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IMPACT OF PHYSICAL ASPECTS ON AGRICULTURAL  
PRODUCTIVITY IN AJAY- MAYURAKSHI INTER RIVERINE TRACT  
OF BIRBHUM DISTRICT



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Short Profile

Koyel Mukherjee is a Research scholar at Department of Geography in Visva-Bharati , Santiniketan.



**ABSTRACT:**

The present study reveals the "Impact of physical aspects on agricultural productivity in Ajay-Mayurakshi inter riverine tract of Birbhum District". The Ajay-Mayurakshi inter riverine tract of Birbhum district occupies a unique position in the agriculture. Various physical and economic factors have prevented its agricultural development. It has remained a region of small, medium and big farms, with paddy as the chief crop. Other crops like, wheat, potato, sugarcane, mustard etc. are cultivated here. The present investigation is intended as a

general survey of the agricultural area, presenting the most salient features of climate, geology and soil formation, together with a detailed consideration of soil types, physiography, rainfall, temperature and their relation to crop production and productivity.

**KEYWORDS**

*Productivity, Rainfall, Temperature, Soil.*

## INTRODUCTION

Agriculture, in India, is influenced by physical, institutional and technological factors. Physical factors deal primarily with topography, soil, climate etc. These factors collectively have impact on the level of agricultural development an output of agricultural production and productivity in a region. Relief is the difference of height between the highest and the lowest points in the region. It is expressed in terms of height from sea level and gradient. Generally plains owing to their low altitude and gentle slope are preferred for agriculture. That is why the Ganga plain is an area of intensive agriculture. On the contrary, plateau and hilly areas owing to paucity of level land, thin soil cover, steep gradient accelerating soil erosion, less temperature affecting plant growth and lack of transport and communication facilities are not considered ideal for agriculture. Climate through its elements like temperature (sun light, cloudiness, and frost free days), rainfall and winds etc. affects agricultural operations in a region. But the high variability of rainfall in place and time adversely affects agricultural prospects. Since about 60% of cropped area is still rain-fed the timely arrival and good monsoon yield rich agricultural harvests. Soil is probably the most important determining physical factor, not only because it supports all kinds of plant life but it also determines the productivity of crops. A fertile soil owing to rich agricultural harvests is always preferred for agricultural activities while a degraded soil facing the problems of erosion, low fertility, ultimately turns the area into ravine and barren lands. Agricultural productivity is a function of interplay between physical and cultural variables and its manifest itself through per acre productivity. This paper shows how physical aspects of this region affect the productivity of different crops in this study area.

### Literature survey:

Anna Ranuzzi and Richa Srivastava (May,2012) represented the Impact of Climate Change on agriculture and Food Security. It reveals how climate affects the productivity of different crops.

Gajbhiye. B.S. and Mandal.C. (January, 2000) observed the Agro-Ecological Zones, their soil resource and cropping system in India.

Chatterjee N.S., Gupta S., Varghese E. (2013) found the Degradation of metaflumizone in soil: Impact of varying moisture, light, temperature, atmospheric CO<sub>2</sub> level, soil type and soil sterilization.

### OBJECTIVES OF THE STUDY:

#### Present study possess following objectives-

- (1)to examine impact of physical aspects on productivity of crops of the study area.
- (2)to evaluate the impact of physical aspects on regional economy.

#### Data base:

The data have been collected from secondary sources. The secondary data on the physical aspects of the study area have been collected from west Bengal district gazettters, Birbhum written by Durgadas Mazumdar (Dec.1975), Mayurakshi canal circle of Suri. These data are regarding to geology,

drainage, etc. Data about rainfall, temperature have been obtained from the office of Deputy Director Of Agriculture (Administraion), soil related data have been gathered from District Agricultural Office, Birbhum. etc. have been collected from the records of the respective offices e.g. Mayurakshi canal circle, principal agricultural of Suri, from district census handbook, Birbhum 1981.

### Methodology:

The step of methodology is concerned with the collection of data and information about the Ajay-Mayurakshi inter riverine tract of Birbhum. Agricultural farms (in acre) have been selected from five villages in Ajay-Mayurakshi inter riverine tract of Birbhum district and land owners of 250 farms have been interviewed and data regarding their productivity per acre, agricultural development have been collected. Later these data have processed. productivity (in quintal) of has been arranged. Crop wise agricultural productivity has been shown by pie graph. Arc GIS 10 software has been used for making maps.

### Location of the study area:

Birbhum lies between 23° 32'30'' and 24 ° 35'00'' north latitude and 88° 01'44'' and 87 ° 05'25'' east longitude. The study area is located between 23°40'00''N to 23°50'00''N latitudes to and 87°20'00''E to 88°00'00''E longitudes. . Mayurakshi runs through Birbhum from West to East the Ajay marks the southern boundary. The study area is located between this Ajay-Mayurakshi inter riverine tract. In this region five villages namely Sattore mouza in Bolpur block, Koma mouza in Suri II block, Hatora mouza in Sainthia block, Ramkrishnapur mouza in Nanoor block and Gopedighi mouza in Labpur block represent the entire study area.

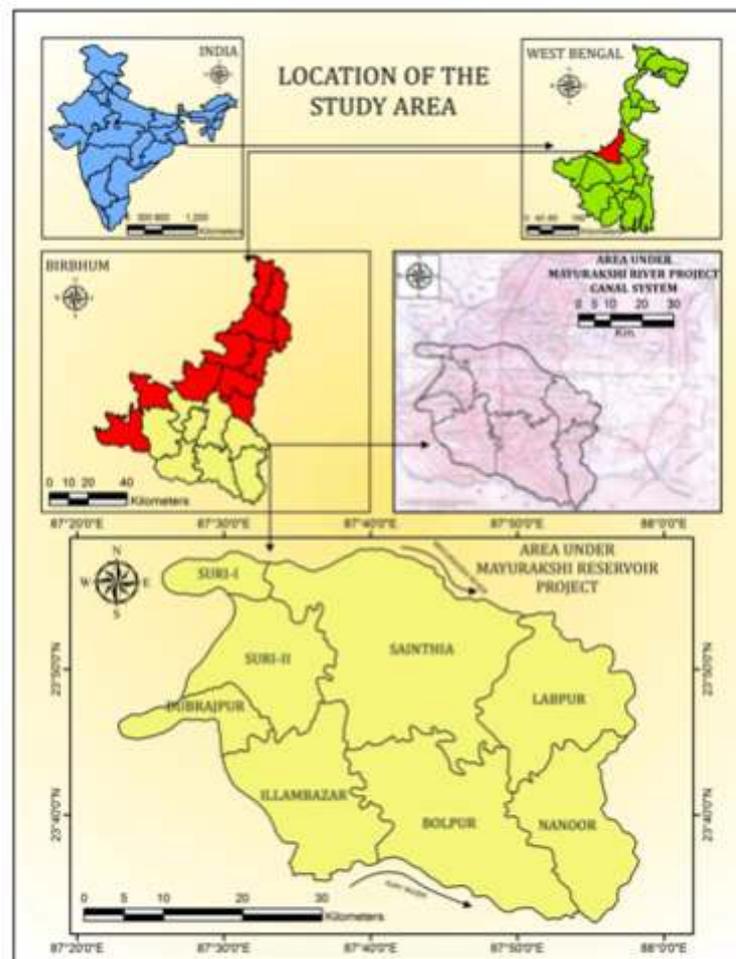


Figure-1  
SOURCE: Compiled by the author

#### Physical aspects and related agriculture of the study area:

The different physical aspects and its impact of agriculture will now be discussed in this chapter.

#### (a)PHYSIOGRAPHY -

The region, under study, is a depositional plane. Sand and silt are denuded enormously from the Vindyan range and Chotanagpur plateau are deposited in this region. The western part of the region is elevated, where the maximum height is 72 meters. The terrain then gradually slopes down to the east, where the minimum height is 24 meters. Two kinds of laterites are found in this region—(a) Gravel, (b) rock.

The above mentioned physiography is more or less suitable for agriculture and the farmers can make full use of such kind of land.

**(b)GEOLOGY -**

The region has Grit, Ironstone and Shale with beds of fireclay and coal. These have been originated during upper Gondwana or middle Triassic - Jurassic ages. The Granite, Gneiss, Schist with Pegmatite and Quartz veins are the important rocks that are strewn over the land of this region. Thick sequence of gravel, sand, laterite interbeds and sedimentary rocks of tertiary and cretaceous ages are found near Bolpur P.S. These rocks indicate alternation of deltaic, estuarine and shallow marine condition during the deposition of the sediments.

**CLIMATE -**

The climate of the region is generally dry and hot for its continental location. It is suitable for agriculture. The hot weather lasts from the middle of March to the middle of June, the rainy season from the middle of June to the middle of October, & the cold weather from November to February. During the months of April & May & in the first half of June the heat is for the most part intense, while the beginning & termination of the rainy season are generally oppressively close, cloudy & sultry. The cold season is moderately cold & bracing, almost always with a clear sky & very little rainfall. The heat, however, in the sun's rays is considerable. As a rule, the wind is from the South East in summer & from the North West in winter.

Chotanagpur plateau influences the climate of this region to a considerable extent.

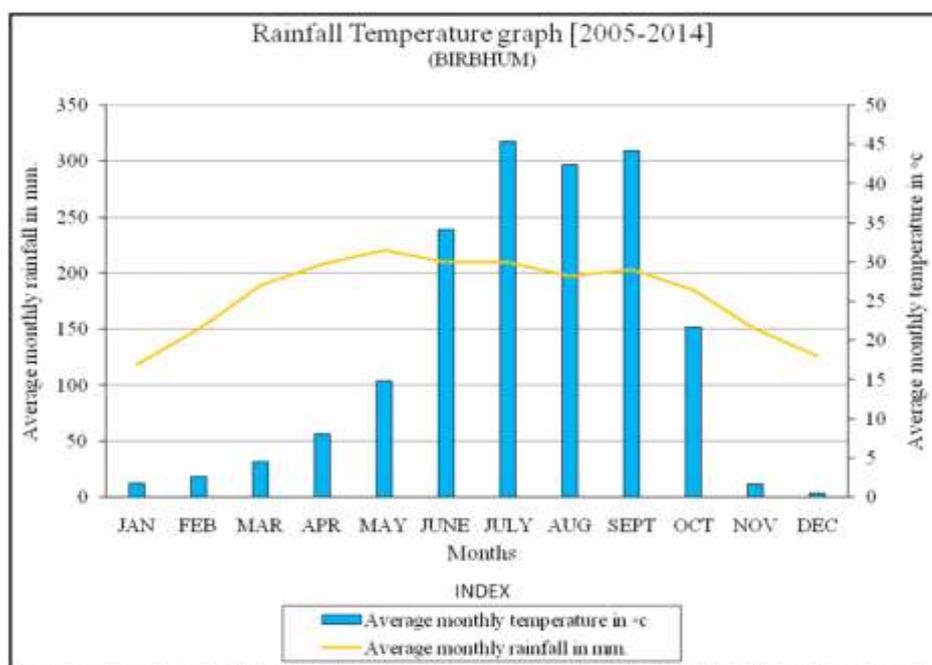
**(1)RAINFALL:** The region receives 78 % or the total rainfall during Monsoon period and rest are occurred during winter and summer. Rainfall during March-May is associated with conventional overturning of air. The rainfall caused due to cyclonic disturbances of varying intensity during Monsoon or post Monsoon seasons. The Winter rain is associated with westerly Winter depressions and convergences.

**(2)TEMPERATURE:** Suitable temperature helps in germination of seeds & growth of plants, as temperature regulates all the chemical & physical processes of plant metabolism. Following table (Table-1) helps to analyze the rainfall and temperature characteristics of the region.

Table: 1 – Distribution of rainfall and temperature of Birbhum.

Months	Average monthly rainfall in mm. since 10 years (2005-2014)	Average monthly temperature in °c since 10 years (2005-2014)
January	12.6	17.00
February	18.4	21.50
March	31.4	27.00
April	56.5	29.80
MAY	104.2	31.50
June	238.8	30.05
July	318.1	30.00
August	296.9	28.20
September	309.8	29.00
October	151.8	26.50
November	11.5	21.50
December	3.5	18.50

Source- Deputy Director Of Agriculture (Administration), Birbhum. (for rainfall) and Meteorological Office, Bolpur, Birbhum (for temperature).



Source- Rainfall- Temperature graph compiled from data obtained from Deputy Director Of Agriculture (Administration), Birbhum. (for rainfall) and Meteorological Office, Bolpur, Birbhum (for temperature).

18.3°C & 23.9°C. The crucial air temperature is 6°C (Schimper 1903) at & above which plants grow. Throughout the year it is favourable for crop husbandry because the temperature always remains above threshold temperature (the point at which a stimulus begins to bring a response).

It is inferred from the table (see table no 1), that the temperature is very high during summer season, low during the winter & moderate in other months. From the table it is observed that the temperature varies according to the seasonal changes.

**(3) HUMIDITY:** The relative humidity reaches its peak during Monsoon season and decline gradually after this season. The summer is dry when the relative humidity is about 45 % in the morning and about 20% to 25% in the afternoon (Majumdar, 1975).

**(4) DRAINAGE :** The region is well drained by a number of rivers and rivulets running in nearly every case from west to east with a slight southerly inclination. Only two are rivers of any magnitude, viz., the Mor and the Ajay, the latter of which marks the southern boundary, while the Mor runs through Birbhum from West to East. The command area is drained by a number of rivers & rivulets running in nearly every part from west to east with a slight southerly inclination. The command area is watered by the rivers Bakreswar, Kopai in the south of it. In the dry weather its beds is broad expanses of sand with small streams trickling down the centre but during the rainy season it grows much broader & deeper & after a heavy downpour rise in a few hours, occasionally overtopping their banks & inundating the surrounding areas.

**(6) FLOOD:** Flood does not occur frequently in this region and the drainage is also not so serious in comparison with the southern part of West Bengal. Flood occurs in this region due to Steady silting of beds of the rivers and their distributaries, discharge of immense amount of water from canal during heavy rainfall etc.

#### **(7) SOIL :**

The region under study has different types of soil.

**Laterite Soil:** This is red coloured soil is characterized with iron & aluminum oxide. Suri, Sainthia under the canal command are the areas where laterite soil is found .This soil is devoid of plant nutrients like nitrogen, potash, phosphorus & organic matter. It is deficient in limes & acidic in reaction where pH value varies from 4.8 to 5.5. Less amount of nitrogen & humus content in this soil makes it infertile. This soil is best suited for rice in Kharif season with improved drainage condition.

**Older Alluvial Soil:** This soil Texture is moderately fine & neutral to slight acidic where pH varies from 5.5 to 7.5. This type of soil is found in Bolpur, Nanoor, Labpur,. Soil is cultivated mainly for paddy. Other Rabi crops are possible if irrigation facilities are provided.

**Younger Alluvial Soil:** In this soil, the pH varies from 6.5.to 7.5. This soil is cultivated for rice in Kharif season & wheat, pulses & oilseeds are grown with irrigation in Rabi season. Southern part of Nanoor is the areas where this type of soil is found.

### Distribution of soil PH:

All the blocks ranging pH value 5.2 to 6 i.e. moderate acidic due to presence of coarse grained laterite soil, where leaching removes the base forming cations i.e. calcium & magnesium & deposits aluminum, hydrogen or iron. These soil PH values of this region are suitable for paddy, wheat, pulses, potato and sugarcane. Following table (Table-) will discuss it.

Table: 2- Distribution of soil PH

Blocks	Values of P <sup>H</sup>
<b>Suri I and Suri II</b>	<b>5.60</b>
<b>Sainthia</b>	<b>5.20</b>
<b>Labpur</b>	<b>6.20</b>
<b>Illambazar</b>	<b>5.50</b>
<b>Bolpur</b>	<b>6.20</b>
<b>Nanoor</b>	<b>6.20</b>

Source: Table compiled from data obtained from Deputy Director Of Agriculture (Administration), Birbhum.

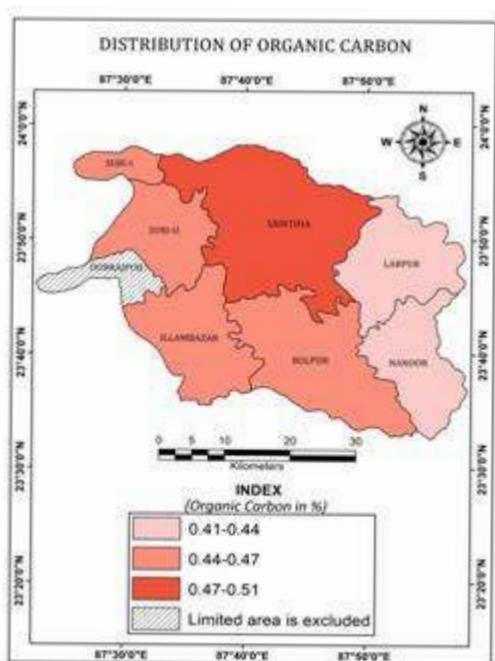
### Distribution of soil organic carbon:

The term soil organic carbon refers to the carbon occurring in the soil in soil organic matter. The amount of soil organic carbon depends on soil texture, climate, vegetation & historical & current land use management. Soils with high clay content tend to have higher soil organic carbon than soils with low clay content under similar land use & climatic conditions. Here it varies from 0.41 % to 0.51%. Table-3 will discuss it.

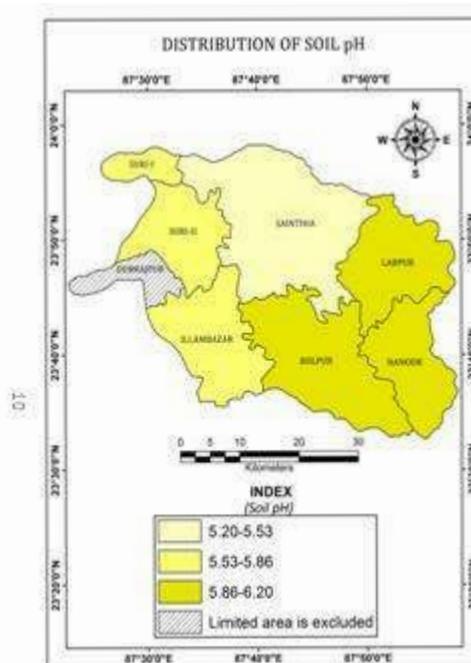
Table: 3 Distribution of organic carbon (%)

Blocks	Organic carbon (%)
<b>Suri I and Suri II</b>	<b>0.46</b>
<b>Sainthia</b>	<b>0.51</b>
<b>Labpur</b>	<b>0.43</b>
<b>Illambazar</b>	<b>0.47</b>
<b>Bolpur</b>	<b>0.45</b>
<b>Nanoor</b>	<b>0.41</b>

Source – Table compiled from data obtained from Deputy Director Of Agriculture (Administration), Birbhum.



Source: Assistant Director Of Agriculture Office



Source: Assistant Director Of Agriculture Office

### Distribution of potash and phosphorous in soil:

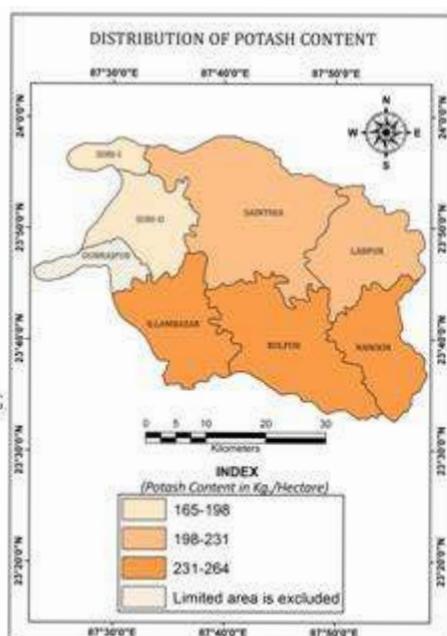
It has wide application to fruit & vegetables, rice, wheat & other grains, sugarcane, pulses, all of which benefit from the nutrient's quality enhancing properties. It is observed from the analysis of the table (see table no. 4), that maximum potash content 264(kg/ha) is in the soil of Bolpur followed by Nanoor, Illambazar. Suri I and II has 165 (kg/ha) in the soil.

On the other hand In this Ajay-Mayurakshi inter riverine tract of Birbhum district, Labpur, Bolpur, Sainthia, are the blocks where phosphorus content is high (table-no-4)) above 25 kg/ha. Suri-I&II, Nanoor.

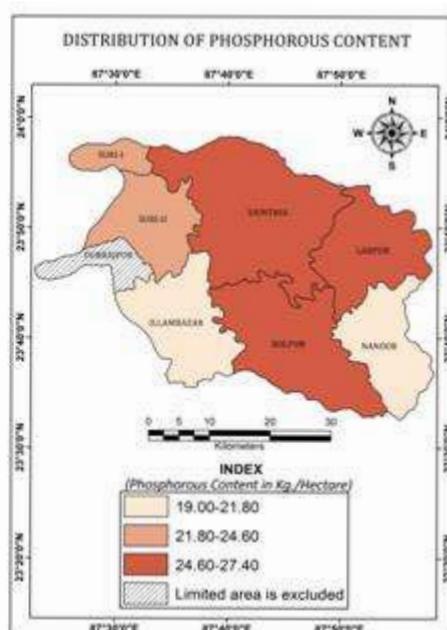
Table- 4 Distribution of potash and phosphorous content (kg./ha)

Blocks	Potash (kg./ha)	Phosphorous (kg./ha)
Suri I and Suri II	165.00	22.10
Sainthia	207.00	26.00
Labpur	230.00	27.40
Illambazar	252.00	19.00
Bolpur	264.00	25.20
Nanoor	262.00	21.20

Source – Deputy Director Of Agriculture (Administration), Birbhum.



Source: Assistant Director Of Agriculture Office.



Source: Assistant Director Of Agriculture Office.

Impact of these physical aspects on productivity of crops:

Aman and Aus paddy are produced in all five villages. Aus is harvested one month prior to Aman paddy. Sugarcane and Pulses are produced only in Sattore and Hatora. Potato, Boro paddy and Wheat are cultivated in all four villages except Ramkrishnapur. Mustard is harvested in Sattore, Hatora and Ramkrishnapur villages. Table-5 and diagrams 1,2,3,4,5 will represent it. Though Physical aspects of this five villages largely influence the productivity of crops but technological inputs like canal water, chemical fertilizer, organic manure, HYV seeds, pesticides, ploughing etc. also largely affects the production and productivity of crops.

Table- 5: Distribution of productivity (q. /acre) of different crops

Name of crops	Sattore Produ- ctivity (q./acre)	Koma Producti vity (q./acre)	Hatora Product ivity (q./acre)	Ramkrishnapur Productivity (q./acre)	Gopedighi Productivi ty (q./acre)
Aman paddy	4.43	5.23	4.33	5.16	4.85
Aus paddy	5.00	5.30	4.31	5.16	1.12
Sugarcane	1.75	-	1.83	-	-
Potato	29.56	21.60	29.00	-	12,21
Wheat	11.00	12.37	17.46	-	7.10
Pulses	0.26	-	0.79	-	-
Mustard	0.94	1.39	-	0.41	-
Boro paddy	5.70	5.12	6.00	-	5.00

Source: Table compiled from data obtained from field survey

In spite of being positively influenced by these physical features, agricultural productivity is suffered from some other problems.

#### PROBLEMS AND ALTERNATIVE MEASURES:

In this study region, particularly in the elevated western part of Birbhum district, physical environment creates constraints to human being and throws adverse influence on the agriculture as well as on the economy until and unless the agricultural resources are properly mobilized through appropriate technologies with the help of favourable and efficient socio-cultural and economic institutions. The terrain as well as the slope affects the availability of soil moisture, depth, structure of soil, possibilities of irrigation, the amount of solar radiation, the feasibility of terracing, field pattern, agricultural transport, the size and distribution of holding, continuity of cultivation and the most important aspect of agriculture i.e. the crops, their nature and output. The terrain of the elevated part of the command area is quite undulating in nature which is restricted for the growth of agricultural economy. Here frequent contact between farm and field is harder, it is difficult to use agricultural implements. The above constraints of topography are not so acute in the central and eastern parts of

the study. Excessive rain causes water logging in the eastern lowering part of the study area ( Labpur and Nanoor blocks) and soils are therefore eroded which restricts the cultivation of crops and also damages the standing crops. On the other hand, scarcity of rainfall in the elevated part of the study area causes moisture deficiency in the crops and it may give rise to drought. Soils are poor and hold an inadequate amount of organic matter which causes a decline in the soil fertility in an elevated part of the area.

To reduce these problems planning is necessary regarding development and management of physical and natural resources such as land, water, crops, forests etc. Forests would be protected, waste land and fallow land should be converted into agricultural land by using proper scientific technology.

### CONCLUSION:

The above discussion reveals the fact that physical set up i.e. geology, terrain, climate, soils, drainage etc. constitute an overall natural environment, which is responsible for shaping & patterning the agricultural activities. These natural land resources make a considerable contribution to the development of agricultural activities in these five villages. The natural land resources include all those features & processes of land, which can, in some way or other, be use to fulfill human needs, i.e. shelter, clothing & food which are derived from agricultural activities. Physical factors encourage not only the pattern of agricultural practice but also restrict some crop production at a certain area. At the same time, with the application of other man made inputs can reduce the physical constraints on agricultural practice. The entire region has thus obtained direct and indirect primary and secondary benefits and sometimes negative impacts in the regional economy.

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