IJRDMS • Volume 15 • Number 1 • January-June 2021 • pp. 51-67

ANALYSIS OF LAND USE AND CROPPING PATTERNS IN MAHRAJGANJ TEHSIL OF RAE BAREILLY IN UTTAR PRADESH

Avinash Chandra Sharma

Abstract: *Land is a basic and indispensable resource for agriculture. Its quality and extent largely determines the diversity and magnitude of agricultural production. The development of any nation depends upon the availability of productive land resources and its effecting and judicious utilisation. With the increment in population, these resources are over overstressed and shrinking as development projects and housing settlement require conversion of land use from agriculture to non-agriculture , thus, resulting in low productivity of crops and migration of farming communities for search of employment and sustenance. This paper attempts to examine the present scenario of land use and land cover besides analysis of cropping patterns in Mahrajganj tehsil of Rae Bareilly of Uttar Pradesh. The analysis shows that Mahrajganj tehsil has comparatively large proportion under cultivation of agricultural crops. The proportion of irrigated area against gross cropped area was also recoded significant. The paper is based on secondary data and pertinent literature.*

INTRODUCTION

Land is a basic and indispensable resource for agriculture. Its quality and extent largely determines the diversity and magnitude of agricultural production. Crop yields and cropping patterns are highly noticed, which have shared changes in recent years and the relatively stable position in various uses of land is responsible for this neglect (Nadkarni and Deshpande, 1979). Land is essential to human existence, as it provides man with a place to live, with food and with many raw materials used to fulfill his will. Man uses land within several frameworks i.e. physical, social and economic, which often work together. The usefulness of land depends on soil, topography, and climate and water resources. Therefore, agricultural activities of humans on the land surface are restricted. Land use is a geographic concept because it includes specific areas. The study of land use in its spatial context requires understanding the regional zoning of optimal land use, degraded areas, etc. The use of land for various purposes reflects the intimate relationship between the prevailing ecological conditions and humans. The efficient use of land depends on the ability of the land to use the land in proper perspective (Shinde, et.al., 1987). Land use patterns for the present study mean the proportion of area under different land uses at a time.

Knowledge of land use and land cover is important for many planning and management activities related to the Earth's surface. The term land cover is related to the type of features

* Research Scholar, Department of Geography, Pt. Lalit Mohan Sharma Government P.G. College, Rishikesh, Uttarakhand, India

present on the surface of the earth, examples of types of land cover such as wheat fields, roads, rail tracks, lakes, etc. The term land use refers to human activity or economic activity associated with a specific land. As an example, the passage of land on the edge of an urban area can be used for family housing (Lilles and Kiefer. 2002)). The study area consists of various land use / land cover classes. The classes are as follows: agricultural land, barren land, water, and urban or built land. Maximum land use / land cover is classified as agricultural land, second in the barren land classification. The third category is unqualified land after barren land. Land use change by considering forest use as crop and border land, loss of productive land through various factors, conversion of wet land for agricultural and urban use, and conversion of other types of land for other human uses, etc.(Stamp,, 1984).

The land use classifications mean ding information on land cover, and providing from work to satisfy the basic needs of the community of respective regions. Land classification is based largely on the quality and intensity of the land utilization (Mohammad Ali, 1978). The land use of the reporting area is classified into five main categories of land use patterns. Land use is always related to conservation of land resources. Converting urban land to agricultural land use is not easy, but an unprecedented change in forest areas and arable land can be managed through human efforts. We can increase the net sowing area by additional effort to reduce the cultivable wasteland. There are huge amounts of cultivable wasteland which can be converted into cultivable land using proper techniques and management. Cultivable waste lands include fallow lands, shrubs and under-bamboo lands. The development of related products can increase the income of the people of the region or convert the land into cultivable land. This can increase the production of the area. Thus, there is an urgent need to develop and adapt land-saving technologies for better utilization of agricultural potential. Land and water are important natural resources for any development activity. Consequently, access to land and control over its use were major sources of conflict within and between communities in human history. As with any other resource land has two dimensions, viz., Quality and quantity, and both these important aspects are under serious threat due to intensive and widespread use of land for agricultural and non-agricultural purposes (Ramasamy et al. 2005).).

Land use dynamics is a complex phenomenon that is influenced by many socio-economic, agro-climatic and ecological variables. Both climatic and institutional factors are important in determining land use patterns. Land use limits are also affected by technical changes from time to time. Technological changes ignited intensive farming, resulting in the conversion of marginal land into productive agricultural land through capital intensive farming. Analysis of land use patterns and low use of land use suggests that the land use pattern was mainly influenced by the extent of adoption of modern technology (Reddy, 1991). However, it is not applicable to drought-prone areas where technical dissemination is highly limited. Another study has concluded that land use patterns of land, crops, forests to meet people's food needs and raw material requirement of industries using raw materials (Giri, 1966) as raw material for industries and is influenced by the demand for fodder farming. . Pandey and Tiwari (1987) analyzed land use dynamics and estimated land use changes in each

state with the help of a simple identification of linearly additive land use changes. A recent state-level analysis of trends and dynamics of annual changes in land use in different states of the country (Sharma and Pandey, 1992) showed that there was a general declining trend in permanent pastures, pasture land and area under barren and unusable land. .

The land requirement for non-agricultural use was met from the area under cultivable waste. The present and other fallow lands registered positive growth in most of the states. The inter-regional land budget indicated a shift in area from desirable and undesirable ecological areas towards agricultural and non-agricultural sectors. In Bihar, the area under fallow lands has been increasing over time thereby reducing the net sown area (Singh and Vashist, 1997). Culturable waste land includes miscellaneous tree crops, groves and culturable waste land and it also include fallow land. The miscellaneous tree crops and groves are grown in the areas not included in the net sown. All the culturable land put to some agricultural use, but not included under 'net area has sown', is included under this class. The lands under thatching grasses, bamboo bushes and other groves trees for fuel, etc., which are not included under orchards, are placed under this category. Cultivable wasteland included land available for cultivation, whether taken for cultivation or not or left after a few years for some reasons. Such lands may be either fallow or covered with bushes and forests which are not used. They may or may not be assessed and may be cultivated in isolated blocks or cultivated. Land, once cultivated but not cultivated for five years in succession, is included in this category. There is a type of residual class, which includes all the unused land which is not accounted for by any other class (Singh and Vasishtha, 1997) . Unlike other agricultural uses, fallow land is a regular part of cultivated land, on which farming is temporarily suspended for some reason. Falling is applied either by adverse weather conditions such as drought and flooding, which causes the land to not be sown or destroyed to be sown or farmers resort to fallow because the returns from farming of the land involved are very low. And may therefore work financially, or if they do, decrease the need for vital for cultivation of such lands (Sharma, 1999).. Fallow lands, other than the present fallow, include all lands that were taken for cultivation, but for cultivation are temporarily not less than one year and not more than five years old. Against this, the present fallow includes cropped areas which are kept fallow during the current year. There is a close relationship between fallow land and net area sown. Good and timely rainfall, weather conditions, agricultural commodity prices, political stability, tenure and tenancy conditions help to increase the area sown, representing the actual physical area under crops and orchards (Hussain , 1996). The area under forest includes all the lands which are under forest, whether private or state. There is a close relationship between the nature of the terrain, the amount of rainfall, and the area under the forests (Reddy, et al. 2002).

Forest is an important asset of the country. The area covered by forests actually includes all areas or lands connected with forests or administered as forests to deal with forests whether they are state-owned or private. If any part of such land is not actually forested or kept for some agricultural use, then that part is included under the appropriated head of the cultivable or un-plowed land. It is very important for society and is important for living

species. Forest is a major component of environment, without forest we cannot think of life. This gives us many resources without any payment such as maintaining fresh air as well as temperature and rainfall in the area. Apart from this we get wood for commercial purpose such as furniture, wood and main uses in cooking. Dhaka, Khair, Babylon, Mahua, Sheesham, Neem, Kanji, Sirus, Nilgiris, Mangoes and Berries. Peepal, vest, pakar, gular, chilbil, Arjuna are popular trees. The district has mostly mango and mahua rosewood flakes. Sheesham teak is expensive to use in wood furniture. Only 1 percent of the tehsil area is surrounded by forests. Uncultivable land stands for all land not available for agriculture means land used in other purpose besides agriculture. It is classified into different categories such as land used in settlements, buildings, industrial undertaking, road, canal, cemetery, crematory, bridge, land under the control of Army, Railway and others paramilitary force and all other lands put to any other non-agricultural uses. In the tehsil about 3 percent of land under uncultivable land means land not available for primary activities. Pasture included permanent pastures and other grazing lands. Pastures included permanent pastures and other pasture lands. Permanent pastures and other pasture lands cover all pasture lands, whether or not they are permanent pastures and grasslands. Common lands in villages and grazing lands within forest areas are included under this head. Pasture is a very important land in the village. It is community land available for the use of the resident of the village. It cannot be occupied by anyone from the village. One percent of the land in the tehsil is occupied by pasture. The net sown area is the total area sown with crops and orchards. It represents an area in which total crops are grown only once a year. The net sown area of the field is normal.

LAND USE PATTERNS

Land use in Mahrajganj of Rae Bareilly is shown in Table 1. About one per cent area in Maharajganj tehsil was reported under forest. However, forest area in Maharajganj block was recorded significantly high (2.08 per cent). Agriculturable waste land, fallow land, barren and non-agriculturable land and area under pasture constituted about 22 per cent against reported area. About 8 per cent area was under uses of other than agriculture purposes while about 2 per cent area was under orchard, trees and bushes. Thus, about 2/3rd area was net sown area. The proportion of net sown area was reported comparatively high in Bachharawan block (77.32 per cent). About 1/3rd area was reported as area sown more than once. It was reported high in Maharajganj block (47.33 per cent).

Table 1 : Land Use in Mahrajganj of Rae Bareilly

Particulars	Bachharanwa	Shivgarh	Mahrajganj	Total	**District**
Total Reported Area	**48213**	**21928**	**21614**	**91755**	**392045**
(%)	100.00	100.00	100.00	100.00	100.00
Forest	410	185	450	1045	4802
(%)	0.85	0.84	2.08	1.14	1.22
Agriculturable Waste Land	1301	1474	1239	4014	17304
(%)	2.70	6.72	5.73	4.37	4.41

Current Fallow	3018	1208	1019	5245	37846
(%)	6.26	5.51	4.71	5.72	9.65
Other Fallow	1548	2563	2345	6456	35880
(%)	3.21	11.69	10.84	7.04	9.15
Barren and Non-Agriculturable Land	1204	1038	1017	3259	13645
(%)	2.50	4.73	4.71	3.55	3.48
Land Use Other Than Agriculture	2625	2383	2702	7710	40988
(%)	5.44	10.87	12.50	8.40	10.45
Pasture Land	292	220	372	884	3344
(%)	0.60	1.00	1.72	0.96	0.85
Land Use Under Orchard, Trees and Bushes	538	869	701	2100	11564
(%)	1.11	3.96	3.24	2.29	2.95
Net Sown Area	37277	11988	11769	61034	226672
(%)	77.32	54.66	54.45	66.52	57.82
Area Sown More than Once	11985	8579	10230	30794	143387
(%)	24.85	39.12	47.33	33.56	36.57

Source: Zilla Sankhakiya Patrika, Rae Bareilly

Size of landholding in Mahrajganj of Rae Bareilly i is shown in Table 2. The average size of landholdings was recorded 0.67 per cent during 2012. Most of the landholdings were reported to be small and marginal as about 81 per cent land holdings had area less than one hectare. About 22 per cent landholdings had area of 1-2 hectares. Thus, medium and large holdings were reported to be low.

Table 2: Size of Landholdings in Mahrajganj of Rae Bareilly

Particulars	Bachharanwa	Shivgarh	Mahrajganj	Total	District
Less Than 0.50 Hectare					
Number of Holdings	10064 (55.28)	8464 (57.73)	11736 (60.11)	30264 (57.77)	193549 (61.95)
Area of Holdings	2849 (21.76)	1765 (17.99)	35432 (28.37)	8157 (23.02)	44649 (23.69)
0.50 to 1.00 Hectare					
Number of Holdings	4085 (22.33)	3341 (22.79)	4889 (25.04)	12315 (23.51)	68552 (21.94)
Area of Holdings	2780 (21.24)	1712 (17.36)	3532 (28.28)	8024 (22.64)	47081 (24.98)

1.00 to 2.00 Hectare					
Number of Holdings	2654 (14.58)	1939 (13.22)	1709 (8.75)	6302 (12.03)	34466 (11.03)
Area of Holdings	2937 (22.44)	3375 (34.22)	1610 (12.89)	7922 (22.36)	45835 (24.32)
2.00 to 4.00 Hectare					
Number of Holdings	1146 (6.29)	770 (5.25)	975 (4.48)	2891 (5.52)	13211 (4.23)
Area of Holdings	3114 (23.79)	2059 (20.88)	2510 (20.10)	7683 (21.68)	35773 (18.98)
4.00 to 10.00 Hectare					
Number of Holdings	245 (1.34)	142 (0.97)	203 (1.04)	59 (1.13)	2542 (0.81)
Area of Holdings	1286 (9.82)	864 (8.76)	1157 (9.27)	3317 (9.36)	13714 (7.28)
More Than 10.00 Hectare					
Number of Holdings	9 (0.04)	6 (004)	9 (0.05)	24 (0.04)	103 (0.03)
Area of Holdings	124 (0.95)	86 (0.87)	133 (1.06)	343 (0.97)	1383 (0.73)
Total Land Holdings					
Number of Holdings	18203 (100.00)	14662 (100.00)	19521 (100.00)	52386 (100.00	312423 (100.00)
Area of Holdings	13090 (100.00)	9861 (100.00)	12485 (100.00)	35436 (100.00)	188435 (100.00)

Source: Zilla Sankhakiya Patrika, Rae Bareilly

Land use pattern in Mahrajganj of Rae Bareilly is shown in Table 3. Out of gross sown area, rabi crops constituted 63.58 per cent while kharif crops accounted for 34.42 per cent. Thus, area under zaid crops was reported just 1.97 per cent. However, area under zaid crops was reported significant in Shivgarh block (4.20 per cent). Out of gross cropped area, net irrigated area constituted 36.33 per cent while gross irrigated area was reported 86.06 per cent. Gross irrigated area was recorded high in Mahrajganj block while net irrigated area was recorded high in Shivgarh block.

Table 3 : Land Use Pattern in Mahrajganj of Rae Bareilly

Particulars	**Bachharanwa**	**Shivgarh**	**Mahrajganj**	**Total**	**District**
Gross Sown Area	49262	20567	21999	91828	370059
(%)	100.00	100.00	100.00	100.00	100.00
Rabi Crop	31600	11740	15041	58381	195920
(%)	64.15	57.08	68.37	63.58	52.92
Kharif Crop	17101	7962	6541	31604	165570

(%)	34.71	38.71	29.73	34.42	44.74
Zaid Crop	546	865	402	1813	8293
(%)	1.11	4.20	1.83	1.97	2.24
Land Ready for Sugar Cane	15	-	15	30	176
(%)	0.03	-	0.07	0.03	0.05
Net Irrigated Area	12502	10232	10632	33366	205251
(%)	25.38	49.75	48.32	36.33	55.46
Gross Irrigated Area	27038	19686	22302	79026	326562
(%)	54.89	95.72	98.64	86.06	88.24

Source: Zilla Sankhakiya Patrika, Rae Bareilly

CROPPING PATTERNS

Cropping pattern means the proportion of area under different crops at one point. The cropping pattern is, however, a dynamic concept as it changes over space and time. The cropping pattern of a region is strongly influenced by geo-climatic, socio-cultural, economic, historical and political factors (Hussain, 1996). The crop pattern is influenced by physical factors such as soil, climate. Technical factors such as irrigation, improved seed varieties, availability of fertilizers, and plant safety chemicals; Institutional factors such as land reforms, consolidation of holdings, loan facilities, price structure, procurement policies and storage facilities (Shafi, 2006). Climate plays an important role in determining the current cropping pattern. By the time crops are sown, harvests are harvested and stored; they are more or less at the mercy of the climate. Any abnormalities in the climate during the growing season, such as delays in rain outbreaks, dry spells or the arrival of rain, too high or too low temperatures severely affect crop growth and final yield. The crop pattern varies from region to region due to the variation of terrain, slope, temperature, quantity and rainfall reliability, soil, availability of water for irrigation, use of fertilizers, pesticides and mechanization. The change in cropping pattern refers to the change in the proportion of area under different crops at two different times. Such changes, though governed by ecological status, also determine socio-economic and technical factors as to which crop the farmer will choose. Therefore, the ensuring clause relates to cropping method and replaces them especially for individual crops in the region and especially for irrigated crops. This chapter outlines the overall cropping pattern of the study area, followed by a discussion of the area under individual crops. The change in the use of agricultural land is the change in the proportion of area of different crops at two different times (Pawar, 1989). The ratio of area under different crops at one time means the cropping pattern of that area. When the area under different crops changes at two different times, it is called a change in the cropping pattern. Agriculture occupies a key position in the Indian economy because it contributes to over-all economic growth by supplying of food, raw materials and exports. Cropping patterns have changed and attention of farmers has shifted to the cultivation of more remunerative crops. Coarse grained crops have been replaced by more remunerative crops. Thus, by and large, monetary returns per hectare yield have increased to a considerable extent (Thakur, 1992).

Cropping pattern in Mahrajganj of Rae Bareilly is shown in Table 4. About 3/4th gross sown area was reported under cereals crops while food grains crops accounted for 77.25 per cent against gross sown area. About 3 per cent area was reported under pulses while about one per cent area was reported under oilseeds crops. The propotion of area under pulses was recorded high in Mahrajganj block (6.79 per cent) similarly, area under oilseeds crops and vegetables was recorded comparatively high in Maharajganj block.

Table 4: Cropping Pattern in Mahrajganj of Rae Bareilly

Particulars	Bachharanwa	Shivgarh	Mahrajganj	Total	District
Gross Sown Area	49262	20567	21999	91828	370059
(%)	100.00	100.00	100.00	100.00	100.00
Rice	13734	11116	11413	36263	122515
(%)	27.87	54.05	51.88	28.60	33.11
Wheat	12900	7756	10788	31444	173154
(%)	26.19	37.71	44.04	34.24	46.79
Barely	195	30	50	275	1984
(%)	0.39	0.15	0.22	0.299	0.54
Jowar	22	12	35	69	4632
(%)	0.04	0.06	0.16	0.07	1.25
Bajara	20	20	-	40	473
(%)	0.04	0.09		0.04	0.13
Total Cereals	26871	18934	22286	68091	302792
(%)	54.55	92.06	10130	74.15	81.82
Total Pulses	742	609	1494	2845	28733
(%)	1.50	2.96	6.79	3.09	7.76
Total Food Grains	27613	19543	23780	70936	331525
(%)	56.05	95.02	108.09	77.25	89.59
Total Oilseeds	358	361	452	1171	11898
(%)	0.73	1.75	2.05	1.27	3.21
Sugar Cane	35	20	51	106	1731
(%)	0.07	0.09	.023	0.11	0.47
Potato	63	55	91	209	4969
(%)	0.13	0.27	0.41	0.23	134
Onion	56	6	18	80	313
(%)	0.11	0.03	0.08	0.09	0.08
Other Vegetables	264	260	299	823	9117
(%)	0.54	1.26	1.36	0.89	2.46

Source: Zilla Sankhakiya Patrika, Rae Bareilly

Production of major crops in Rae Bareilly is shown in Table 5. There has been significant growth in production of major crops in the district during 2014-15 to 2016-17. However, the production of rice has significantly declined over the period (23.92 per cent).

Table 5: Production of Major Crops in Rai Bareli (Metric Ton)

Crops	2014-15	2015-16	2016-17
Rice	286478	247541	217939
Wheat	280322	329963	438200
Barley	2716	1291	10279
Jowar	3351	2724	3779
Bajara	482	622	985
Maize	48	61	430
Total Cereals	573398	582203	671612
Urd	3717	3049	4654
Moong	429	630	567
Gram	1046	255	6964
Masoor	27	39	36
Pea	1935	2519	2487
Arhar	1089	1493	3508
Total Pulses	8243	7985	18216
Lahi/Mustard	4276	2657	4568
Ground Nut	264	166	299
Total Oilseeds	5434	5675	6708
Sugar Cane	94069	91518	191189
Potato	68841	65285	68485

Source: Zilla Sankhakiya Patrika, Rae Bareilly

Productivity of major crops in Rae Bareilly is shown in Table 6. The productivity of major crops has significantly increased in the district over the period of 2014-15 to 2016-17. However, there was no productivity of urad and moong during 2016-17 due to crop failure. Similarly, the productivity of jowar and ground nut recorded negative growth,

Table 6: Productivity of Major Crops in Rae Bareilly (Quintal/Hectare)

Crops	2014-15	2015-16	2016-17
Rice	23.38	21.26	24.07
Wheat	16.19	19.69	32.77
Barley	13.69	8. 77	27.38
Jowar	7.23	6.18	6.32
Bajara	10.19	11.68	14.24

Maize	14.55	17.04	19.00
Urd	2.33	1.82	0.00
Moong	3.49	4. 88	0.00
Gram	1.89	0.51	8.36
Masoor	5.46	7.83	7.14
Pea	9.46	12.32	11.96
Arhar	2.78	3.88	7.07
Total Pulses	2.76	2.76	6.07
Lahi/Mustard	6.05	3.76	6.58
Ground Nut	3.97	2.72	3.08
Total Oilseeds	4.57	4.50	6.20
Sugar Cane	543.44	537.08	561.00
Potato	138.54	139.26	176.01

Source: Zilla Sankhakiya Patrika, Rae Bareilly

Irrigation development plays an important role in agriculture for irrigation development as triggered by the use of yield stimulating inputs such as HYV of seeds and chemical fertilizers to encourage farmers to adopt advanced farming techniques and advanced farming practices. Irrigation helps in diversifying crop patterns in favor of remunerative crops and increasing the intensity of the crop (Dhawan, 1988). Recent studies suggest that, irrigation will have to play a large role in achieving higher yields per unit area and ensuring national food security (G0I 1999; Bhaduri et al., 2008). The dependence of modem agriculture on groundwater irrigation has increased manifold. Irrigation is the practice of applying water to soil to supplement natural rainfall and to provide moisture for plant growth (Weisner, 1970). It enhances the benefits of modern inputs applied in farming, enables an improved crop rotation, diversification, mixed farming practices, reduces crop production volatility and increases agricultural employment (FAO, 1969). The rapid expansion of irrigation and drainage infrastructure has been a major contribution to agricultural development.

Source of irrigation in Mahrajganj of Rae Bareilly is shown in Table 7. Canals are major source of irrigation in tehsil (59.11 per cent). It was reported more pronouncing in Shivgarh Block (70 per cent). Private tubewells accounted for about 40 per cent share in net irrigated area. It was found more pronouncing in Bachharawan block (44.99 per cent).

Table 7: Source of Irrigation in Mahrajganj of Rae Bareilly

Particulars	Bachharanwa	Shivgarh	Mahrajganj	Total	District
Net Irrigated Area	12838	10128	11435	34401	205241
(%)	100.00	100.00	100.00	100.00	100.00
Canal	7003	7090	6242	20335	74157
(%)	54.55	70.00	54.59	59.11	36.13
Government Tubewell	57	76	100	233	1570
(%)	0.44	0.75	0.87	0.68	0.76

Private Tubewell	5776	2962	5092	13830	129491
(%)	44.99	29.25	44.53	40.20	63.09
Other	2		1	3	23
(%)	0.01		0.00	0.00	0.01

Source: Zilla Sankhakiya Patrika, Rae Bareilly

Means of irrigation in Mahrajganj of Rae Bareilly are shown in Table 8. The total length of canals was recorded 533 km in tehsil which constituted about 22.37 per cent against total length of the district. The length of canals was reported comparatively high in Bachharawan block. There were 23 government tubewells, however, a number of shallow private tubewells were reported in the tehsil.

Table 8: Means of Irrigation in Mahrajganj of Rae Bareilly

Particulars	Bachharanwa	Shivgarh	Mahrajganj	Total	District
Length of Canals (Km.)	228	141	164	533	2383
No. Government Tubewells	10	2	11	23	392
No. of Wells	340	350	344	1034	5229
Electric Shallow Tubewells	127	29	576	532	9082
Shallow Diesel Tubewells	5096	4885	3947	13928	77317
Other Shallow Tubewells	120	30	100	250	609
Total Shallow Tubewells	5343	4944	4623	14910	87008
No. of Medium Depth Tubewells	330	200	210	740	3389

Source: Zilla Sankhakiya Patrika, Rae Bareilly

Dynamic ground water resources in Mahrajganj of Rae Bareilly are shown in Table 9. The state of ground water development during 2009 was recorded 77.06 per cent in tehsil however; it was recorded high in Bachharawan development block (84.86 per cent. There has been significant changes in ground water resources in recent period as ground water table is gradually declining and traditional train water harvesting structures such as open wells, ponds, lakes etc. are being degraded.

Table 9: Dynamic Ground Water Resources in Maharajganj of Rae Bareilly

Particulars	Bachharanwa	Shivgarh	Mahrajganj	Total	District
Net Annual Ground Water Availability (in Hectare Meter)	5835.81	4581.82	5165.11	15582.74	98303.63
Existing Gross Ground Water Draft for All Uses	4952.40	3374.25	3681.04	12007.69	74480.13
Provision for Domestic and Industrial Requirement Supply for 2025	506.23	356.38	443.73	1306.34	7772.61
Net Ground Water Availability for Future Irrigation Development	724.02	1104.91	1346.36	3175.29	19903.75
State of Ground Water Development (Percentage)	84.86	73.64	71.27	77.06	75.76

Source: A. K. Bargava (2009) Ground Water Brochure Raebareli District, U.P.

Agricultural mechanization or technological development is regarded as sinequa- non to reduce human drudgery and enhances the agricultural productivity. During the post-green revolution period, the impact of farm mechanization on agricultural production has been well recognized in India. With faint mechanization, agricultural production and productivity has witnessed three to four-fold increase (Velma, 2012). Growth in irrigated area with high tractor density has a direct impact on crop intensity. The intensity of the crop has increased with the inclusion of tractors in farming. The use of tractors and tube wells is of greater importance in crop intensity than the use of bullock carts and canal irrigation. Farmers who have tractors and use them for high average crop intensity (Aggarwal, 1983; Nandal and Rai, 1986). The contribution of mechanization in agriculture in collaboration with irrigation and biological and chemical inputs of HYV, fertilizer and pesticides is well recognized in increasing crop production. Therefore, three variables relate to fertilizer consumption, number of private tube wells and pumping sets, and number of tractors per thousand hectares. The gross cropped area was put together to achieve the level of technological development in the districts of the state.

Agriculture equipments and tools in Mahrajganj of Rae Bareilly are shown in Table 10. Farm mechanization is important to increase the agricultural productivity and improving efficiency in cultivation of crops. However, as per information, a large number of small and marginal farmers are still using traditional agricultural equipments for cultivation of crops. There were significant number of other agricultural equipments such as threshing machines, harrow and cultivators. Farmers are also hiring tractors for cultivation of land, transportation of agriculture produce and threshing of crops.

Table 10: Agriculture Equipments and Tools in Mahrajganj of Rae Bareilly

Particulars	Bachharanwa	**Shivgarh**	**Mahrajganj**	**Total**	**District**
Wooden Plough	5224	3485	4498	13207	78791
Iron Plough	2037	1782	439	4258	29333
Harrow and Cultivator	6406	3367	1233	11006	70996
Threshing Machine	1180	909	372	2461	15759
Improved Sowing Equipments	22	42	54	118	165

Source: Zilla Sankhakiya Patrika, Rae Bareilly

Distribution of fertilizers in Mahrajganj of Rae Bareilly is shown in Table 11. Farmers are using nitrogen and phosphorus as chemical fertilizers in tehsil. However, use of nitrogen was reported mainly in rabi and kharif crops such as wheat and rice. The use potash was reported to below.

Table 11: Distribution of Fertilizers in Maharajganj of Rae Bareilly (MT)

Particulars	Bachharanwa	Shivgarh	Mahrajganj	Total	District
Nitrogen	2598	1078	2067	5743	29613
Phosphorus	843	367	772	1982	11607
Potash	494	101	75	670	2435
Total	**3935**	1546	2914	8395	43655

Source: Zilla Sankhakiya Patrika, Rae Bareilly

Animal husbandry is an important agriculture sub-sector of Indian economy. It significantly contributes to the agricultural GDP in India (Iqbal 2013). In the absence of fertile lands and assured irrigation which are controlled by a small population of rich farmers and lack of employment in the industrial and service sectors, most of the rural families belonging to socio- economically weaker sections of the society maintain different species of livestock to supplement their income. (Hegd. 2006). When abundant fodder is available, livestock can be considered a form of wealth, power, and protection, a belief that is based on the conversion of solar energy into products (biomes) valuable to human society. Livestock is an important source of income and employment in rural areas. In addition to agricultural power, it provides balanced nutrition in the form of milk, poultry and meat. .Animal husbandry plays a major role, especially in providing self-employment with high participation of women. The increase in demand and supply of livestock and livestock products grew globally as a sequel to increasing urbanization, increased population growth, as well as improvements in income levels, lifestyle changes and high-calorie food consumption. A variety of livestock species such as cattle, buffalo, goat, sheep, poultry and pig were reared as domestic and subsistence animals (Khan, 2012). There are many ways in which animal husbandry is practiced; Mixed farming, nomadic herring, and commercial grazing and so on. Livestock rearing not only involves keeping and feeding animals, but also includes the marketing, raising and processing of milk or milk products for the marketing of livestock, rearing animals and marketing them to get maximum remuneration (Khan, et al. 2013).

Infrastructure plays a strategic role to create large multiplier effects in the economy with development in agriculture (Mellor, 1976). Transaction costs and rural marketing costs are linked to the agricultural sector in better rural infrastructure. The benefits generated by these activities are known as 'indirect benefits' of irrigation investments (Bhattarai *at al.,* 2002. Rural roads speed up the process of transformation of agriculture by connecting the surrounding places and facilitate the transportation of agricultural inputs at very low rates. As a result, farmers receive incentives to promote all types of agricultural production (Mohannnad, 1992 and Majutndar, 2002). Development of transportation facilitates access to fertilizer selling points, markets, credit facilities and expansion facilities (Thorat and Sirohi, 2002). Variables of rural infrastructure such as cooperatives and banks have played an important role in enhancing agricultural development. Primary agricultural cooperative credit societies play an important role in providing credit to weaker sections of rural society and helping in the practice of intensive agriculture to promote agriculture, including the distribution of seeds and fertilizers (Shaft and Aziz, 1989) . Institutional lending reduces the reasonable savings-capital gap for poor farmers by reducing the high interest rate in rural areas and extending the repayment period, which is essential for investment in minor irrigation works (Dhawan, 1979) .

Agricultural facilities in Mahrajganj of Rae Bareilly are shown in Table 4.21. The tehsil has vast network of cooperative seed stores, fertilizer sales centres, and agriculture seed stores, agriculture godowns besides private agricultural shops for seeds, fertilizers, pesticides and agricultural equipments.

Table 12: Agricultural Facilities in Mahrajganj of Rae Bareilly

Particulars	Bachharanwa	Shivgarh	Mahrajganj	Total	District
No. of Cooperative Seed Stores	10	7	8	25	160
No. of Agriculture Seed Store	-	1	-	1	23
Other Seed Store	32	21	28	81	549
Cooperative Fertilizer Sale Centre	11	8	8	27	175
Agriculture Fertilizer Sale Centre	-	1		1	17
Other Fertilizer Centre	61	73	58	192	1064
Cooperative Rural Godown	20	15	16	51	312
Agriculture Godown	-	1	-	1	18
Other Godown	-	-	-	-	90
Total Godown	20	16	16	52	420
Capacity of Total Rural Godown (MT)	1000	800	800	2600	17650
No. of Cold Storage	1	-	-	1	58
Capacity of Cold Storage (MT)	7287	-	-	7287	255247
Agriculture Centre (Agro and Other)	-	-	-	-	2
Agriculture Production Marketing Committee	1	-	-	1	6
No. of Biogas Plant	500	389	559	1448	7847

Source: Zilla Sankhakiya Patrika, Rae Bareilly

CONCLUSION

The analysis shows that Mahrajganj tehsil of Rae Bareilly district has comparatively large proportion under cultivation of agricultural crops. The proportion of irrigated area against gross cropped area was also recoded significant. The major sources of irrigation are canals and private tubwell while Rabi and Kharif are main agricultural crops. However, there is still high dependence on tradional crops such as whea and rice. The area under pulses, oilseed and sugarcane crops was recorded low. Thus, there is need to increase the acreage under commercial and high valued crops with diversification of agricutlre in order to create employment opportunities in agriculture sector. The tehsi has also sufficient agricultural facilities and network of cooperatives for facilitating farmers. The road connectivity, availability of electricity and irrigation facilities provide favaourable environment for agriculture development .

References

Bhaduri, A., Amarasinghe, U. and Shah, T. (2008). Groundwater Expansion in Indian Agriculture: Past Trends and Future Opportunities. In: India's Water Future: Scenarios and Issues (Eds. U.A. Amarasinghe, T. Shah and R.P.S. Malik), IWMI, Colombo, Sri Lanka, pp. 181-196.

Bhattarai, M., Sakihivadivel, K. and Hussain, I. (2002). Irrigation Impacts on Income Inequality and Poverty Alleviation: Policy Issues and Options for Improved Management of Irrigation Systems,

Working Paper 39, IWMI, Colombo, Sri Lanka.

Dhawan, B.D. (1979). Trends in Tubewell Irrigation: 1951-78, Economic and Political Weekly, Vol. 14, No. 51/52,

Dhawan, B.D. (1988). Indian Irrigation: An Assessment, Economic and Political Weekly, Vol. 23, No. 19, pp. 965-967, 969-971.

Diddee J., et. al. (Ed.) (2002): Geography of Maharashtra, Rawat Publication, Jaipur and New Delhi, pp. 163.

FAO (1969). Smaller Farmlands Can Yield More: Raising Agricultural Productivity by Technological Change, Rome.

Giri, R. (1966), "Changes in Land Use Pattern in India" Indian Journal of Agricultural Economics, Vol.21, No.3, July-September, pp. 23-32.

GOI (2011). Annual Report 2010-2011, Department of Agriculture and Cooperation, Ministry of Agriculture, GOI, New Delhi.

Government of India (1999). Integrated Water Resource Development: A Plan for Action, Report of the National Comnussion on Integrated Water Resources Development, Vol. I, Ministry of Water Resources, New Delhi.

Hegde, N.G., (2006). Livestock development for sustainable livelihood of small farmers, Souvenir of the 39th annual general meeting and 48th national symposium on "Energising Rural India – A Challenge to Livestock Industry". Compound Livestock Feed Manufactures Association of India (CLFMA), Manesar, Haryana. pp. 50-63.

Husain, Majid (1996): Systematic Agricultural Geography, Reprinted 2007, Rawat Publication, Jaipur and New Delhi, pp. 217, 218

Hussain Majid (1996) "Systematic Agricultural Geography" Tata Mcgraw –Hill Publication New Delhi, Pp 256-264.

Iqubal, M.A., (2013). Livestock husbandry and environmental problems, International journal of scientific and research publications, vol. 3, issue 5.

Khan, N., & Iqubal, M.A., (2011). Livestock trade in rural markets of Aligarh district, Journal of Economics and Sustainable Development, vol. 2, No. 8

Khan, N., & Iqubal, M.A., (2011). Livestock trade in rural markets of Aligarh district, Journal of Economics and Sustainable Development, vol. 2, No. 8.

Khan, N., khan, M.M. and Rehman, A., (2009). Livestock husbandry, rural workforce and employment generation: a case study, The Geographer, vol. 56, No. 2.

Khan, N., Rehman, A. and Salman, S., (2012). Pattern of livestock husbandry in Mahamaya Nagar, the Geographer, vol. 59, No. 1.

Khan, N., Rehman, A. and Salman, S., (2013). Impact of livestock rearing on the socio-economic development in North India, Forum Geografic, volume XII, issue 1, pp. 75-80.

Lilles, Thomas M ,Kiefer, Ralph W, (2002) Remote Sensing and Image Interpretation, John Wiley and Sons, Inc. New York, 4th Edition

Majumdar, R. (2002). Infrastructure and Economic Development: A Regional Analysis, CSRD/SSS, Jawaharlal Nehru University, New Delhi.

Mellor, J.W. (1976). The New Economics of Growth: Strategy for India and the Developing World, Cornell

University Press, New York, USA.

Mohammad Ali (1978): Studies in Agricultural Geography. Rajesh Publication, New Delhi, p.-30, pp. 82-88.

Mohammad, N. (Ed.) (1992). Spatial Dimensions of Agriculture, Concept Publishing Company, New Delhi.

Nadkarni, M.V., Deshpande, R.S. (1979): 'Under Utilization of Land-Climatic or Institutional Factors', Indian Journal of Agricultural Economics, Vol. 34, No. 2, pp. 1-16.

Nandal, D.S. and Rai, K.N. (1986). Impact of Farm Mechanization on Farm Productivity and Income in Haryana, Haryana Agricultural University, Hissar.

Pandey, V.K. and S.K.Tewari (1987), "Some Ecological Implications of Land Use Dynamics in Uttar Pradesh", Indian Journal of Agricultural Economics, Vol.42, No.3, July-September.

Pandey, V.K. and S.K.Tewari (1996), "Regional Agricultural Land Use – A Sectoral Aggregate View", Indian Journal of Agricultural Economics, Vol.51, No.1 and 2, January-June, pp.260-269.

Pawar, C.T. (1989): Impact of Irrigation-A Regional Perspective, Himalaya Publishing House, Bombay, p.68.

Ramasamy C, et. al (2005) Dynamics of Land Use Pattern with Special Reference to Fallow Lands – An Empirical Investigation in Tamil Nadu, Indian Journal Of Agricultural Economics, Vol. 60, No. 4, Oct.-Dec

Reddy, Ratna V. (1991), "Under-utilization of Land in Andhra Pradesh: Extent and Determinants", Indian Journal of Agricultural Economics, Vol.46, No.4, October-December, pp.555-567

Shafi, M. and Aziz, A. (Eds.). (1989). Food Systems of the World, Rawat Publications, Jaipur.

Shafi., Mohommad (2006): Agricultural Geography, Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education in South Asia, New Delhi,p. 287.

Sharma , A.C et. al (2019) Analysis of Land Use And Availability of Agricultural Land: A Case Study of Tehsil Maharajganj, District Raebareli, U.P., Journal of Global Resources Volume 5 (02) July

Sharma, T.C. (1999): Technological change In Indian Agriculture. A Regional Perspective, Rawat Publications, Jaipur and New Delhi.p.68.

Sharma, U.K. and V.K.Pandey (1992), "Dynamics of Land Use in Different States of India", Agricultural Economics Research Review, Vol.5, No.1, January-June.

Shinde, S. D., Jadhav, M.G., More, K.S.and Pawar, C.T. (1987): Landuse Pattern and Landuse Capability Studies In South Maharashtra's Western Ghats. Project Report, Sponsered by Deptt. Of Env. And Wild Life, Govt. of India, New Delhi, pp.1, 2.

Shinde, S.D.,(1980) : Agriculture in an underdeveloped Region: A Geographical Survey, Himalaya Publishing House, Bombay, p.25

Singh, P. and A.K.Vashist (1997), "Dynamics of Land Use Pattern in Bihar", Agricultural Situation in India, Vol.53, No.11, February

Study based on Punjab. Allied Publishers, Delhi School of Economics: Monograph in Economics, India, No.6. 2.

Thakur, R. (1992). Patterns of Agricultural Growth in Bihar. In: New Dimensions in Agricultural Geography: Dynamics of Agricultural Development (Eds. N, Mohammad), Vol. 7, Concept Publishing Company, New Delhi, pp. 97-126.

Thorat, S. and Sirohi, S. (2002). Rural Infrastructure: State of Indian Farmers, A Millennium Study,

Ministry of Agriculture, GGI, New Delhi.

Verma, S.R. (2012). Impact of Agricultural Mechanization on Production,Productivity, Cropping Intensity Income Generation and Employment of Labour. In: Status of Farm Mechanisation in India - A Document Published by the Department of Agriculture and Cooperation, Ministry of Agriculture

Weisner, C.J. (1970). Climate, Irrigation and Agriculture: A Guide to the Practice of Irrigation, Angus and Robertson, Sydney.