & allied GDDP 2. Figures in [] are annual growth rates.							

Table 3 demonstrates the percentage share of sub-sectors within the secondary and tertiary sectors. Within the secondary sector, manufacturing had about 40% share in the secondary sector in 2018-19. Its share shows high variability across years and on average decelerated during the period. More or less similar pattern is observed in the share of construction. Its share ranges from 30 to 60 percent. The share of electricity, gas and water supply increased from 6.07 % to 10.26% during the same period.

Within the tertiary sector, real estate and professional services constituted the highest share (26.94%) in 2018-19, followed by other services (21.58%), transport, storage and communication (17.35%) and trade and hotels (14.34%). The average annual growth rate is observed highest in transport, storage and communication (16.36%), followed by other services (10.05%). Although real estate & professional services have the highest share, it is growing at the lowest rate, followed by trade & hotels (3.15%) among all the sub-sectors of services.

Table 3: Trends in percentage share of non-agriculture sub-sectors in GDDP in Ballia 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	53.73	6.07	40.20	100	9.46	18.92	9.85	34.40	10.32	17.06	100
2012-13	34.77	9.54	55.70	100	10.56	15.44	9.83	34.57	11.99	17.60	100
2013-14	40.51	9.23	50.27	100	10.48	15.32	10.10	34.35	11.66	18.08	100
2014-15	28.82	10.91	60.27	100	11.84	15.05	10.61	33.94	8.96	19.60	100
2015-16	52.83	9.96	37.22	100	14.18	15.67	10.43	31.37	8.51	19.85	100
2016-17	62.91	6.53	30.56	100	14.67	17.41	9.51	29.03	9.07	20.30	100
2017-18	39.29	11.20	49.51	100	15.48	14.23	8.55	29.94	10.53	21.27	100
2018-19	39.80	10.26	49.94	100	17.35	14.34	9.21	26.94	10.58	21.58	100
Av. Growth Rate	16.70	6.26	0.11	1.63	16.36	3.15	5.73	2.74	7.64	10.05	6.44
Source: Compiled from: http://updes.up.nic.in/esd/reports_publication_copy(ELib_Reports).htm											

2 QUANTITATIVE DATA ANALYSIS

2.1 Agriculture and Allied Activities

2.1.1 Trend in Land Use Pattern

The total reported area of the district is 2992.65 sq km. The share of cultivable wasteland declined from 0.48% in 2011-12 to 0.39% in 2017-18. The share of barren and uncultivable land has declined from 3.12% in 2011-12 to 1.44% in 2017-18. Areas under trees and gardens increased in 2018-19. The net sown area has decreased from 74.18 in 2011-12 to 72.46% in 2017-18. Contrary to this, area under non-agricultural has constantly gone up from 15.04% to 15.94% during the period (Table 4). Overall, the land-use pattern does not show much visible change during the last nine years.

Table 4: Trends in Land Use pattern in Ballia District

Year	Total Reported Area (ha)	Area under forest	Cultivable wasteland	Current Fallow	Other Fallow	Barren and uncultivable land	Land other than agriculture	Pastureland	Area under trees and gardens	Net Sown Area
1	2	3	4	5	6	7	8	9	10	11
2009-10	299265	0.01	0.48	4.00	1.47	3.12	15.04	0.04	1.67	74.18
2010-11	299265	0.01	0.45	4.47	1.36	3.11	15.23	0.04	1.65	73.69
2011-12	299265	0.01	0.44	5.25	1.51	2.23	15.31	0.04	1.64	73.56
2012-13	299265	0.02	0.44	4.32	1.36	3.08	15.74	0.04	1.63	73.38
2013-14	299265	0.03	0.40	5.46	1.08	3.17	15.75	0.03	1.58	72.50
2014-15	299265	0.03	0.40	6.12	1.64	3.13	15.76	0.03	1.51	71.39
2015-16	299265	0.03	0.39	7.42	4.64	1.45	15.76	0.03	0.49	69.79
2016-17	299265	0.03	0.38	6.63	1.61	1.45	15.90	0.03	1.51	72.46
2017-18	299265	0.03	0.39	4.39	3.38	1.44	15.94	0.03	1.94	72.46

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

2.1.2 Trends in Operational Land Holdings

In Ballia district, the total number of operational holdings has declined from 380 thousand in 201011 to 373 thousand in 2015-16, a net decrease of 1.84 percent. Contrary to this, in the state, the number has increased from 23325 thousand in 2010-11 to 23822 thousand in 2015-16, a net increase of 2.13%. The majority of land holdings in the district are marginal and small. These categories of holding together constituted 94.55% in 2015-16, while the corresponding percentage in the state was 92.81% (Table 5). A slight decrease in the number of marginal holdings implies that some marginal farmers have left agriculture and shifted to non-farm activities.

Table 5: Distribution of Operational Holdings by Size-categories of Farms (in %) in Ballia

	Agri, Census	Marginal Holdings (0-1 ha)	Small Holdings (1-2 ha)	SemiMedium Holdings (2-4 ha)	Medium Holdings (4-10 ha)	Large Holdings (10 & above, ha)	Total Holdings ('000 No.)
Ballia	2010-11	84.78	9.63	4.23	1.27	0.08	380.0
	2015-16	84.67	9.88	4.07	1.30	0.07	373.0
							[-1.84]
U.P.	2010-11	79.45	13.01	5.72	1.71	0.11	23325.0
	2015-16	80.18	12.63	5.51	1.58	0.10	23822.0
							[2.13]

Source: Compiled from Statistical Diary 2018-19, http://updes.up.nic.in
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

Cereal crops dominate the district agriculture. Table 6 shows the trend in the area under principal crops during the last 8 years. In 2017-18, wheat constituted the highest share in the GCA (39.67%), followed by rice (33.98%) and maize (9.09%). The area under total cereals increased from 83.70 percent in 2010-11 to 87.91percent in 2013-14 and then decelerated to 84.64 percent in 2017-18. Masoor and Arhar are the major pulses and these crops together shared 5.26 percent of the GCA and about 87 percent of area under total pulses. Oilseeds do not have much presence in the district. Sugarcane have a little over one percent of the GCA and potato about two percent of the GCA. Cereal consisted of about 36.59 percent share in the total cropped area. Overall, there has not been any significant change in the cropping pattern and no diversification of agriculture has happened in the district. The cropping intensity ranges between 157 and 170.

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

Crop/Year	2010-11	2011-12	201213	2013-14	201415	2015-16	2016-17	2017-18
Rice	33.18	33.30	33.21	35.53	35.29	33.91	33.91	33.98
Wheat	39.86	39.01	39.28	40.94	41.18	39.59	39.59	39.67
Barley	1.09	1.07	1.07	1.40	0.91	0.87	0.87	0.87
Maize	8.56	9.36	9.03	9.06	9.44	9.07	9.07	9.09
Other Cereals	1.01	0.98	1.04	0.99	1.07	1.03	1.03	1.03
Total Cereals	83.70	83.73	83.63	87.91	87.90	84.47	84.46	84.64
Masoor	5.29	5.26	5.35	3.92	4.00	3.84	3.84	3.85
Arhar	1.79	1.76	1.82	1.43	1.47	1.41	1.41	1.41
Other Pulses	1.92	1.87	1.79	1.00	0.85	0.81	0.81	0.81
Total Pulses	8.99	8.90	8.95	6.35	6.31	6.07	6.07	6.08
Total Food grains	92.70	92.63	92.58	94.26	94.21	90.54	90.53	90.72
Mustard	0.25	0.25	0.26	0.26	0.24	0.23	0.23	0.23
Other Oilseeds	0.09	0.09	0.08	0.03	0.04	0.04	0.04	0.04
Total Oilseeds	0.34	0.35	0.34	0.30	0.28	0.27	0.27	0.27
Sugarcane	1.72	0.04	1.79	1.20	1.24	1.19	1.19	1.19
Potato	2.24	2.25	2.27	1.84	1.87	1.80	1.80	1.80
Net Sown Area (% of GCA)	63.10	62.99	63.04	63.56	62.71	58.91	61.16	61.28
Gross Sown Area (in 1000 Ha)	349.50	349.49	348.34	341.38	340.66	354.57	354.60	353.84
Cropping Intensity	158.48	158.76	158.62	157.33	159.46	169.76	163.52	163.18

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

2.1.3.2 Trends in Per Hectare Yield of Principal Crops

A perusal of Table 7 reveals that per hectare yield of most crops varies across years. Yield of wheat ranges between 22.67 to 38.64 qtls/ha during 2013-14 to 2018-19. A more or less similar pattern is also observed in the case of rice, whose yield was lowest (16.31 qtls/ha in 2015-16 and highest in 2011-12 (25.4 qtls/ha). Maize yield ranges from 9.84 to 18.95 qtls/ha. Sugarcane's yield ranges from 384 to 947 qtls/ha; potato from 99.33 to 359.62 qtls/ha; pulses from 9.95 to 19.97 qtls/ha; and oilseeds from 8.15 to 16 qtls/ha. In brief, there is no upward or downward trends in the yield of various crops. The yield shows ups and downs across years. The lack of consistency in the yield of various crops make the returns to farmers more risky and unstable, which calls for a solid insurance protection measure.

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

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	19.14	25.40	21.72	22.13	20.36	16.31	23.00	24.12
Wheat	29.35	32.50	33.74	27.33	22.67	26.85	38.64	35.27
Barley	25.70	23.93	26.10	24.45	13.83	29.79	25.90	20.56
Maize	15.73	17.70	19.02	11.67	15.66	11.98	9.84	18.95
Total Cereals	23.64	27.68	27.07	23.39	20.82	20.91	28.86	28.67
Masoor	10.91	13.10	13.04	11.39	9.42	11.74	19.26	17.70
Arhar	14.27	4.43	11.22	7.44	11.21	8.61	13.50	15.72
Total Pulses	11.88	11.40	13.14	9.95	10.10	10.47	19.97	19.86
Total Food grains	22.50	26.12	25.72	22.49	20.14	20.21	28.26	28.08
Mustard	11.93	11.39	12.73	8.72	7.81	10.32	14.42	15.69
Total Oilseeds	11.50	11.17	11.93	8.83	8.15	11.25	14.63	16.00
Sugarcane	383.88	398.96	480.28	520.08	520.64	552.74	987.12	846.60
Potato	253.36	272.37	245.87	99.33	162.58	209.15	359.62	337.12

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

2.1.3.3 Trends in Production of Principal Crops

Table 8 depicts that in 2017-18, among cereal crops, wheat consisted of the highest production (495.07 thousand tons), followed by rice (290.02 tons) and maize (60.94 thousand tons). Among pulses, the highest production (24.13 thousand tons) was from masur, followed by Arhar (7.85 thousand tons). Masur and Arhar together consisted of about 75% of total pulses production in the district. Oilseed production in the district was quite low, indicating that oilseeds do not have much role in the district agriculture. However, mustard is the key oilseed crop, which shared about 82% of total oilseeds production. Potato is other important crop, whose production ranges from

62.56 thousand tons to 229.26 thousand tons. Sugarcane shared only 1.2% of GCA in 2017-18 and 356.25 thousand tons. Looking at yearly data of various crops' production, we observe that their production does not evince any trend but shows fluctuation across years, partly due to vagaries of nature and partly due to market conditions.

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

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	221.93	295.63	251.22	268.42	244.82	196.10	276.56	290.02
Wheat	408.94	443.13	461.65	381.99	318.05	376.86	542.43	495.07
Barley	9.76	8.99	9.73	11.68	4.29	9.21	8.01	6.36
Maize	47.05	57.91	59.81	36.10	50.34	38.52	31.62	60.94
Other Cereals	3.99	4.37	6.13	3.83	5.83	5.49	5.65	6.22
Total Cereals	691.67	810.03	788.54	702.01	623.34	626.19	864.27	858.61
Masoor	20.15	24.10	24.28	15.23	12.84	16.00	26.25	24.13
Arhar	8.91	2.72	7.10	3.64	5.60	4.30	6.75	7.85
Other Pulses	8.27	8.63	9.59	2.70	3.28	2.22	9.95	10.75
Total Pulses	37.33	35.45	40.98	21.57	21.71	22.53	42.95	42.73
Total Food grains	729.00	845.48	829.51	723.58	645.05	648.72	907.22	901.34
Mustard	1.04	1.01	1.14	0.78	0.64	0.84	1.18	1.28
Other Oilseeds	0.32	0.34	0.26	0.11	0.14	0.23	0.21	0.24
Total Oilseeds	1.35	1.35	1.40	0.89	0.77	1.07	1.39	1.52
Sugarcane	231.06	245.52	299.79	212.45	219.09	232.59	415.38	356.25
Potato	198.00	213.95	194.75	62.56	103.65	133.33	229.26	214.91

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

We have calculated average, standard deviation (SD) and coefficient of variation (COV) in the area, production and yield of principal crops to understand variability across years (Table 8). In the case of area under different crops, the lowest variability is observed in total food grains (0.39%), followed by wheat (1.20%), total cereals (1.31%), rice (1.96%), and maize (2.85%). It is highest in sugarcane (20.63%) followed by total pulses (19.93%).

Table 9: Variability in Area, Production and Yield of Principal Crops (2010-11 to 201718)

Crop/Year	Area (1000 Ha)			Production (1000 tons)			Yield (Qtl. /Ha)		
	Average	SD	COV	Average	SD	COV	Average	SD	COV

Rice	118.78	2.33	1.96	255.59	34.23	13.39	21.52	2.89	13.45
Wheat	139.21	1.66	1.20	428.52	71.85	16.77	30.79	5.19	16.87
Barley	3.56	0.59	16.72	8.50	2.28	26.86	23.78	4.77	20.07
Maize	31.70	0.90	2.85	47.79	11.41	23.87	15.07	3.52	23.38
Total Cereals	296.82	3.88	1.31	745.58	97.73	13.11	25.13	3.35	13.31
Masoor	15.42	2.55	16.52	20.37	5.07	24.90	13.32	3.42	25.67
Arhar	5.45	0.66	12.04	5.86	2.17	36.97	10.80	3.79	35.10
Total Pulses	25.17	5.02	19.93	33.16	9.63	29.05	13.35	4.19	31.35
Total Food grains	321.99	1.23	0.39	778.7	106.1	13.63	24.19	3.29	13.60
Mustard	0.85	0.04	4.38	0.99	0.22	22.20	11.63	2.68	23.09
Total Oilseeds	1.05	0.12	11.28	1.22	0.27	22.28	11.68	2.63	22.54
Sugarcane	4.92	1.01	20.63	276.52	74.20	26.83	586.29	215.7	36.78
Potato	6.92	0.78	11.26	168.80	61.11	36.20	242.42	85.93	35.45
Source: Compiled from UPDES http://updes.up.nic.in/spiderreports/intialisePage.action									

Overall, variability in the production of different crops is higher than in the area under these crops. Variability in production depends on the variability in the area under the crop and variability in the yield. Among all crops, variability in production is observed highest in Arhar (36.97%), followed by potato (36.20%), total pulses (29.05%) barley (26.86%) and sugarcane (26.83%). In the case of yield, the highest variability is estimated in sugarcane (36.78%), followed by potato (35.45%) and arhar (35.10%). Several factors, such as market prices, rainfall patterns, etc., affect the variability in agricultural production.

2.1.4 Consumption of Chemical Fertilizers

Table 10 shows trends in the consumption of chemical fertilizers in agriculture. The recommended ratio of nitrogen to phosphorous to potassium is 4:2:1, which is not being maintained in the district. For example, in 2010-11, nitrogen constituted 68% of total fertilizers used while the shares of phosphorous and potassium were 26.24% and 5.78%, respectively. In 2017-18, the share of nitrogen had slightly declined to 66.56%, while share of phosphorous increased to 28.81% and the share of Potassium further declined to 4.63%. The table also indicates that the consumption of chemical fertilizers varies across years, which may be due to various factors, including rainfall patterns, cropping patterns, etc. Chemicalization of agriculture degrades soil and water resources, which calls for use of organic manure and bio-fertilizers.

Table 10: 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	114.43	103.34	113.32	108.08	115.39	102.75	101.10	99.77
Phosphorous	44.16	33.88	45.01	27.71	33.30	38.50	39.59	43.19

Potassium	9.72	4.90	3.59	3.80	6.81	7.06	8.32	6.94
Total	168.31	142.11	161.92	139.59	155.50	148.32	149.01	149.89
Gross Sown Area (Ha)	349501	349493	348335	341381	340658	354568	354600	353842

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

2.1.5 Irrigation Structure and Status

Table 11 shows no change in the length of canals (419 kms) during the last nine years. The number of government tube wells has increased from 729 in 2010-11 to 848 in 2018-19. Number of wells remained same (732) during the period. Number of shallow tube-wells went up from 40866 in 2010-11 to 42672 in 2018-19, a net increase of 4.21%. The net cultivated area under irrigation ranges from 79.57% to 85.37%. There is significant progress in bringing more area under irrigation. Gross irrigated areas as a percentage of GCA increased from 74.29% in 2010-11 to 80.80% in 2018-19.

Table 11: Types of Irrigation Systems and percentage of 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)	419	419	419	419	419	419	419	419	419
No. of Govt. Tube wells	729	760	760	861	802	802	847	847	847
No. of Wells	732	732	732	732	732	732	732	732	732
Shallow Tube well	40866	42025	42025	42025	42025	42025	42192	42484	42672
Medium Tube well	15	15	15	15	15	15	15	15	15
Deep Tube well	12	12	12	12	12	12	12	12	12
% Of NIA	79.57	80.14	80.93	82.88	84.66	85.37	82.22	82.22	-
% Of GIA	74.29	76.25	76.20	82.17	81.00	80.65	80.65	80.80	-

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

Groundwater (GW) is the major source of irrigation in the district and its share in the NIA has increased from 85.70% in 2010-11 to 88.05% in 2017-18, while the corresponding share of surface irrigation has declined from 14.30% to 11.94% between the same periods. The table also shows that the percentage of remaining GW to the total GW ranges from 29.61% to 66.24%. This show that the GW development in the district has not yet reach to the 100% level.

Table 12: Source-wise Area under Irrigation in Ballia (in %)

Source/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18

Canal (surface Irri.)	14.30	16.68	13.55	13.96	14.68	11.94	11.94	11.94
Wells And Tubewells (GW Irri.)	85.70	83.32	86.45	86.04	85.32	88.05	88.05	88.05
Others	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
NIA (1000 ha)	175.48	176.41	177.73	179.83	180.86	178.30	178.30	178.28
Source: Compiled from UPDES http://updes.up.nic.in/spiderreports/intialisePage.action								

Table 13 shows that rice, wheat, sugarcane, and potato consume the maximum irrigation water in the district. These crops have 95-100 percent net area under irrigation, and are the more water consuming crops compared to pulses and oilseeds.

Table 13: Trends in Crop-wise Irrigated Area in Ballia (as % of cropped area)

Crop/Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice	85.12	91.06	91.60	95.35	95.39	95.39	95.39	95.39
Wheat	97.39	97.44	97.21	97.87	99.76	98.95	98.95	98.95
Total Cereal	81.43	83.88	83.93	86.05	86.80	86.44	86.44	86.44
Total Pulses	9.79	9.45	8.53	7.60	7.28	7.33	7.33	7.33
Total Food grains	74.48	76.73	76.64	80.77	816.21	81.14	81.14	81.14
Total Oilseeds	33.47	34.57	37.26	61.51	62.95	62.95	62.95	62.95
Sugarcane	92.14	3805.19	94.09	96.65	96.74	96.74	96.74	96.74
Potato	100	100	100	100	100	100	100	100
Source: Compiled from: http://updes.up.nic.in/spiderreports/intialisePage.action								

2.1.5 Electricity Intensity in Agriculture

Electricity is one of the key source of energy used in agriculture. Table 14 shows that per capita consumption of electricity in agriculture has significantly increased from 115 KWH in 2011-12 to 249 KWH in 2019-20, a net increase of about 117 percent. However, the percentage share of agriculture in total electricity consumption in the district has substantially declined from 37.52% in 2011-12 to 14.59 in 2019-20, indicating that the electricity consumption in non-agriculture activities has been rising faster than that in agriculture.

Table 14: Trends of Electricity consumption in Agriculture

Division/ Year	2011-12	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Per Capita electricity consumption (K.W.H)	115	117.13	115.1	168.83	229.53	244.67	248.96

% of electricity consumed in Agriculture sector to total consumption	37.52	39.35	35.81	26.18	22.15	17.23	14.59
Source: Compiled from UPDES http://updes.up.nic.in/spiderreports/intialisePage.action							

2.1.6 Status of Agriculture Markets

Table 15 shows the marketing infrastructure in the district. It has 4 main markets and 6 submarkets, which remains constant during the period. Number of regulated mandies per lakh hectares of NSA has declined from 4.61 in 2013-14 to 1.92 in 2018-19.

Table 15: Status of Agriculture Markets in Ballia District

Category/Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Main Markets (No.)	4	4	4	4	4	4	4
Submarkets (No.)	6	6	6	6	6	6	6
Total Markets (No.)	10	10	10	10	10	10	10
No. of Regulated mandis per lakh Ha. of net area sown	4.61	3.34	-	1.84	1.87	1.92	-
Source: Compiled from Statistical Abstract, Uttar Pradesh and District-wise Development Indicators file. http://updes.up.nic.in							

2.1.6 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. The district has converted 1200 hectares of cropped area under organic farming and 155 acres (62.30 hectares) under zero budget farming, a concept developed by Shri Subhash Palekar. Under the programme, the beneficiary farmers get Rs.12000, Rs. 10000 and Rs.9000 per hectare respectively in the first, second and third year of the conversion period. There is a proposal of setting up of two FPOs of 600 hectares each and a separate place in the Mandi for farmers to sell their organic product under the banner/brand of Namami Gange. However, 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.

The transition period for the full conversion from conventional to organic is considered three years. During this period, crop-yield, on average, is expected to decline by 10—15 percent. But after three years, it may reach its original level. Financial assistance received by the beneficiary farmers seems to be adequate to compensate the yield losses and motivate them to do organic farming. For example, in 2017-18, the average per hectare yield of whear in Ballia district was 36.16 quintals and the reported price was Rs.1750/qtl, the gross value of output was 63280. If in the first year maximum loss is 15 percent, it will come out to be Rs.9492, which is much lower than Rs. 12000 received as financial assistance. This seems to be sufficient to motivate the farmers locating 10

kms both sides of the river to do organic farming. In addition, each cluster will get Rs.30000 for direct marketing, packaging, labelling, logo, leaflets, etc. The project duration is three years starting from 2019-20 to 2021-22. There is also a proposal of setting up integrated processing unit for the organic products. Monitoring of the project will be periodically done through MIS, Geotagging and monthly physical and financial reports.

Table 16 shows the details of establishment of organic clusters under the Namami Gange and Paramparagat Krshri Vikas Yojana in the district. The district has set up 60 clusters in six development blocks. These clusters spread over 32 GPs (40 revenue villages) located on the left bank of Ganga River. These clusters comprise 10.58% of cultivated areas of these villages The highest number of clusters are in Belhari block (17), followed by Dubharh (15), Murali Chhapra (14), and Sohanv (12). Dibhat and Bairia blocks have only one cluster each. On an average, size of cultivated land per farmer in the cluster is only 0.72 hectare. It is reported that the maximum limit of land under a cluster per farmer is 2.00 hectares. Hence, majority of the beneficiary farmers are small and marginal.

Table 16: Block-wise Details of Organic Farming Clusters in Ballia District (2020)

Block	Number Clusters	No of farmers	Total Area(ha)
Dubharh	15	465	304.3576
Dubhar	01	41	20.286
Bairia	01	45	20.229
Belhari	17	515	345.0042
Murali Chhapra	14	368	285.141
Sohanv	12	251	244.2905
Total	60	1685	1219.308

Source: Compiled from data received from District Ballia

The main problems for the growth of organic farming are:

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

5. According to the farmers, implementing policies initiated to promote organic farming in the area is not very efficient as the inspection is not conducted regularly, and the farmers did not receive subsidies in time under the scheme.

6. The knowledge level regarding practices under organic farming was not high among farmers, and the awareness regarding its benefits was low.

2.2 Trends in Livestock

Livestock has an essential place in the rural economy. Milk, meat, wool, hides & skins are all extracted from livestock. Livestock accounted for 543.32 cr of GDP in 2018-19. Table17 shows that the total number of indigenous cattle (cows and bulls) has declined from 251387 in 1997 to 217703 in 2019. The decline was mainly due drastic reduction in male cattle (from 108662 in 1997 to only 4811 in 2019), while number of female cattle increased from 142725 to 217703 during the same period. Number of exotic cows has substantially increased from 22985 in 1997 to 211932 in 2019. Comparing 1097 and 2019 data, we observe that number of female buffaloes has substantially increased from 111766 to 244700 during the same period. However, there has been steep decline in the number of male buffaloes during the same period. The number of sheep declined from 27667 to 18560 during the same period. Number of goats also evince the similar pattern. The number of pigs shows drastic decline in 2019 over the preceding years.

Table 17: Trends in Livestock Population (in numbers) in Ballia

	Category	1997	2003	2007	2012	2019
Indigenous Cattle	Total Male	108662	71764	91036	46109	4811
	Total Female	142725	150054	104721	143443	212892
	Total	251387	221818	195757	189552	217703
Exotic Cattle	Total Male	9586	10345	11475	19320	5267
	Total Female	22985	31417	32704	64976	211932
	Total	32571	41762	44179	84296	217199
Total Cattle		283958	263580	239936	273848	434902
Buffalo	Total Male	35706	44219	60571	54273	5086
	Total Female	111766	142352	149288	179634	244700
	Total	147472	186571	209859	233907	249786
	Total Indigenous Sheep	27295	17323	16603	20443	16513

Sheep	Total Exotic Sheep	372	949	832	2727	2047
	Total Sheep	27667	18272	17435	23170	18560
Goat	Total	185701	153667	168339	154580	157490
Pig	Total Indigenous Pig	46535	27887	18427	13547	5990
	Total Exotic Pig	10965	1102	983	1929	772
	Total Pig	57500	28989	19410	15476	6762
Total Livestock		719809	661313	660432	709611	-
Total Poultry		260212	212846	225766	227593	-

Source: Compiled from UPDES and DADH

http://updes.up.nic.in/spiderreports/intialisePage.action
http://dahd.nic.in/animal-husbandry-statistics

Per day cow and buffalo milk production in the district was 278091 litres and 246157 litres respectively. Average milk productivity of both cow and buffalo was 5 litres per day. Sheep, goat, pig and poultry are other important livestock in the district. Average goat meat yield is 11.5 kg per goat. Average pig output is 90 km meat, while a sheep provides about 2 kh wool in a year (Table 18). Fishery occupies 87.70 hectares and per hectare yield is 124.24 Qtls.

Table 18: Production and productivity of livestock

Animal	population	Production	productivity
Cows	263580	278091 lt/day	5 lt/day
Buffalo	186571	246157 lt/day	5lt/day
sheep	18274	112 qu wool pa	2 kg wool/ sheep /year
goats	153667	461 qu meat pa	11.5 kg meat/goat
pig	28989	4032 qu meat pa	90kg meat /pig
poultry	218034	5561 qu meat pa	1kg meat /poultry
fish	87.70 ha	11071 qt pa	124.24 qt/ha

Source: District Profile KVK Ballia https://ballia.kvk4.in/district-profile.html

2.3 Forestry

Agroforestry, the second most common land use after agriculture, is practiced over 11.24% of land in Ballia, while horticulture is practiced in 4.59%. Out of existing agroforestry practices, scattered

near farms and around homestead is most common (about 37.7 %). This is followed by agrisilviculture (20.20 %), silvi-horticulture (19.1 %) and agri-horticulture (12.3 %). The teak, mango, eucalyptus and aonla were most preferred species in plantations. (Agri-silviculture is a production technique which combines the growing of agricultural crops with simultaneously raised and protected forest crops) (Source: Shukla, Hari Om, et al. "Agroforestry Practices in Ballia District of Eastern Plain Region of Uttar Pradesh, India").

2.4 Tourism

Possibilities in the tourism sector are abound. Ballia is flocked annually by over 13 Lakh tourists. This follows from the fact that UP is the largest destination for internal tourism.

Table 19: Tourism statistics

	2015			2016		
	Domestic	Foreign	Total	Domestic	Foreign	Total
Ballia	1305905	0	1305905	1318461	0	1318461
Uttar Pradesh	204888457	3104062	207992519	211707090	3156812	214863902

Source: Source: Dept. of Tourism UP

District Ballia is surrounded by two rivers Ganga and Ghagra on the lower and upper boundaries.

2.5 Wetlands

Table 20: Area Estimates of Wetland in District Ballia (2018-19)

Sl.No.	Wetland Category	No. of wetlands	Total area wetland (ha)	% of wetland area
1	Lakes/Ponds	111	4747	14.81
2	Ox-bow lakes/cut off meanders	27	1328	4.14
3	Riverine wetlands	31	1636	5.11
4	Waterlogged	43	1481	4.63
5	River/stream	34	21405	66.79
6	Tanks/Ponds	3	8	0.20
7	Wetlands (<2025 ha)	1442	1442	4.50
	Total	1691	32047	100

Source: http://117.252.14.242/Gangakosh/Water%20Resources/wetlands.htm

Out of 1168 water bodies 118 are protected and rejuvenated by the district.

NWIA Wetlands Atlas report

- The district comprises 1694 wetlands; most of them are lakes, meanders and waterlogged. The lake and riverine wetland types with a large wetland size of more than 500 Ha are found in the region.
- The wetland size is small in general, but five wetlands are around 500 Ha
- The number of natural wetlands is more than man-made.
- Many natural wetlands have aquatic vegetation also.

Figure 2: Surha Tal. Important site for birds and wildlife.

2.6 Energy

For renewable energy, solar biomass and biogas are the sources exploited in Ballia. Ballia has tremendous capacity for solar power but presently there is negligible production. In solar electrification mission. UP has an installed capacity of 1292MW. Major solar electrification heads have been under solar parks, roof-top on government buildings, cantonments, floating solar installations and some off grid items like solar lights, pumps etc. In terms of animal waste, the annual consumption of dung cakes is 1201.3 ton while the availability of 4090.48 ton/year of dry dung. Annual dung cake deficit in few villages is 61.04 ton. In agriculture waste, assuming that 30% of total production of agriculture waste is being used for fodder and thatching, the total surplus of agriculture waste in the villages is 886.97 ton/year (Usha B, 2010).

Category	Total energy supply (available)	Total energy demand (consumption)	Gap between supply and demand
Solar energy	**24.15×10^6 kWh/yr**	**0**	**+24.15×10^6 kWh/yr**
Energy plantation	**319.41 ton/yr**	**0**	**+319.41 ton/yr**
Agricultural waste	**1705.238 ton/yr**	**306.7 ton/yr + 511.57 ton/yr fodder and thatching**	**+886.97 ton/yr**

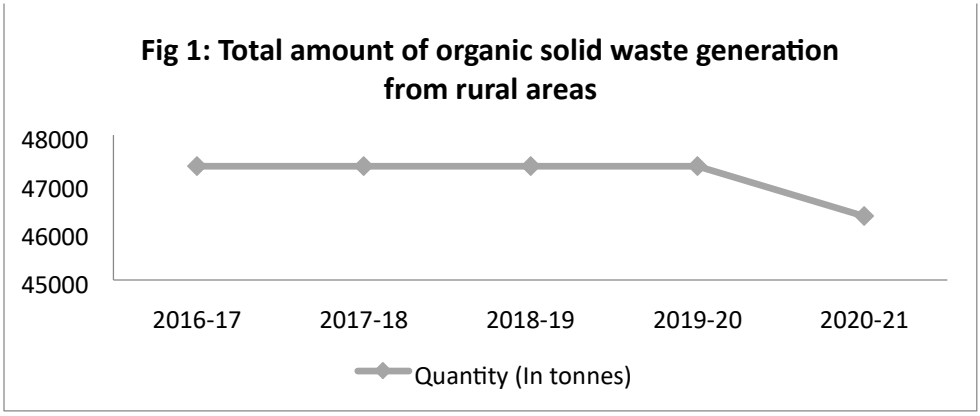
Animal excrete	**1140.26 ton/yr of dry dung is generated in the villages assuming 75% collection efficiency.**	**1201.3 ton/yr dry dung**	**-61.04 ton yr**
Biomass from nonagricultural land	**1054.68 ton/yr of biomass**	**2125.8 ton/yr**	**-1070.32 ton/yr**

Table 4: Energy scenario in few village clusters of Ballia

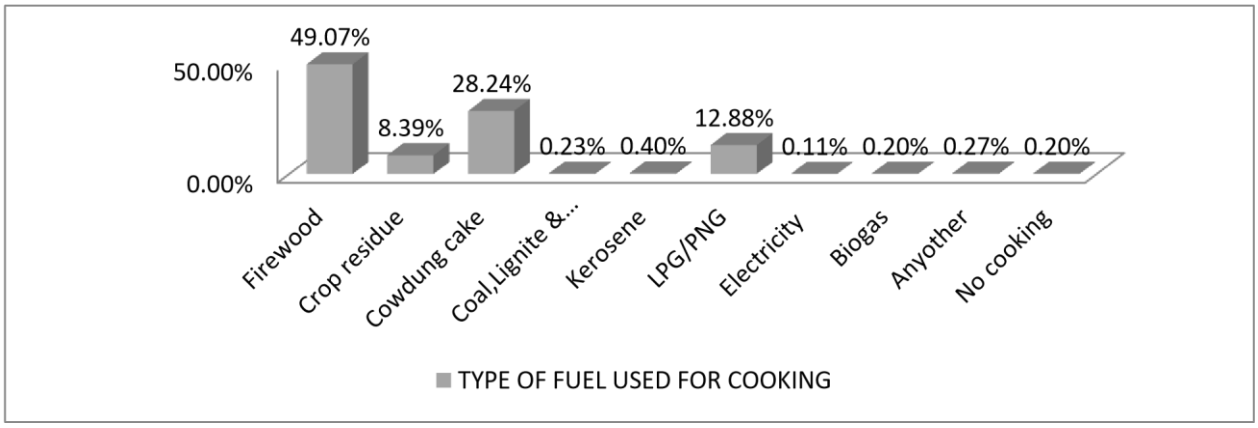
Source: Integrated energy planning for sustainable development in rural areas: A case study from Eastern Uttar Pradesh
Shweta Singh, Usha Bajpai

2.6.1 Biomass Energy

The Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) has a few running programs on biomass energy generation which are- Bagasse Based co-generation Program, Power Projects Based on Other Biomass, Biomass Based Gasifier Power Project, Biomass Based Co-Generation Power Project and Industrial Waste Based Power Projects.



The data collected from the district administration (chart above), shows that there has been a regular trend in production of organic solid waste in the rural areas, although a decline can be seen in 2020-21, this waste so produced can also be brought to use for production of biomass energy. According to census 2011, the type of fuel used for cooking by the majority of households in the district is firewood, followed by cow dung cakes and LPG/PNG.



Hence the need in the district is to manage the agricultural production and crop residues rationally in order to utilize biomass to its maximum capacity.

3 QUALITATIVE DATA ANALYSIS

3.1 AGRICULTURE, ALLIED ACTIVITIES, FORESTRY

NMCG has been keenly active in Ballia for promoting Organic farming and plantations across the banks of Ganga. Around 1200 hectares (ha) of land is cropped under organic farming in 60 patches of 20 ha each. For each 100 ha, a 'Lead Resource Person' (LRP) has been appointed to implement the project. There are 12 LRPs appointed in district Ballia to promote organic farming. This aims at stable production and reduction in pollution, which will further lead to livelihood sustainability, environmental balance and improved soil fertility.

For animal husbandry several schemes are operational in Ballia

- Kamdhenu/Mini Kamdhenu Yojana
- Poultry Farms and Poultry Development
- Pashupalan loan scheme
- Loan for dairy farming Yojana
- Fisheries : PMMSY

Livestock, forestry & logging and Fishery (allied activities) are the growth drivers of the agriculture in Ballia. Their combined share in agriculture and allied sectors went up from 28.86% in 2011-12 to 37.30% in 2018-19. There is huge potential of income and employment generation in the primary sector making integrated plan of organic crops and horticulture along with fishery and livestock.

SWOT Analysis of Organic Farming in the District

Strengths	Weaknesses
• Suitability of agro-ecology for horticulture and livestock • Agro-biodiversity and multiple cropping System • The abundance of organic manure (cattle urine & Dung) • Community-based certification system (PGS) • Less dependence on external inputs	Small land holdings • • Lower productivity during the transition period • Inadequate marketing infrastructure and market linkages • • Knowledge and skills-deficit in OF • Lack of effective monitoring Inadequate testing and certification system • Lack of effective farmers' Organisation
• Opportunities Income-elastic demand for organic • • products, including milk and meat Crop- • livestock integrated farming system Common "Namami Gange" brand Possibility of Convergence with MGNREGA	Threats Risk of Reversibility after • the project period High transaction cost • • • Market risks • Shortage of labour in agriculture Sustainability risk
• Local livelihood generation through production and sales of bio-fertilizers & Bio-pesticides • Huge scope for Agro-processing • Government Institutional and policy support	

3.2 ENERGY

The UPPCL has been making efforts to come up with community biogas plants based on solid and liquid wastes in the adjoining area i.e. Mau. The Jatropha Mission cell has been making efforts to bring green and non-conventional energy sources in eastern UP. Earlier, the cell had established a bio-gas unit at Mishrawallia village in Ballia district in 2008 for piped bio-gas supply to rural households. Hence, it can be estimated that Ballia has the potential for community biogas plants and with proper planning, technique and community participation, the status of RE can be amplified in the district.

3.3 TOURISM

Surha Taal is a natural lake located in Ballia District. It is an oval shaped natural oxbow. This lake is a tourism hotspot and several other wetlands have the potential as well. Other tourist attractions include Ballia Baleshwar Temple. Legend says that King Bali performed a yagya here and ever since pilgrims come to the temple. Maharishi Bhrigu Ashram is also located here. 'Dardar', an accomplished student of Maharishi Bhrigu was remembered by a 15 day long Dadri mela. This

fair ends on Kartik Purnima with a royal dip in Ganga. People come here each year due to shared civilizational memory in massive numbers.

Figure 3: Dadri Mela, royal dip

4 ACTION PLAN DEVELOPMENT

As is clear, Ballia is most strongly connected to agriculture. Since most of the population is engaged in it, agriculture is a keystone sector in Ballia. Hence, any major success in this sector would have a very positive feedback to others like tourism. So, interventions in agriculture needs to be prioritized over others.

4.1 AGRICULTURE

At the moment, yields of Ballia are at par with the state, but for an agrarian district, very little high value crops are cultivated here. This fact should be addressed first. Diversification and promotion of horticulture/agroforestry should be taken up. Awareness and outreach programs are needed to this end.

1. Mitigating High Risks

Moreover, low risk taking capacity of marginal farmers must be enhanced. NABARD's self help group bank link program(SBLP) can be vital here. Pooling of resources and risk would allow farmers to cultivate higher value producing crops. Lower Value of Product but at par yields point to the ripeness of community intervention.

2. Linking Microfinance Institutions with Green Projects

Both micro finance initiatives and enviro conscious projects more often than not need strong organisations with a firm organizational belief. Organisations like ZBNF, Manuvikasa, Art of Living, Lok Bharti are the partners that will help us in the laying the foundations. Only after prolonged efforts will a trust for the products create markets demand. Till then the farmers need support. Microfinance and incentives under PKVY should be deployed generously in this regard.

3. Scaling up of Nanami Gange and PKVY project.

The district has converted 1200 hectares of cropped area under organic farming and 155 acres (62.30 hectares) under zero budget farming. There are 60 organic clusters under the Namami Gange and Paramparagat Krishi Vikas Yojana in six development blocks. This is a useful experiment and should be successfully scaled up. Existing initiatives and thrust areas identified by KVK range from seed replacements, plant protections, and diversification. These should be utilized in future action plans.

4.2 FORESTRY

Agro forestry has the capability to increase earnings of marginal farmers, increase their quality of life (by providing services like medicinal plants, shade, timber, fodder, protection against erosion), while helping us create additional carbon sink.

The systematic pattern in tree planting needs to be improved for the region. The extension and training programs regarding selection of species, tree planting pattern, nursery raising, quality planting material, maintenance and management of plantations and most importantly, the marketing of trees as end produce. In marketing or sale of trees, transit and felling permit to be issued by forest department is very important. The unawareness of rules and fear of administration discourages farmers for adopting agroforestry widely at large level in this region.

Hence permit related confusion and hesitation to contact administration must be addressed. Proper sales permit and informed choice of species can revitalize the timber markets of India and go a long way in improving economic conditions of Ballia.

4.3 TOURISM

Tourism promotion needs primarily an information dissemination based initiative. Similarly, Wetland conservation needs people to know their fragility and threats. For spreading the information, a medium that has a great reach in the vernacular language and a lasting impact should be deployed. Media like Radio, social media are suitable.

Apart from information dissemination, experiences should be developed that can attract more tourists. **Water sports, bird watching, boating, diving etc.** should be developed on wetlands. For religio-cultural tourism the cleanliness and transportation factors should be improved.

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

1. Identification and Inventory

- Space Application Centre of ISRO has already made identification of wetlands on the scale of 1:50,000. They need to re-collect the information on the scale of 1:25,000 to gather precise data of small wetlands. Also, they need to re-collect the data on the scale of 1:50,000 to understand the present scenario and compare it with past wetland data.
- Creating an open-source inventory database. Introducing the data with the total number of wetlands on the area basis.
- Marking of the name of wetland, altitude, type on the district-wise maps.
- Criteria for identification of wetlands as those prescribed under the Ramsar convention (9 criteria)
- Produce regional and national wetland inventories, baseline assessments and monitoring programs.
- Data collection of pre and post-monsoon changes in the size of the wetlands.

2. Condition

- Quantification of woods, fish, species (especially endangered species) and valuable goods provided by the wetland ecosystem.
- Measurement of the condition of the wetland like water quality, air quality, soil quality other parameters.
- Assessment of the impact of wetland degradation on public health, food and productive security, and poverty prevention.
- Assessment of pre and post-monsoon condition.
- Assessment of the recent and past condition of wetlands

3. Research

- To improve the health of the wetland, both central and state must fund schemes and research
- Research of sustainable (environmental, economic, social) development of significant wetlands.
- Research on rejuvenation and restoration of wetlands.
- Scientific research and assessment on the vulnerability of wetlands to climate and other factors
- Conduct research on the economic value of wetland ecosystems

4. Reviving Plan

- Conduct extensive study before applying any reviving plan, as many species depend on wetlands.
- Making local stakeholders significant advisors. To document, highlight, apply traditional knowledge to wetland conservation
- Formation of the steering committee of the technical experts of the different domains to assess the reviving/rejuvenation plan.
- Monitoring of plan execution with regular interval data collection.
- Marking of the wetlands based on wetland quality index.

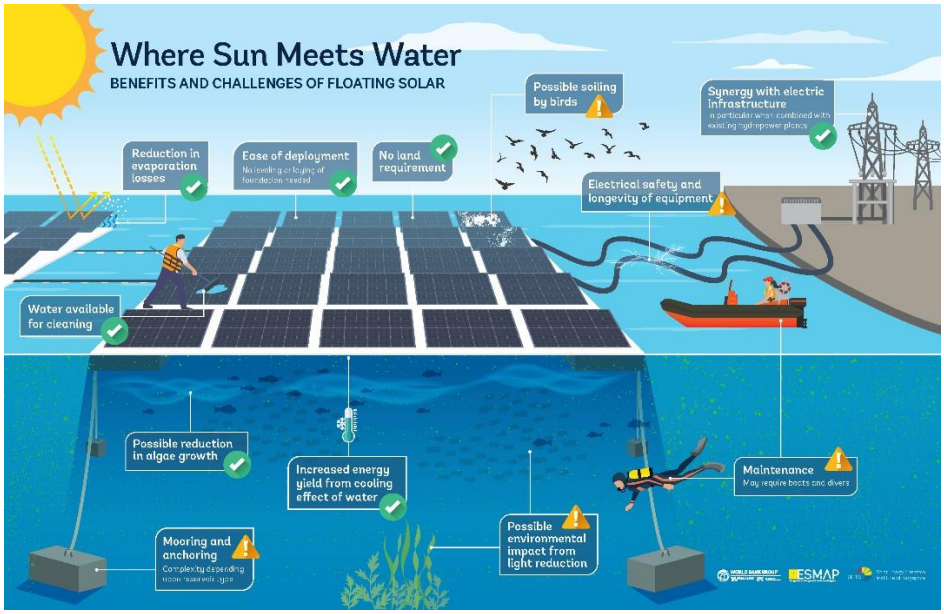
5. Policies

- National Plan for Wetland Development (NPWD)
- Integrated wetland sustainable management policies
- Wetland protection act following the pattern of Ramsar wetlands.
- Providing some wetland of national importance
- Establishment of institution/centre to study the importance of wetlands against climate change/global warming.

4.5 ENERGY

4.5.1 Solar

Solar energy strategy for the city should be in-line with the National Solar Mission. Low hanging fruits in the mission are roof top solar electrification in all government buildings, cantonments, NGO offices etc. A potentially revolutionary idea could be floating solar power (already popular in UP's Rihand Dam). Smaller installations can improve fishing prospects, while generating electricity. The figure below is taken from the Energy Sector Management Assistance Program website (ESMAP), is a model explaining the benefits of floating solar.



Other schemes like PM-KUSUM (for solar powered pumps), solar lighting etc. must be emphasized in order to satisfy the districts energy demands through off grid and connected solutions. Further employment opportunities can be generated through the Saurya Mitra Yojana, which provides for the skill training of solar operators and maintenance staff.

4.5.2 Biomass and Biogas

Biomass and Biogas potential should be further explored and incentivized. Also citizens should be encouraged to use biogas over biomass as fuel. New National Biogas and Organic Manure programme should be utilized here. Compressed Biogas is the natural progression from biomass and biogas. Some states like Gujrat and Maharashtra have done exceedingly well here.

Swach Bharat Mission linked with large scale bio gas plants should be pursued aggressively to achieve twin benefits of clean energy and waste management. Existing incentives of using Biogas for energy consumption and automobile fuel under the SATAT yojana (Sustainable Alternative Towards Affordable Transportation) can be touted as business opportunities.
Figure below depicts the energy products that can be made from sugarcane bagasse. Hence sugarcane as well as the other crop residues produced in the area are as precious as fossil fuels. It is evident from the data provided by the district administration that the district practices

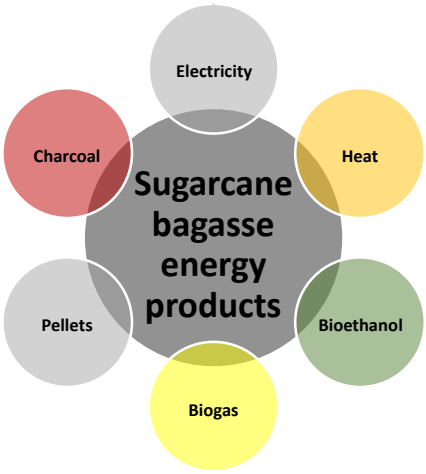


Fig. 3

agriculture on large scale. To increase the crop intensity and the yield farmers have to use different chemical fertilizers which in due time degrades the land. One magical product produced from biomass is biochar used for the amendment of soil. It is also used for composting purposes.

The district can transform itself by bringing some changes at the community level because it is the community only which builds the whole district. Firstly, attention has to be paid to increasing the crop yield of the district, Secondly, people should be encouraged for setting up sugar mills. Thirdly government should try starting up biomass energy producing units and should give it on rent to

people till the expenses are reverted. This will hence in a combined manner improve the economy, ecology and livelihood of the residents of the district.

4.6 INTERGRATED MODEL FRAMEWORK

1. Agriculture is the main source of livelihood for more than half of the population. Most of them are marginal farmers. Enhancement in their quality must be one of the key goals of Arth Ganga. The challenge in these sub-sectors is the environmental externalities. Apart from very high water consumption there are land usage, soil degradation issues related to agriculture.

Thus, the way out in agricultural activities is:

- promotion of organic farming
- zero waste farming
- low water techniques
- crop diversification particularly high value low water usage crops

2. This sector have high livelihood implications particularly artisans and direct and indirect employment generation through tourism. The investment-return ratio at individual level is very attractive though it requires significant investment in infrastructure creation from government side. The challenges in this sector are twofold:

A. There is a carrying capacity of the environment for the tourists which is particularly critical for the eco-sensitive zones.

B. The high influx of tourists can affect flora and fauna.

C. While every district has its own handicraft/artisan product, tourism is not particularly developed in many of the districts and it will require continuous efforts for years before reaching as tourist destination.

Thus, the way out to counter these challenges in tourists' activities are to:

A. Focusing less on environmentally sensitive type of tourism such as religious and historical tourism while limiting the footfall for nature and adventure tourism.

B. Focusing on eco-tourism, agro-tourism and reducing the aqua tourism in River should be considered.

C. Artisan products must be promoted either way even though it's easier to promote where there is tourist influx in the district.

3. This sector has a very high positive environmental impact even though they are low on the livelihood generation. Most of renewable energy and biodiversity and Forestry falls in this category. This is perhaps most critical category for conservation and long-term sustainability. To deal with the challenges in this sector are:

A. Improving solar electrification through aggressive roof top installations in all government buildings and business installations like petrol pumps, solar pumps etc.

B. Exploring floating solar installations in large wetland regions where synergies in fishing and energy production can be exploited.

C. Setting up of biomass plants and solar energy plants.

5 RECOMMENDATIONS

5.1 AGRICULTURE AND ALLIED SECTORS

- Paramparagat Krishi Vikas Yojana is already active in the district. Works already done herein should be expedited. The experiences of the farmers engaged here should be pleasant so that more farmers can be incentivized.
- Mr. Subhash Palekar has been one of the main engines in a recent massive turn around to zero budget natural farming in India. Engaging such organisations and supporting them will be a step in right direction.
- Pradhan Mantri Matsya Sampada Yojana should be expedited. Fisheries can be boosted by rejuvenating traditional ponds under MNREGA scheme and farmers can also be encouraged to construct farm ponds with MGNREGA funds.
- Branding efforts under National Organic Foods Market (Jaivikkheti.in etc.) Listings products here gives a price increment. Farmers need to be informed regarding these opportunities.
- Organic Fisheries which involve a predator like Gharial, Dolphin can make the fish more active, weed out diseased fishes, reduce chances of disease and also allow for higher prices; while also helping a critically endangered species.
- The major crops being cultivated are paddy, wheat, pea, maize, sorghum, pigeon pea, potato, onion, and vegetables. The vegetables are grown during Rabi, Kharif, and Zaid season. The farmers are advised to adopt the improved varieties and technologies recommended for this zone.
- Farmers are advised to increase the cropping intensity by utilizing the cultivable land round the year. It will help to increase the profitability of farmers. The district is based on a wheat paddy cropping system. It needs to be replaced with a vegetable-based cropping system. Many vegetables are of short duration; therefore, they may be fitted in paddy and wheatbased cropping systems and would help increase profitability.
- Sometimes unusual rainfall (heavy rainfall, sporadic rainfall, and uneven rainfall) and drought conditions occurred. In this situation, farmers should follow the Advisory Services provided by the NICRA project of ICAR and implemented by KVK. The short-duration variety of paddy should be grown during drought conditions. SRI system of paddy nursery/transplanting is suggested. In drought conditions, intercropping is suggested to compensate for the loss in main crops.

- Farmers should be in touch with Krishi Vigyan Kendra, Ballia, which comes under the jurisdiction of Acharya Narendra Dev University of Agriculture and Technology, Kumarganj, Ayodhya. The KVK is equipped with the latest technological information about crops, horticulture, animal husbandry, and plant protection. The KVK may be helpful to train the farmers and graduates to start their entrepreneurship, i.e., honeybee keeping, mushroom production, value-added product, poultry farming, etc.
- Under heavy rain situations, the drainage of excess water from the field is essential. Under this condition, paddy variety, i.e., Madhapur, Jalmagn, Jalpriya, Jalnidhi, Awarodhi, should be sown as they survive in deep water.
- The district has good acreage of the riverbank, which are being utilized for the cultivation when the water of the Ganges is receded after the rainy season. These areas are called diaraland and are classified as low, middle, and upper diara. Earlier, this diaraland were used for growing watermelon and musk melon. The sowing in diaraland starts in early November, and the crop continues up to April. The farmers of this district should change this pattern. They have to adopt other vegetables like bitter gourd, bottle gourd, pumpkin, and long melon, which may have better market price due to early production (off-season) of vegetables. The farmers should be advised to use organic and natural-based plant protection measures in riverbed cultivation as insect pest infestation is very low in diaraland. The farmers should also be advised to use the better varieties/hybrids, and they should be purchased or taken from reliable sources.
- Landless farmers should be advised to have poultry farming, which is a very profitable venture. The farmers are advised to have all precautions like a vaccination against important diseases, proper shelter, feed, etc.
- The farmers should be encouraged to register the FPOs to facilitate the purchase of inputs in bulk, marketing their products, and creating the bank of farm implements and machinery, which are costly and can be used by the farmers as per their needs.
- Farmers should follow the Agrometeorological Advisory Services provided by Agrometeorological Field Unit Ayodhya (AMFU Faizabad) as a decision support system for deciding their day-to-day farm operations. Agromet Advisory Services may be helpful to reduce the farm inputs from the prior information of favorable weather conditions and enhance their farm income to alleviate the adverse weather impact.

5.2 FORESTRY

- For the tribal population of the district (3%) and other people residing close to forests; Van Dhan Vikas Yojana should be deployed considering its success elsewhere. Groups of learners should be taught forestry along with collection of produce.
- Associated companies like MittiCool and Bamboo based textile and other industries can supplement incomes and companies must be welcomed with a red carpet. Bamboo based industries are developing rapidly and government's National Bamboo Mission comes with great synergies for Arth Ganga.
- Flood prone areas should be considered for re-forestation and plantation as they serve twin benefit of flood control and economic benefit of the produce they may bear. National Afforestation Program. Compensatory afforestation can be explored under the scheme here

- E adhaar based portal to approve felling and selling permits of trees can revitalize the timber markets. This can help boost other industries, and can make plantation a hassle free event for farmers. Lack of transparency in permits, disincentivizes them.
- Training for selection of species and horticulture management would allow farmers to choose better. This can boost earnings for marginal farmers and should be taken up by local authorities and organisations like KVK.

5.3 WETLAND AND TOURISM

- Fishing in wetlands during mating season for fish should be limited by authorities. A mix of normative and positive approach can be deployed. Farmers can be provided alternate livelihoods through National Livelihood Mission, MGNREGA etc.
- Riverine weeds and algal bloom infestations reduce dissolved oxygen levels. Their impact on aquatic ecosystems is adverse and clearing them out is costly. MGNREGA based work can be utilized here for clearing them out. The biomass collected can be utilized for bio fuel/ biomass/ fertilizers. These ideas should improve livelihood and provide alternatives to fishermen
- Information is most easily spread on social media; Short video format social media, along with whatsapp are most prevalent among rural youth and should be leveraged. Information regarding wetland conservation, opportunities to explore them etc., should be highlighted actively.
- Tourism can be promoted by developing circuits. Promotion of local products 'Bindi' needs to be done which also happens to be product from district under Uttar Pradesh Government One District One Product (ODOP) scheme.

5.4 ENERGY

- Implementing NNBOMP schemes in tandem with National horticulture mission and Nabard's SBLP will increase chances of its success. Biogas generation and Biomass have high synergies with Zero budget farming and Kamdhenu yojana.
- Project investment opportunities in large scale compressed Biogas plants with massive Central financial assistance and Grants;
- Improve solar electrification through aggressive roof top installations in all government buildings and business installations like petrol pumps, solar pumps etc.
- Explore floating solar installations in large wetland regions where synergies in fishing and energy production can be exploited.

6. Discussion during the Report Presentation

- 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

UPDES, Government of Uttar Pradesh; for primary sector time series data Ballia

HTTPS://BALLIA.NIC.IN/DOCUMENT-CATEGORY/CENSUS/ for demography and working population distribution

HTTPS://WWW.THEBETTERINDIA.COM/11897/ARSENIC-CONTAMINATION-WATER-BALLIA-VILLAGEUTTARPRADESH-REVIVING-WELLS/ : Arsenic poisoning in deep groundwater

HTTPS://BALLIA.KVK4.IN/DISTRICT-PROFILE.HTML District profile for agriculture

HTTPS://WOCATPEDIA.NET/WIKI/WATER_RELATED_WEEDS#INTEGRATED_MANAGEMENT_OF_WATER_WEEDS for aquatic weeds

HTTPS://IJOEAR.COM/ASSETS/ARTICLES_MENUSCRIPTS/FILE/IJOEAR-JAN-2020-13.PDF : Agroforestry Practices in Ballia District of Eastern Plain Region of Uttar Pradesh, India

HTTPS://WWW.OUTLOOKINDIA.COM/OUTLOOKTRAVELLER/TRAVELNEWS/STORY/70754/INDIAN-TOURISM-STATISTICS-RANKS-UTTAR-PRADESH-AS-THE-MOST-POPULAR-STATE-FOR-DOMESTICTOURISM : Internal tourism in UP

Integrated energy planning for sustainable development in rural areas: A case study from Eastern Uttar Pradesh: Shweta Singh, Usha Bajpai et al.

FAO's Aquatic weed management and optimisation of fish culture operation: S Pattnaik et al.

HTTPS://PIB.GOV.IN/PRESSRELEASESHARE.ASPX?PRID=1596332 : press release on National Afforestation Program and Green India Mission

HTTPS://SANNAMS4.COM/DIGITAL-AND-SOCIAL-MEDIA-LANDSCAPE-IN-INDIA/: digital and social media landscape in india

Ministry of New and Renewable Energy Annual Report 2020

"Where Sun Meets Water: Floating Solar Market Report" world bank report

24x7 power for all report: UP

Deen Dayal Upadhyay Gram Jyoti Yojana report for Ballia

https://sujal-swachhsangraha.gov.in for CBG plants in Gujrat

7 APPENDICES

7.1 AUXILLLARY DATA

….(Meeting details, photographs, additional data, note)….

S. No.	Classes of agroforestry systems	Status in Ballia district (%)
1	Agri-silvi	20.20
2	Silvi-horti	19.1
3	Agri-horti	12.3
4	Agri-silvi-horti	3.5
5	Silvi-pastoral	7.3
6	Homestead	37.7

7.2 LIST OF TABLES AND FIGURES