

## An Assessment and Management of Cultivable Wastelands for Sustainable Agricultural Development: A Case Study of District Rae Bareli, U.P., INDIA.

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### Abstract

India is a predominantly an agrarian country, about 70 percent of its rural working force earns its livelihood directly from agricultural resources. It is misfortune that the land resource is gradually becoming scarce due to rapidly increasing growth of population. The problem is further compounded because of miss-utilization of land resulting in severe degradation. It is thus imperative that all available land be put to optimum use, the hitherto degraded land be properly utilized and the cultivable wastelands reclaimed. In order to reclaim the cultivable wastelands and put to profitable use, it is essential that such degraded lands be accurately identified at micro-level with a view to establish their ownerships for sustainable agricultural development.

In the present study, an attempt has been made to assess the nature and types of existing cultivable wastelands, highlight the issues and problems associated with them and to provide a fruitful discussion and suggest reclamation measures for their sustainable management and conservation. For providing a detailed insight of cultivable wastelands, district Rae Bareli, Uttar Pradesh, has been chosen as a case study. In order to fulfill the above objectives relevant data have been procured from revenue office of Rae Bareli district at block level and primary data on such aspects is generated by conducting interaction and interviews with the local people in various villages of the study area. Out of the total reporting area of 4,54,370 hectares, about 1,30,020 hectares (28.62 percent) has been recorded as cultivable wastelands, which is almost one third of the total area. Based on physical and chemical features, cultivable wastelands of the district can be classified into eight categories namely fallow lands, garden and groves, pasture lands, land affected by salinity/alkalinity, surface waterlogged area, ravinous land, sand accumulated land and brick kilns field. The reclamation of cultivable wastelands will have to be taken up based on local soil and terrain characteristics, for which detailed field survey is needed. There is an urgent need to provide a package of the reclamation technology, finance and informative education, time to time for systematic cultivation, adequate irrigation, construction of check dams, ponds and drain for surface water logged area etc.

**Key Words:** U.P. (Uttar Pradesh), cultivable Wastelands, sustainable agriculture, reclamation

### I. Introduction

One of the fundamental problems facing the world today is the rapidly increasing pressure of population on land resources. So land is an important aspect of geographical

studies and the progress of an area can be measured to certain degree by the way which its land is used and maintained (Prakash Rao, 1986). Land is the basic unit of all material production which has to be used very

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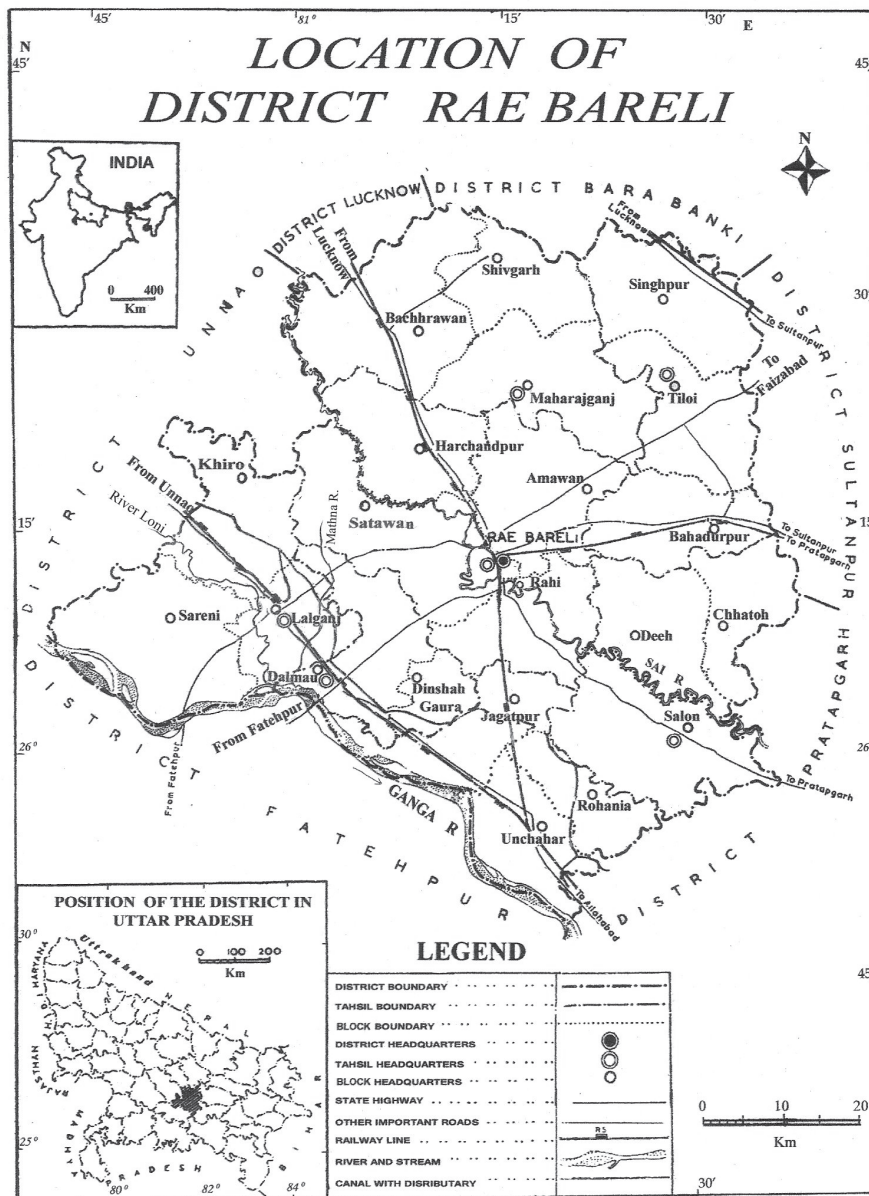


Fig. 1: Location of District Rae Bareli, Uttar Pradesh, India

judiciously to meet various competing demands. Expanding human requirements and economic activities are place ever increasing pressures on land resources, and the land resources are gradually becoming scarce. The problem is further compounded because of miss-utilization of land resulting in severe degradation. It is thus imperative that all available land be put to optimum use, the hitherto degraded land be utilized and the cultivable wastelands reclaimed. In order to reclaim the cultivable wastelands and put to profitable use, it is essential that such degraded lands be accurately identified at micro-level with a view to achieve the goal of sustainable agricultural development.

The land resources are over exploited to meet the growing demand of increasing population and over

consumption. Improvements in the standard of living and income have further aggravated the problem of over exploitation of land resources. The direct impact of this is degradation and pollution of environment which has its effect on the all spheres of human life as well as natural environment. So the cultivable wastelands assessment and management has become most important in the context of present situation. The present paper is an attempt to analyze some aspects of cultivable wastelands for sustainable agricultural development by taking empirical evidence of district Rae Bareli in the studying of U.P.(Uttar Pradesh), India.

### 1. Geographical Features of the Study Area

The study area district Rae Bareli, located in the Gonti-

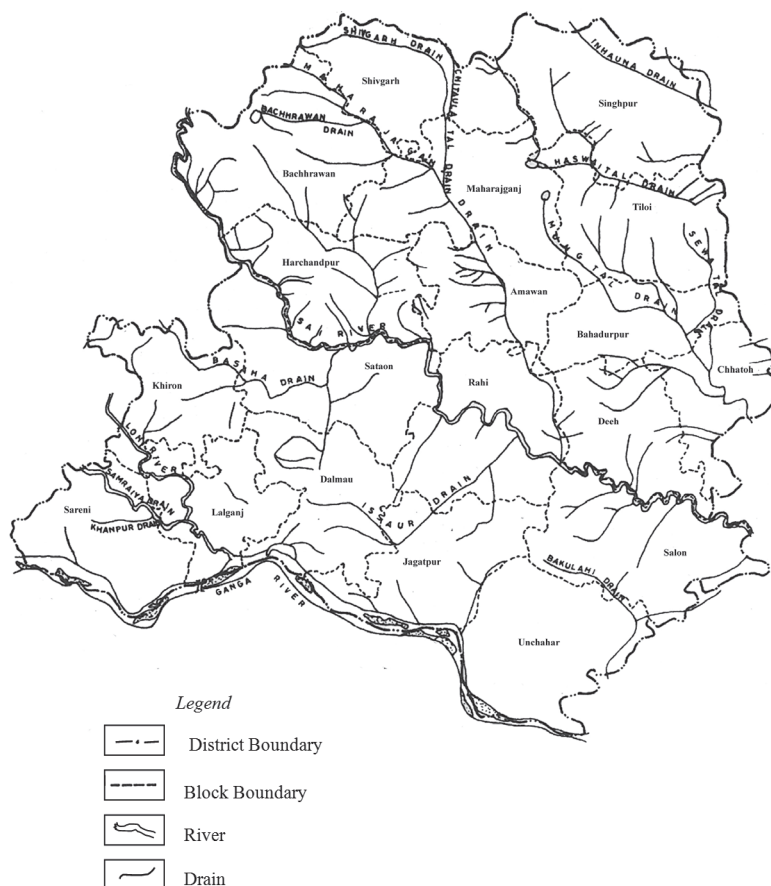


Fig.2: Drainage Network, District Rae Bareilly, Uttar Pradesh, India

Ganges doab, is a part of Indo-Gangetic alluvium between latitudes  $25^{\circ} 41'$  to  $26^{\circ} 36'$  north and longitudes  $80^{\circ} 41'$  to  $81^{\circ} 34'$  east (Fig. 1). Rae Bareilly district forms the southern part of the region which used to be known as *Avadh*. It was also called *kosala-vishaya*, *kosala-mahajanapada* or the *kosala* country. Rae Bareilly was created as a district by the British Government in 1858 and was named after Rae Bareilly town. The district has a long agrarian history and settled life for centuries. Administratively the study area is divided into 7 Tahsils, 21 Development Blocks, 180 Nyaypanchayats and 1733 Revenue Villages.

The district lies in the Ganga Plains and is generally uniform surface with a gentle slope from north – west to south – east, which is the direction in which the rivers drain. The average height ranges from 96 metres along the river Ganga in the south (near Dalmau Town) to 112 meters in the north. The major natural drains in the district are river Sai, river Loni, Samraiya drain etc. all of which are tributaries to the river Ganga. River Sai flows across Rae Bareilly district entering along the north-western border of the Bachhrawan block and leaves the

district from Salon block in the south- east corner (Fig.2). The highest points are the crowns of the watersheds of the streams and rivers which serve to divide the district into six physiographic units (Mehrotra and his associates, 1972) viz., *Ganga Khadar*, *Ganga Recent Alluviums*, *Ganga Flats*, *Sai Uplands*, *Sai Lowlands*, and *Sai Flats*. These physiographic variations have contributed to the development of soil of different physical makeup and chemical characteristics. The soils are coarse textured showing no sign of pedogenic development. The major soil types of the study area are *loam* (43.97 percent), *clay loam* (24.79 percent), *sandy loam* (17.78 percent), *loamy sand* (10.98 percent) and *silt loam* (2.48 percent) soils.

Rae Bareilly district covers an area of 4543.70 km<sup>2</sup> and as per 2011 census (provisional census report) its population was 34,04,004 persons resides in 1733 villages and 9 urban centers which are connected through metalled and un-metalled roads. The literacy rate of the study area is 69.04 percent and density of the area is 749 persons per Km<sup>2</sup>, sex ratio is 941 females per thousand males. The percentage of workers constitutes 35.63

percent (12,12,847 persons) of the total population, the remaining 64.37 percent (21,91,157 persons) constituting non-workers. The total number of marginal workers were 1,77,561 persons (14.64 percent) out of which 1,75,395 persons were rural and only 2,166 persons were urban workers. Cultivators and agricultural labourers constitute the two most important categories of the working force and account 54.35 percent and 16.71 percent respectively of the total workers in the district. Thus about 70 percent of the total working population is engaged in agriculture and allied activities. The remaining working population engaged in household industries (5.12 percent), trade and commerce, construction, transport and communication, manufacturing and other services accounted for about 28.94 percent of the total working force in Rae Bareli district. The region is endowed with edaphophysical and ecological diversity as well as with unique socio-economic and political heritage. Rapid growth of population, human being and livestock, hunger for crop production and other socio-economic activities are increasing the pressure on the land resources, thereby changing the existing land use/cover scenario of the district. The district also suffers with inadequate resources of irrigation, coupled with extremes of temperature, erratic and uncertain rainfall, as well as salt affected land (*usar*), waterlogging, ravinous lands, decreasing soil fertility and undulating topography resulting into poor productivity in the cropped areas.

## 2. Objectives and Methodology

In the present study, an attempt has been made to assess the characteristics and types of existing cultivable wastelands and to suggest fruitful possibilities of its reclamation and management for sustainable agricultural development. In order to fulfill the above objectives relevant data have been procured from revenue office of district Rae Bareli and personal observation at block levels. For effective management of cultivable wastelands the perception of the concern people/farmers is utmost important. So the primary data on such aspects was generated by conducting interaction and interviews with the local people/farmers in various villages of the region. The areal strength together with the percentage of each selected category has been worked out and mapped at block level.

## II. Land Use and Cropping Pattern

Land resources are the most important natural wealth of the any country. Land utilization is the process of exploring the land for a specific objective. The purpose for which land is used to commonly associated with type of cover whether they forested, settlement, water bodies, fallows or agriculture etc. The existing pattern of land use in the region has resulted from process of land exploitation within the frame of physio - climatic - soil complex and is modified by man through his numerous activities. The pattern of land use in time and space directly or indirectly reflects the level of agricultural development in the region. In the study area agriculture is the most important sector of economy as about 71 percent of the area is arable land and employed about 70 percent of the total working population.

In general, the land use of district Rae Bareli is dominated by three major land use categories, namely the cultivated land (58.20 Percent), the cultivable wastelands (28.62 Percent) and the un-cultivated lands (12.33 Percent) that account for more than 99 percent share of the total reporting area. It is interesting to note that these three categories have different land use practices. It is general premise when population pressure increases and agricultural technology intensified, there is off-course, a decrease in cultivated land and increase in cultivable wastelands. It is a matter of great concern that the cultivated land decreases because of inadequate irrigational facilities and much faster development in the economy of the district. For example, new road are being constructed, new towns are emerging, new settlements are being established and new industries / institutions being established (rail coach factories, reliance cement factory, fashion technology, FDDI, Petroleum institute, menthol park, etc.) such activities change the land use pattern. The second dominating category of land use is cultivable wastelands. Since there is an increase of nearly 3.21 percent land under this category (Table 1) from 25.41 percent (2000-01) to 28.62 percent (2011-12).

There is little scope for the horizontal expansion of current cultivated land in the study area. So agricultural planners have advocate for improving the cropping intensity by multiple cropping and augmenting per hectare yield. But since planners have also inherent task to determine the optimum use of the land in the national

interest from every acre of the surface (Stamp, 1962), guidelines have been proposed to cultivate fallow lands and reclaim the other cultivable wastelands for agricultural purposes.

Table 1: Changing patterns of Land Use, District Rae Bareli.

Land use categories	Area (in ha.)		Percent		Change (percent)
	2000 - 01	2011 - 12	2000 - 01	2011 - 12	
Forested land	4,986	3,829	1.10	0.85	-0.25
Un-cultivated lands	59,483	55,992	13.09	12.33	-0.76
Cultivable wastelands	115,480	130,020	25.41	28.62	3.21
Cultivated land	274,492	264,529	60.40	58.20	-1.80

Source: Milan Khasara, Revenue Office, District Rae Bareli.

Cropping pattern may be described as the spatial hierarchical arrangement and / or association of crops in a given area at a point of time. A systematic study of crop land utilizations and identification of crop combination regions provides a comprehensive understanding of crop scenario of the region and ultimately it is useful in regional agricultural planning and development. The cropping pattern in the district is dominated by the food grains. Kharif (44.49 percent of GCA) and Rabi (53.19 percent) are the two main agricultural seasons of the district. Rice, maize, pearl millets (*jowar* and *bajra*) are the major crops of the former season, while wheat, peas, gram, barley, potato and mustard etc. are the principal crops of the latter. At the present time *menthol* is only important commercial crop intensively grown in the district. A general view of cropping pattern of the study area reflects that wheat (40.54 percent) or rice (27.34 percent) occupies the first place in every block accounting for over 68 percent of the gross cropped area.

### III. Population Pressure on Land Resources

India is not short of land, water, solar energy, and other environmental blessings along with large human resources. As a matter of fact we are surviving and bearing our big population pressure mainly with the assistance and gifts of nature. Our problem is not availability of resources, our problem is rapidly increasing growth of population and productive land base has been shrinking. With a given land area,

population growth has the effect of reducing the man-land ratio and it can be eased by making rational utilization of the available resources. Each person has need for food, water, shelter, transportation etc. all having its impact on land resources. The area of agricultural land per capita reflects the population pressure on land resources and is an indicator of land stress. It is difficult, however, to decide how much land area a person requires for sustenance, without considering the characteristics of the land resources like relief features, soil types and fertility status, climatic conditions, types of land use, irrigational intensity, cropping intensity, organizational measures etc.

Some standards have been worked out by different scholars to give an idea of the sufficiency of land to meet the needs of the population. Meadows et al. (1972) have the opinion that 0.4 ha of per capita cultivated land is necessary for sustenance. The minimum amount of cultivated land is necessary for sustainable food security, with a diversified diet similar to those of America (USA) and Western Europe is 0.5 ha per capita, said Norman Myers (1999). Since the calorie intake of people in the western countries is much more than that in India and since they require only 0.5 ha of land per capita (Mukherjee, 2000).

Hence, in this paper, one acre of cultivated land, which is equivalent to 0.4 ha, is taken as the absolute minimum requirement per person. In the study area, in all development blocks, availability of per capita cultivated land ranges between 0.051 (Rahi block) to 0.129 ha (Chhatoth block) in 2001 and 0.039 (Rahi Block) to 0.107 ha (Harchandpur Block) in 2011 (Table 2 & Fig. 3). Out of total reported area (454,370 ha), only 12.33 percent area comes under non-agricultural area, 28.62 percent (1,30,020 ha) cultivable wastelands and 58.20 percent (2,64,529 ha) area is available for cultivation in the study area. The per capita availability of land resource is 0.134 ha only while at block level it ranges between 0.071 (Rahi Block) to 0.168 ha (Shivgarh block). In Rahi block it is recorded per capita availability of land resources the relatively lowest value is 0.071 ha due to high concentration of urban population (Rae Bareli City) and urban encroachment of agricultural area for residential colonies.

The above mentioned indices are much below national average (0.27 ha/head) and entail the account of

Table2: Trends of Population Pressure on Land Resources, District Rae Bareli

Year	Reporting Area of District (in Ha.)*	Population*	Cultivated Land (in Ha.)**	Cultivable Wastelands (in Ha.)**	Per Capita Land Resource (in Ha.)	Per Capita Cultivated Land (in Ha.)	Per Capita Ag. Area (in Ha.)
1971	456,918	1,510,812	296,256	81,305	0.303	0.196	0.249
1981	455,362	1,886,940	283,080	99,322	0.241	0.15	0.202
1991	453,584	2,310,074	271,967	113,924	0.196	0.118	0.163
2001	454,441	2,872,335	274,492	115,480	0.158	0.096	0.136
2011	454,370	3,404,004	264,529	130,020	0.134	0.078	0.116

Source: \*District Census Handbook, Rae Bareli, Census of India.

\*\*Milan Khasara, Revenue Office, District Rae Bareli.

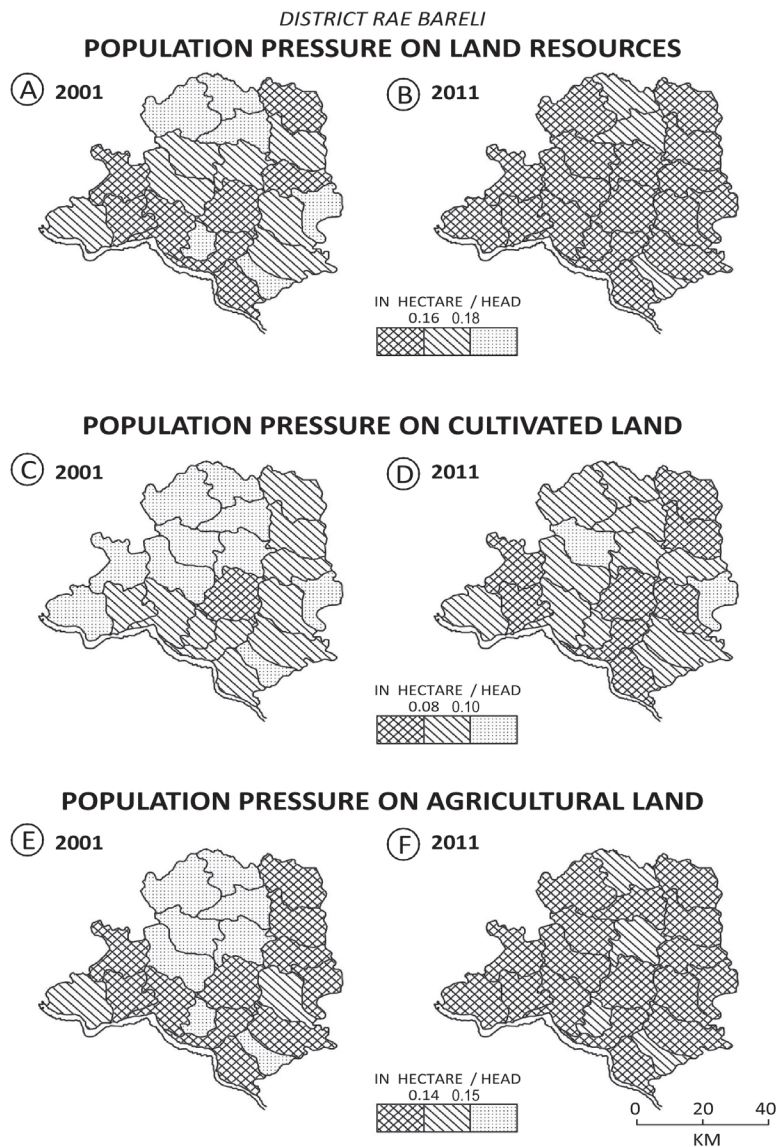


Fig. 3: Trends of Population Pressure on Land Resources, District Rae Bareli, Uttar Pradesh, India

population pressure on the available land resources. It is clear from table, the land resources and cultivated land in 1971 was 0.303 and 0.196 ha per capita respectively, while in the year 1981, 1991, 2001, and 2011, the land resources and cultivated land were decrease to 0.241 and

0.150; 0.196 and 0.118; 0.158 and 0.096; and 0.134 and 0.078 ha per capita respectively. But if farmers and agricultural policies measures can cultivable wastelands reclaimed according to local geographical conditions then certainly cultivated land per capita may increase.

These measures should be ensured in the study area, and then surely the cultivated land may increase 0.116 ha from 0.078 ha per capita (Table 2). Therefore, according to local geographical conditions cultivable wastelands can improve its use for agriculture and allied agricultural activities to ensure sustainable agricultural development. At present there is a pressing need for sustainable land management in order to associate solution for present problems e.g. insufficient land resources, increasing cultivable wastelands, decreasing soil fertility, decreasing per hectare yield, decreasing food production, low income in rural households etc. with the planning towards long term sustainable use of land resources for sustainable agricultural development.

#### **IV. The Cultivable Wastelands**

Cultivable wastelands have become a matter of great concern to academicians, politicians, planners, and decision makers all over the world during last four and half decades. Due to rapid growth of population, the land resource is gradually becoming scarce. Cultivable wastelands denote land considered by present judgment as cultivable but actually not cultivated on account of physical, agronomic, socio-economic and demographic constraints. The National Remote Sensing Agency (NRSA) has defined the wasteland as.... "the lands which are presently lying unutilized or not being used to their optimum potential due to certain constraints." The National wasteland Development Board (NWDB, 1986) identified comprehensive estimation of the status of wastelands in the country, as one of the primary tasks. "Wasteland is defined as that land which is degraded and is presently lying un-utilized except as current fallow, due to different constraints" . Hence, according to Jasbir Singh (1974) the cultivable wastelands comprise the land actually not cultivated during current year and last five years or more in succession, but they are important for future expansion in cultivation. The utilization of cultivable uncultivated land is one of the protective, productive and profitable measures of meeting the national food requirements. Singh and Singh (1970) says that the cultivable wastelands are the potential land which can be brought under plough after reclamation. Singh and Chandel (1998) have expressed the similar view point viz. the more is the percentage of cultivable wastelands, the greater is the scope of extension of

cultivation through sometimes reclamation cost is prohibitive.

In India, there are variety of cultivable wastelands such as forest, pasture, garden /groves, threshing ground, manure pits, cemeteries, cremation ground, ravinous land, lakes, river, ponds etc. which could broadly be grouped into three main categories i.e. land, forest and water. In 1986 (NWDB), the cultivable and non-cultivable wastelands in India was broadly classified in to 13 categories e.g. gullies and/or ravinous land, undulating upland with or without scrub, surface waterlogged and marshy land, land affected by salinity / alkalinity, shifting cultivation area, degraded notified forest land, degraded land under plantation crops, sands, degraded pasture/grazing land, mining/industrial wastelands, barren rocky/stony wastes/sheet rock area, steep sloping area and snow covered and/or glacial area. Based on physical and chemical features, cultivable wastelands of the Rae Bareli district can be classified into eight main categories namely fallow lands, garden/groves, pasture land, land affected by salinity/alkalinity (*user*), surface waterlogged area, ravinous land, sand accumulated land and brick kilns field. There are lands like cultivable wastelands which are saline/alkali land, ravinous land, surface waterlogged area, sand accumulated land and brick kilns field they cannot be used easily for cultivation because of quite expensive land reclamation. On the other hand fallow lands, garden/ groves and pasture land can be easily reclaimed and brought under proper cultivation. These constituents of cultivable wastelands altogether occupy about 28.62 percent (1,30,020 ha) of the total reporting area of district. Undoubtedly it is huge land resource which needs to be conserved and managed properly in order to fulfill the gap in the supply of the basic needs of food, fuel and fodder in our country. And, it could be done more efficiently by identification, delineation, proper utilization and sustainable management of this category of resource especially by participatory management practices.

#### **V. Regional Patterns and Characteristics of Cultivable Wastelands**

The cultivable wastelands cover more than 28 percent (1,30,020 ha) of the total reporting area of the district. Out of this, fallow lands occupy about 19.67 percent

which is more than 68 percent of the total cultivable wastelands of the district. The remaining 8.95 percent is covered by garden/groves, pasture land, land affected by salinity/alkalinity (*user*) and other cultivable wastelands, which together occupy about 32 percent of the cultivable wastelands of the district (Table.3).

The spatial distribution of cultivable wastelands is not uniform throughout the district and it ranges from 18.36 percent (Harchandpur Block) to 39.63 percent (Jagatpur Block). On the basis of the percentage strength of cultivable wastelands the district has been divided into three regions (Table.3 and Fig.4). The area of highest concentration having more than 30 percent area is in 9 blocks viz. Jagatpur (39.83 percent), Deeh (39.03 percent), Shivgarh (36.24 percent), Dinshahgaura (34.51 percent), Bachharawan (33.97 percent), Uchahar (32.87 percent), Maharajganj (31.26 percent), Amawan (30.59 percent) and Singhpur (30.49 percent). Physical factor are the fundamental reasons for such a higher concentration. The moderate areal coverage of cultivable wastelands is found in 7 blocks viz. Rohnia (29.48 percent), Sareni (29.44 percent), Rahi (29.11 percent), Satawn (28.76 percent), Bahadurpur (26.09 percent), Tiloi (25.58 percent) and Khiron (25.39 percent). The area of low concentration with less than 25 percent areal coverage is mostly, found 1 block in central part, 2 blocks in western part and 2 blocks in south - east part of the district. This is the fertile irrigated agricultural tract of the district. By and large, the lower percentage of cultivable wastelands is in those blocks which have higher percentage of cultivated land. In following paragraphs the existing cultivable wastelands of the study area has been discussed in detail.

### 1. Fallow Lands

Fallow land denotes all those lands which are generally used for cultivation but are temporarily out of cultivation for a period not less than one year and not more than five years. Because of the great scarcity of arable land the practice of fallowing is reduced to a minimum in this region. The fallow lands have been divided into two categories i.e., old and new fallow, depending upon the period they are left vacant. The old fallow lands (land lying uncultivated for more than two years) are the degraded land through inference of natural (drought, famine, floods, soil erosion etc.) and social (litigation,

family partition, improper management of cultivation etc.) disturbances. They are also used as common land such as threshing grounds and play grounds or for other social activities. The old fallows occupy about 2.21 percent (10,042 ha) of the total area of the district.

The occurrence of new fallow (land lying uncultivated for less than two years) on the other hand might be due to lack of irrigation and other agricultural resources on the part of poor peasants as well as there are land owners who possess lands beyond their tilling capacity and therefore do not care to bring all their land under plough. Sometimes wild animals (blue bull, monkey, peacock etc.) destroy the crops in the very beginning and thus make the land fallow. The new fallows occupy an area of about 17.45 percent (79,315 ha) of the total area of the district and usually common in each and every block with varying intensity depending upon the need of agricultural land and available facilities.

The fallow lands occupy about 19.67 percent (89,357 ha) of the total area of the district. The spatial distribution of the fallow lands is depicted in the Fig.4A, which shows uneven and widely scattered distribution except in case of region of higher concentration with more than 50 percent areal coverage. It includes 9 blocks in south-eastern part of the district and Sareni and Shivgarh block in west-south and north respectively (Fig.4 A). Drought and improper management of irrigation system are the basic factors of higher concentration of the fallow lands. The moderate concentration ranging from 50 to 60 percent is found in 6 blocks widely scattered distribution pattern. The area of low concentration with less 50 percent is found only in 4 blocks. By and large, the lower percentage of fallow lands is in those blocks which have good irrigational facilities and other agricultural infrastructure.

### 2. Garden and Groves

According to the world land use classification, garden and groves come under horticulture (Valkenburg,1950). But garden and groves are included in the cultivable wastelands because they are garden and groves only in name. Generally there are only 5 to 10 trees standing over an acre of land which do not serve the purpose of garden/groves and at the same time disturb the cultivation of the plot. They are being maintained in this



Table 3: Type of Cultivable Wastelands, District Rae Bareli, 2011-12.

Categories of Cultivable Wastelands	Area (in Ha.)	Percentage to Reporting Area of the district	Percentage to total Cultivable Wastelands
Fallow Lands	89,357	19.67	68.73
Garden/Groves	12,482	2.75	9.60
Pasture Land	3,821	0.84	2.94
Land affected by Salinity/Alkalinity	7,686	1.69	5.91
Water Logged Area	6165	1.36	4.74
Ravinous Land	1171	0.26	0.90
Sand Accumulated Land	75	0.02	0.06
Brick Kilns Field	368	0.08	0.28
Other Cultivable Wastelands	8895	1.96	6.84
Total of District	1,30,020	28.62	100.00

Source: Milan Khasara, Revenue Office, District Rae Bareli.

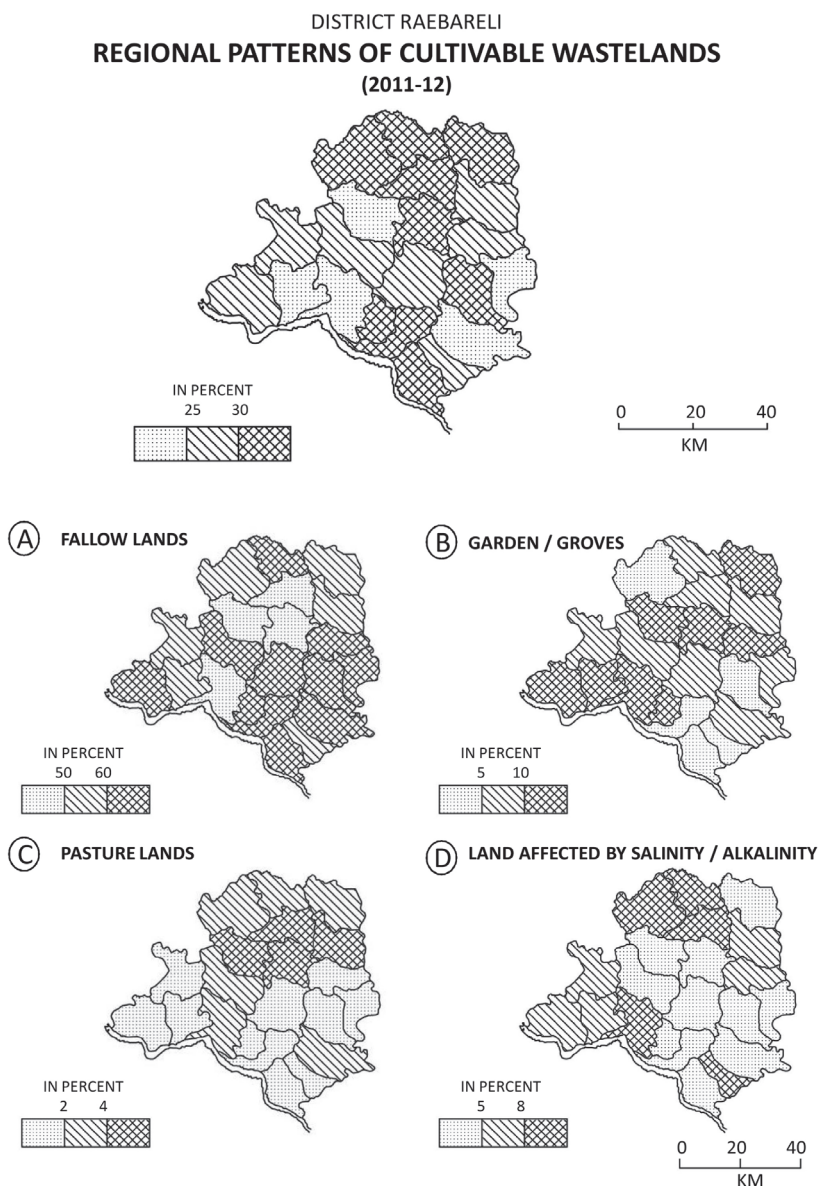


Fig.4: Regional Patterns of Cultivable Wastelands, District Rae Bareli, Uttar Pradesh, India

stage possibly to evade the rent of land as garden/groves are excluded from the land revenue and land 'ceiling act'. Garden and groves in the area under study always comprise mainly mango, guava, lemon, jackfruit, *mahua* (*madhuca indica*), *shisham* (*dalbegia sissco*), *teak*, *amla* (*phyllanthus emblica*), *eucaliptus*, *popular* (*populous alba*) etc. These are especially home garden/groves and serve the domestic needs but sometimes they are leased for money also.

The garden/groves cover 12,482 ha of land amounting to 9.60 percent of the total cultivable wastelands area of the district. The spatial distribution of garden/groves is not uniform throughout the district (Fig.4 B) and it ranges from 2.84 to 17.81 percent. The region of highest concentration having more than 10 percent area under it lies in central part of the district covering all the 3 blocks viz. Bahadurpur (11.73 percent), Harchandpur (10.70 percent) and Amawan (10.61 percent) and in the block of Singhpur (17.81 percent), Dalmau (14.54 percent), Dinshahgaura (13.62 percent) and Sareni (10.53 percent) and Lalganj (10.42 percent) are widely scattered distributed. The area of moderate and low concentration is found in 13 blocks spreading in north and south. This is the most fertile agricultural tract of the district.

### 3. Pasture Lands

The lands cover all grazing lands whether they are pastures and meadows as well as village common grazing lands. The area lying between agricultural land and reserved forest which are not suitable for cultivation or from where forest have been cleared for the purpose and the agricultural land which have been left open for are classified as pasture and other grazing lands. The most important point to be taken into account is the reduction of land under pasture and other grazing lands. The pasture lands, situated mostly around the settlements and drains, are brought under plough by illegal encroachment.

The pasture lands cover 3,821 ha of land amounting to 2.94 percent of the total cultivable wastelands area of the district. The spatial distribution of pasture land is depicted in the map of Fig.4 C which shows uneven and widely scattered distribution except in case of region of higher concentration with more than 4 percent areal coverage. It includes four northern blocks viz. Amawan (8.00 percent), Harchandpur (7.66 percent), Tiloi (4.86

percent), and Maharajganj (4.37 percent). The areas of moderate and low concentration have widely scattered distribution pattern with big patch in the north and south part of the district.

### 4. Land Affected by Salinity and Alkalinity (*Usar*)

The salinity and alkalinity affected land is generally characterized as the land that has adverse effects on the growth of most of the plants due to the action or presence of excess soluble or excess exchangeable sodium. Alkali land has an exchangeable sodium percentage (ESP) of about 15 which is generally considered as the limit between normal and alkali soils. The predominant salts are carbonates and bicarbonates of sodium.

The land affected by salinity/alkalinity is the main category of cultivable wastelands in the district and occupies about 7686 ha which is 5.91 percent of the total cultivable wastelands and 1.69 percent of the total area of district. Except for the area along and on both sides of river Sai in Rae Bareli and Salon tahsil called central tract or the Sai Upland and south-west portion of Dalmau tahsil called the Ganga Upland. This category is distributed all over the district covering most of the northern and southern clay tracts (Fig.4 D). The most affected blocks are Rohnia (15.26 percent), Maharajganj (9.61 percent), Shivgarh (9.21 percent), Bachharawan (8.87 percent), and Dalmau (8.75 percent) followed by Lalganj (7.71 percent), Sareni (6.65 percent), Khiro (6.63 percent), Bahadurpur (5.42 percent), and Tiloi (5.14 percent). The area of low concentration have widely scattered distribution pattern all over district.

### 5. Waterlogged and Marshy Lands

Waterlogged and marshy land is that land where the water is at or near the surface and water stands for the most of the year. Land with surface water bodies like lakes, ponds, and tanks do not fall under waterlogged category. And marsh land which gets permanently or periodically inundated by water and is characterized by vegetation which includes grasses and reeds. Marshes are classified in to salt, brackish and fresh water categories depending on the salinity of water. The importance of eco-conservancy may be taken into account before classifying these lands as cultivable wastelands.

This category occupies 6,165 ha which is 4.74 percent of

the total cultivable wastelands in the district. While the land in Maharajganj and Salon tahsils is most affected by salinity/alkalinity, in Salon tahsil, the area lying to the south of Sai river, comprising southern clay tract, is relatively low lying and has natural depressions filled with water (Fig.4). The oxbow lakes and abandoned channels of *Bakulahi River* contain water and contribute significantly to the problems of waterlogging in this tahsil. Lalganj and Rae Bareli tahsils have the least problem of waterlogging in the district.

#### **6. Ravinous Land**

The word 'ravine' is usually associated not with an isolated gully but a network of gullies formed generally in deep alluvium and entering nearby river or stream, flowing much lower than the surrounding table lands. The ravines then are extensive systems of gullies developed along river courses. Rae Bareli district does not have extensive development of ravinous land. This category contributes only 1,171 ha which is 0.90 percent of the total cultivable wastelands in the district. It is confined mainly along the Sai and Ganga rivers in Salon tehsil (Fig.4). A few patches of ravinous land are also noted in Rae Bareli and Dalmau tahsils along the Sai and Ganga rivers and its tributaries.

#### **7. Sand Accumulated Land:**

Sandy areas have stabilized accumulation of sand, in riverine areas. Most of the sand accumulated area along river Ganga forms a part of river system and has not been classified as cultivable wastelands. However, few patches of sand along river Sai towards south-west of Rae Bareli city and Ganga 'Kachhar' area in Dalmau and Lalganj tahsils (Fig.4) have been classified as cultivable wastelands. This occupies an area of 75 ha which is only 0.06 percent of total cultivable wastelands.

#### **8. Brick Kilns Field**

Bricks are one of the most important building materials or unit of construction in India (Singh, 2001). Baked bricks are produced locally. The process of manufacture of bricks is today considered to be a threat to the environment particularly the land and air. This is because it requires a good quality soil particularly the fertile soil. Alluvial soils forming the top strata of most parts of Gangetic plain are needed for production of agriculture

crops but are used for making bricks. With increasing demand, there is more and more production of bricks exclusively from this type of soils. This has exerted tremendous pressure on the availability of fertile soil for agricultural purposes. This categories of land comprises a total area of 368 ha or 0.28 percent of the cultivable wastelands.

The preceding analysis revealed that farmers were giving preference to brick kilns rather than growing agricultural crops because the bricks kilns owners were offering them higher return than they could earn from agriculture. This kind of thinking among the farmers forces them to surrender their agricultural land for lease of four or five years. During this period, the brick kiln owners remove the top four or five feet of soil. After four years of exploitation of agricultural land it turn into a ditch which in due course of time are filled with either waste or rain water or it becomes a dumping ground and it causes soil erosion, it generates solid wastes, it causes irrigation water management problems and waterlogging. All these factors help in degradation of the land.

#### **VI. Problems and Prospects of Cultivable Wastelands**

The foregoing analysis of cultivable wastelands unfolds the stark reality that study region requires a comprehensive plan for sustainable agricultural development. There is little scope for the horizontal expansion of current cultivated land in the study region. That is why agricultural planners have advocated for improving the cropping intensity by multiple cropping and augmenting per hectare yield. But since planners have also inherent task to determine the optimum use of the land in the national interest from every acre of the surface, guideline have been proposed to fallow lands and reclaim cultivable wastelands for agricultural purposes.

Fallow lands account for 19.67 percent (89, 357 ha) of the total area of Rae Bareli district. This area can be easily brought under cultivation by stopping the practice of fallowing through scientific farming. Although it is neither possible nor rational to propose to bring total fallow lands (89357 ha) under cultivation but its 70 percent (62,550 ha) may be easily re-cultivated. Such priority for reclamation of the fallow land should be given in those areas where there is higher pressure of population on land. Hence it is proposed to bring 62,550

ha of fallow lands under cultivation by, 2011-12 which will increase the percentage of cultivated areas from 58.20 to 71.97.

It is not an easy task to reclaim other cultivable wastelands for agricultural purposes owing to their poor adapting conditions which require comprehensive and expensive measures. But the pressing needs of rapidly growing population compel us to adopt the scientific techniques in this direction. Hence there is proposal to reclaim total cultivable wastelands (1,30,020 ha) of the district for agriculture and allied activities. For this purpose, blocks of the study region are grouped under following two categories:

a) This category is concerned with those blocks where the percentage of cultivable wastelands is higher than the regional average of 28.62 percent. These include Jagatpur (39.83 percent), Deeh (39.03 percent), Shivgarh (36.24 percent), Dinshahgaura (34.51 percent), Bachhrawan (33.97 percent), Unchahar (32.87 percent), Maharajganj (31.26 percent), Amawan (30.59 percent), Singhpur (30.49 percent), Rohnia (29.48 percent), Sareni (29.44 percent), Rahi (29.11 percent) and Satawn (28.76 percent) blocks (Fig.4) where government incentives are necessary for reclamation.

b) The second category incorporates those blocks where the percentage of cultivable wastelands below the regional average. Such areas may reclaim within next 20 years depending upon the need of the time and situation. Here reclamation may be carried out through farmers and the government should provide necessary help including technical know-how and credit facilities for the same. This needs proper development of field channels, drain system, and renovation of tanks and extension of a number of inputs.

## VII. Suggestions for Reclamation of Cultivable Wastelands

The reclamation of cultivable wastelands will have to be taken up based on local soil and terrain characteristics, for which detailed field investigation may be needed. A periodic assessment of the extent of cultivable wastelands is also necessary to know the increase or decrease in their extent. This will provide information on the efficacy of reclamation measures carried out and the utilization pattern of these cultivable wastelands. Assessment of cultivable wastelands at an interval of

five years may be appropriate, based on which suitable long-term strategy for management of these lands can be developed. However, the following points may be considered for reclamation and proper utilization of these cultivable wastelands for sustainable agricultural development:

1) The shortage of water that is always felt here is one of the most important factors contributing to cultivable wastelands especially fallow lands. Some measures should be taken to offset the poor timing and undependability (Eyre, 1955) upon rain mainly based on surface water resources. Rae Bareli district is rich in surface water especially in the form of lakes, streams and rivers.

2) Provision of an assured irrigation infrastructural facilities to the farmer. There are two canals (Sharda Sahayak and Sharda canal) and one Ganga lift canal (Dalmau) which come from great distance and do not supply the sufficient amount of water. The problem of water becomes more acute and difficult during the period of drought and famine. Its capacity should be increased and more minors should be constructed branching off the main one in all the directions.

3) It is unfortunate that the easily available animal manure and vegetative matter is used very little. Use of the animal manure and vegetative matter in the cultivable wastelands may assure the fertility of the land for continuous cropping. Farmers should be trained through exhibitions and popular shows about the animal manure. Similarly, use of green manure and wastes from biogas should be popularized amongst farmers by development agencies.

4) The government should also encourage the decomposed agricultural waste and wormy culture for the use as manure.

5) To achieve the maximum benefit from these lands the distribution of agricultural land should be more democratic and the problems of both landless and small farmers should be solved which always off set the good effect of an increment in agricultural production. With the fact that their labour is wasted and they cannot move for fruitful job.

6) The extension of ravine lands and bad land has been marked near the streams and rivers within the good cultivated lands. A scheme should be formulated by the Government to prevent the further extension of these

ravine lands and also to reclaim the existing area affected. To combat soil erosion and extension of ravine lands main schemes as shallow ravine reclamation, contour bonding of cropped lands can be encouraged.

7) As regards anti-erosion scheme, stripped cropping and growing of shade crops like hemp, black gram, green gram and Dhaicha (*Crotalaria mucronata*) mixed with pearl millets and proper rotation can be practiced. These should be demonstrated by the Government experts practically on the spots affected.

8) Reclamation and contour bonding cost should be done partly by the farmers and partly by the Government.

9) Soil and soil moisture conservation small scale engineering structures and vegetative measures like gully-plugging, check dams, terracing, water harvesting structure, vegetative barriers, etc.

10) Land affected by salinity/alkalinity in the district can be utilized for growing agricultural crops after treating with suitable reclaiming techniques like gypsum or pyrite and provision of surface and sub-surface drainage. Tolerance to alkalinity/salinity for some forest species is greater than agricultural crops and hence some of the lands affected by salinity/alkalinity can be planted with suitable forest species like *Prosopis juliflora*, *Acacia nilotica*, *Pongamia pinnata*, *Terminalia arjuna*, *Azadirachta indica*, *Albizia lebbek*, *Eucalyptus hybrid*, *Tamarindus indica*, *Acacia leucophlaea*, *Albizia procera*, *Dalbergia sissoo*, *Acacia auriculoeformis*, *cassia siamea*, *cordia dichotoma*, *syzygium cumini*, *Haplophragma adenophyllum*, *Pithecolobium dulce*, *Palmarosa*, *Lemongrass*, *Citronella Java*, etc. which have shown different degrees of success. All species do not, however show similar results. The local soil conditions and drainage pattern varies from place to place which affects the establishment and growth of plants.

11) Salt tolerant grasses like *Karnal grass*, *Rhodes grass*, *Bermuda grass*, *Paragrass*, *Blue Panic*, *Doob*, etc. are the grass species that can be grown successfully either along with trees or individually, on some of the lands affected by salinity and alkalinity.

12) The Problem of waterlogging region should be solved by planning efficient drainage. In surface waterlogged and marshy land, deep water paddy can be taken wherever water depth is shallow. In areas where water depth is more, pisciculture and the forming of

lotus Fox nut (*Makhana*) and Water Chest nut (*Singhara*) can also be developed.

13) Sand accumulated areas can be planted with forest trees like *Casuarina* species. This will provide fuel wood and also help in checking soil erosion.

14) Brick kilns industries have played a major role in degrading the land, the farmers think it otherwise. It is suggested that sustainable development of the brick kiln industry, which includes utilization of unsuitable soils and fly ash as the main constituent of bricks making and reclamation of excavated lands.

15) Amongst the agricultural allied activities dairy farming is very important due to its economic and social viability in the region. For the development of dairying, improved breeds of cattle should be given top most priority, with proper facilities for cattle care and health. This activity will also help in reclaiming the cultivable wastelands in the region.

16) Indian agriculture is characterized by excessive emphasis on the cultivation of cereals crops. Farmers are almost unaware about the role of agriculture allied activities like dairy, pisciculture, poultry, piggery, goatery, bee farming, silk worm farming, horticulture etc. Hence there is a need for planning allied agricultural activities not only for raising the total output of agriculture but also to solve the problems of unemployment and poverty in rural areas.

17) Agricultural credit schemes can do much in this respect. These schemes should provide loans in the forms of seeds, tools, fertilizers (chemical / Biological) and cash on minimum rate of interest payable in easy installments. In this way poor peasants will get rid of their debts and devote much of their energy on the farms.

18) While in the process of reclaiming the cultivable wasteland, the consideration should also be given to maintain the ecosystem in the region.

Adequate attentions should be paid for the implementation of above scientific techniques, programmes and periodic monitoring with suitable corrective measures should be adopted from time to time. Similarly there should be proper development of infrastructural facilities in the region with full provision for marketing of agricultural and allied products.

Land resources are the most important natural wealth of the any country. In the present context, the need is to

create an informational, legal, institutional and economic environment that facilitates and encourages the best use of land resources especially cultivable wastelands from the point of view of the individual users and the community or the government. Effective institutional supports and enabling environment for active stakeholder participation and conflict management are key factors for successful planning at national and local levels for sustainable agricultural development.

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