

Regionalization Of Agricultural Development Region With Z Score From The Perspective Of Indian Agriculture: A Case Study Of Sipajhar Revenue Circle, Darrang District, Assam

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Abstract: Currently increasing demand for non-agricultural uses on farmlands leads to a pressing need for the formation of agricultural development regions. Such regionalization of farmland can be of functional use for preserving the same as headquarters of agricultural production by investing more in production infrastructure. Sipajhar revenue circle, Darrang district, Assam having diverse farming practices among different communities, a scientific inquiry into the pattern of agricultural development has been made to have a clear insight into it during 1915-16. The spatial pattern of agricultural development in 14-gram panchayats of the revenue circle is represented through choropleth mapping. Thus the study demonstrates a significant spatial variation concerning different aspects of agricultural practices in the circle and delineates it into three agricultural development regions by using the Z score technique based on six variables. The required data have been collected from a field survey with the help of structured questionnaires and also from secondary sources. The present study is designed to provide a rationale for the future orientation of agricultural planning for a laggard district like Darrang in Assam.

Keywords: Agricultural Development, Spatial Pattern, Spatial Variation, Choropleth mapping, Z score technique

1. INTRODUCTION:

Current population dynamics illustrate that the world's population is rapidly increasing, it is expected to reach 9.8 billion in 2050 and 11.2 billion in 2100 (world population projection, 2017). To feed the exponential growth of the population there is a need for a judicious agricultural plan to have sustainable growth. Agricultural regionalization is such a process that regionalizes the area into spatial units of homogeneous region of agriculture which has always allured researchers from various dimensions. Such a process of regionalization plays a vital role in sculpturing Agricultural development regions of India. In the context of present-day agriculture, inclusiveness, micro policies, and doubling farmer's income are some areas of concern to be addressed (Dev, 2018). So Agriculture development in its true sense brings about a revolution to give birth to agriculture which is profit giving and at the same time sustainable. It is influenced by various factors like agro-ecological, socio-cultural, techno-economic, and demographic characteristics of the agricultural labour force (Patil, 1993). In the context of modernization, the concept of agricultural development is actually up-gradation of the traditional mode of cultivation to increase the production of crops to feed the rapidly increasing number of people in the developing countries (Bezbaruah, 1995). Nowadays the choice of criteria for measuring the development of agriculture forms an unlimited range of possible variables from the perspective of the Indian agricultural scenario.

Therefore, the productivity of various crops, technological advancement of the agricultural method, and innovation in agriculture, crop diversification, and crop intensity are some of the reliable factors taken into consideration keeping the traditional farming practices in view for assessing the agricultural development in the spatial context. Currently increasing demand for non-agricultural uses on farmlands leads to pressing need of forming Agricultural Development Regions at the local level. It is estimated that over 7447 hectares of agricultural land have been transferred into the non-agricultural category across Assam in the last 13 years (Economic Times, 26Aug. 2014). So regionalization of agricultural land of an area can be of functional for preserving the same as headquarters of agricultural production by investing more in production infrastructure. Whittlesey, as back as the 1930s, has also precisely enunciated that microscopic geography and quantitative field sampling technique as one of the critical field check techniques in terms of agricultural regionalization (Whittlesey, 1936). Sipajhar revenue circle, Darrang district, Assam, India having diverse farming practices among different farming communities of varied physical settings, a scientific inquiry into the pattern of agricultural development has been made across 14-gram panchayats (GP) of this circle to have a clear insight into the agricultural scenario. Thus, the study demonstrates a significant spatial pattern of variation in respect of agricultural development in the revenue circle and it delineates the case study area into three agricultural development regions. The present study is designed to provide a rationale for the future orientation of agricultural planning for a laggard district like Darrang of Assam.

2. AIMS AND OBJECTIVES:

Agriculture is the outcome of a highly complex system of interrelated components, among which apart from the physical, socio-economic processes play a vital role. Such a scenario of agricultural practices is quite conspicuous in the study area wherein the diversity of castes and

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communities characterizes the area. Hence, the present study puts before itself the following objectives -

- I. To examine the physio-social background of the area.
- II. To delineate the area into agricultural development regions.
- III. To put forward some strategies for agricultural planning and development.

3. DATABASE AND METHODOLOGY:

The present study is based on both primary and secondary database to determine the agricultural practices in Sipajhar revenue circle of Darrang district, Assam. The primary data have been collected through a stratified random sampling technique based on castes-communities and the size of landholding. The caste-community wise dominant villages of the panchayats are first sorted out from those villages wherein particular caste and community are found to be above 50 percent of the total population and after having done so 23 sampled caste-community villages (26% of the total village) have been selected by employing random sampling number. A well-designed household survey schedule has been used for 16% of the total households of each sampled caste-community village and care has been taken so that proportionate sampled households are selected based on landholding size. Thus primary information has been collected during 2015-16 from 23 sample villages through the inductive-empirical approach. Relevant secondary data on population, occupational composition, cropping pattern, and farming practices at panchayat level have been collected from Revenue Circle Office, Darrang; District Agriculture Office, Darrang; A.D.O. Circle, Sipajhar; Department of Irrigation, Darrang; Census Hand Book of Assam and Darrang and Directorate of Economics and Statistics, Assam. Besides some relevant information about population, social composition, and landholding size of the corresponding village have been obtained from the village headmen of 23 sample villages. The data so obtained have been tabulated and processed employing traditional and sophisticated statistical measures that include Index of Cropping Intensity, Crop Diversification Index of Gibb-Martin, Crop Productivity Index of Kendall, and Composite Index of farm Mechanisation for the exposition of the cropping pattern and finally Z score for agricultural development regions. The locational quotient technique is also applied to determine caste community concentration areas in the circle. The result of data analysis has been presented in the form of choropleth maps by applying suitable cartographic techniques with the help of Geographical Information System for giving a clear exposition of the spatial pattern of desired variables. In this study, the base map wherein the panchayats of the circle are considered as spatial units of investigation is prepared with the help of Topographical Map No. 78 N/15 and 78 N/16 with the scale of 1:50000.

4. GEOGRAPHICAL CONTEXT OF THE STUDY AREA:

Sipajhar revenue circle of Darrang district is located in the south-western part of the district. It extends from 26°09' N to 26°22' N latitude and 91° 45' E to 91° 52' E longitude. This revenue circle with a population of 1, 22,937 (as per 2011 census) covers an area of 299.87 km² (29987 ha)

comprising 89 villages, 14 Gram panchayats, and 3 Mouzas, namely Sipajhar, Lokrai, and Hindughopa Mouza. The word 'Sipajhar' is derived from the two terms the 'Sipha' referring to an ancient river passing through this area and the 'Jhar' to the shrubs grown on the bank of that river. The Sipajhar revenue circle is popularly known as the 'rice bowl' of the district where 70% of the total working population is engaged in farming activities. The net sown area of the circle is 21,217 ha which accounts for 70.75% of its total geographical area.

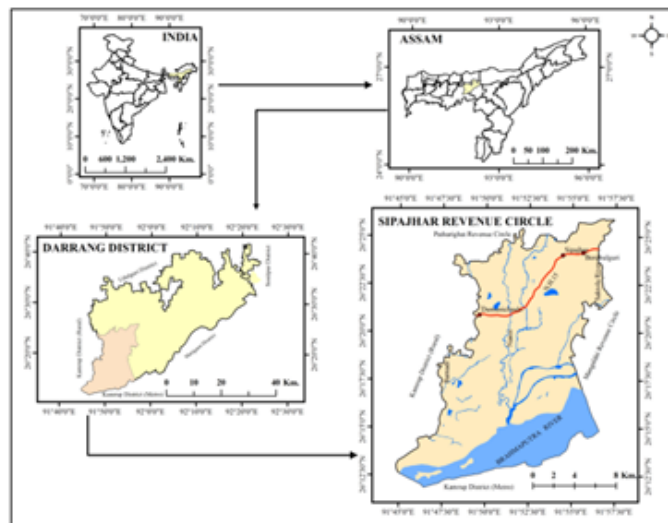


Figure 1: Location of Case Study Area, Sipajhar Revenue Circle in Darrang District, Assam

Food crops comprising paddy and maize predominate the circle area. Paddy consists of three varieties of rice - winter rice, summer rice, and autumn rice; 'sali' and 'bao' crops are included in winter variety, whereas 'ahu' & 'Kharma' are included in the autumn rice and 'boro' paddy in spring or summer rice. Paddy cultivation accounts for 82% of the total net sown area. To some extent, traditional varieties of winter rice are still grown in the Sipajhar region while summer rice, boro paddy comprises high yielding variety. It is to be noted that indigenous varieties of rice have been traditionally preserved by some peasant communities of certain villages of this circle. Apart from rice, oilseed comprising mustard, different varieties of pulses, sugarcane, vegetables, and jute are cultivated by different farming communities of the Sipajhar circle area.

5. PHYSICAL AND SOCIAL BACKGROUND:

Physiographically this revenue circle of southwest Darrang district is by and large a part of the Brahmaputra valley. It consists of the alluvial deposits brought down by the Brahmaputra River and its tributaries originating from the Bhutan and Arunachal Himalayas. In general, the configuration of the region is that of a large open plain with an average elevation of 75 meters from mean sea level (Nath, 1984). The plain slopes gradually southwards to the Brahmaputra River. Although it is a plain area, local differences in elevation are found in different parts of the circle. In general, the whole revenue circle can be divided into three micro physiographic units - the active flood plain or char area below 40m, the marshy and low-lying area with

low hills (40-100m) and the built-up region with high and low plains (40 - 60m) as shown in fig. 2.

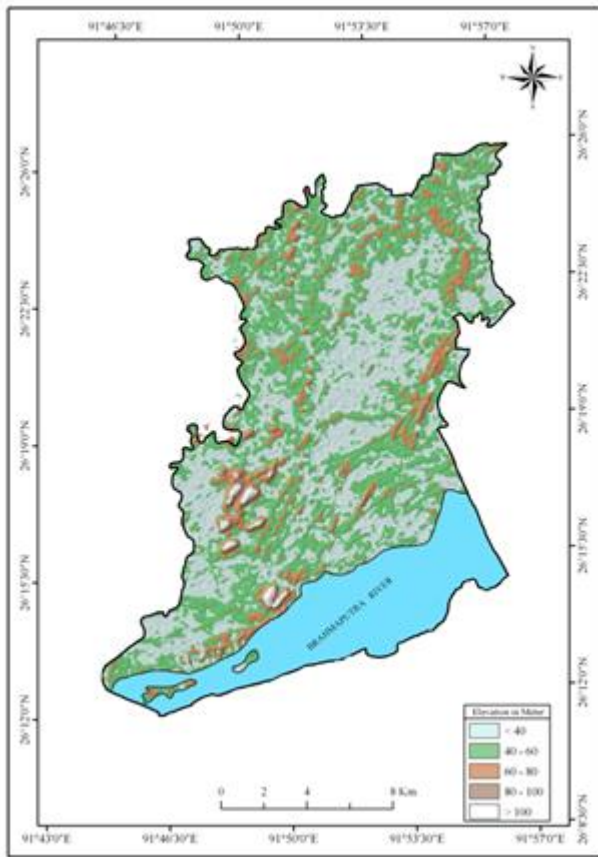


Figure 2: Sipajhar Revenue Circle: Digital Elevation Model, Source: ASTER DEM

The diversity of castes and communities is well reflected in the densely populated area of Sipajhar revenue circle. Of the total population of the circle 58% belongs to the non-tribal Hindu community, 19% to Assamese speaking Muslim (indigenous Muslim), 18% to Bengali speaking Muslim (non-indigenous Muslim), 4% to Nepali and only 1% to belongs to scheduled tribe (Bodo) community. Out of the non-tribal Hindu community, 78% comprises Other Backward Class, 15% High Caste, and 7% Scheduled Caste group. Caste-community concentration has been derived by employing the locational quotient(LQ) technique as mentioned below.

$$\text{(LQ) Index for determination of community concentration} = \frac{\text{Population of X community in the areal unit}}{\text{Population of all communities in the component areal unit}} \div \frac{\text{Population of X community in the entire region}}{\text{Population of all communities in the entire region}}$$

Table 1: Shows the L.Q. values of different castes and communities in Gram panchayats

Gram Panchayat	Indigenous Non-Tribe	Scheduled Caste	Other Backward Class	High Caste	Indigenous Muslim	Non-Indigenous Muslim	Nepali	Scheduled Tribe
Bordoulguri	0.95	0.04	1.27	0	2.37	0	0	0
Ghorabandha	1.84	0.16	2.39	0.3	0.04	0	0	0
Hazarikapara	1.85	1.53	0.88	6.08	0	0	0	0
Debananda	1.85	0.78	2.17	0.99	0	0	0	0
Sipajhar	1.33	1.66	1.61	0	1.36	0	0	0.17
Maroi	1.17	2.8	1.22	0.22	1.8	0	0	0
Byaspara	1.43	0	0.32	6.69	1.12	0	0	0
Lokrai	1.76	0.11	2.29	0.28	0.24	0	0	0.07
Dumunichowki	0.8	0.72	1	0	2.72	0	0	1.07
Ganeshkuwari	1.02	2.47	1.05	0.23	1.2	0	6.12	12.22
Garukhuti	1.45	0.41	1.9	0	1.07	0	0	0
Sanoa	0.01	0.13	0	0	1.48	3.01	0	0
Kuruwa	1.85	2.15	0.7	6.55	0	0	0	0.19
Bazanapathar	0.17	1.14	0.01	0.06	0	3.67	3.59	0

Source: Calculated based on Data of District Census Handbook, Darrang District, 2011

It is shown in fig.3 that in the riverine charland of Sanowa, and Bazanapathar gram panchayat the Bengali speaking Muslim community is highly concentrated (>1.60 LQ). There lie a few concentrations of Bodo and Nepali community in the low lying area with low hills of Ganesh Kuwari and Bazanapathar gram panchayat. on the other hand, the rest of the gram panchayat of the built-up area like Kuruwa, Maroi, Lokrai, Sipajhar, Ghorabandha, Garukhuti, Hazarikapara, Dumunichowki, and Bordoulguri gram panchayat represent the highest concentration of non-tribal Hindu community (OBC, high caste, and SC) and Assamese speaking Muslim community.

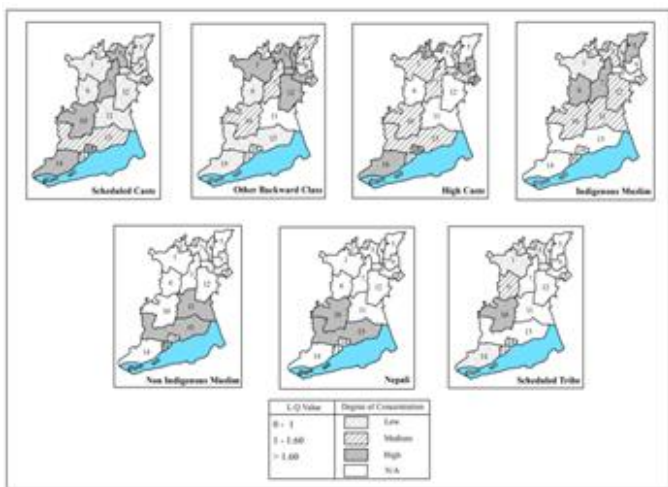


Figure 3 Sipajhar Revenue Circle: Concentration of Caste and Community, 2011

Sl. No.	Gram Panchayat	Sl. No.	Gram Panchayat
1	Lokrai	8	Debananda
2	Byaspara	9	Hazarikapara
3	Sipajhar	10	Geneshkuwari
4	Ghorabandha	11	Sanowa
5	Bordoulguri	12	Garukhuti
6	Dumunichowki	13	Bazanapathar
7	Maroi	14	Kuruwa

Thus, these varied physical and socio-cultural bases play a dominant role in bringing about variation in agricultural practices of the study area.

6. ANALYSIS AND RESULT:

Sipajhar revenue circle possesses a diverse agricultural landscape with a multi-ethnic population structure. According to the 2011 census, the proportion of total workers directly engaged in agricultural activities is recorded at 70%. It has been observed that there is marked spatial variation in the level of agricultural development in the study region. The different gram panchayats of the circle are contrasted with different levels of agricultural development due to the varied impact of physical and socio-cultural factors. In studying the pattern of agricultural development in Sipajhar revenue circle the indicators applied are given as follows:

1. Cropping intensity (x_1)
2. Physiological density (x_2)
3. Crop diversification index (x_3)
4. Composite index of Farm Mechanization (x_4)
5. Percentage of High Yielding Variety (x_5)
6. Productivity index (x_6)

Table 2: Data Matrix

Gram Panchayat	Cropping intensity in %	Physiological Density (persons per ha)	Crop Diversification Index	Composite Index of Farm Mechanisation	% of HYV to Net area	Productivity Index
Hazarikapara	178	10.31	0.69	8.03	28.5	11
Debananda	172	9.1	0.67	7.93	21.5	6
Ghorabandha	141	5.31	0.28	4.67	16.5	5
Lokrai	128	7.32	0.43	5.01	2	10
Sipajhar	151	16.6	0.55	6.06	9.2	7
Byaspara	132	10.3	0.49	2.75	17.4	1
Bordoulguri	113	10.23	0.45	6.54	1.5	8
Maroi	151	10.08	0.62	3.38	2.2	4
Sanoa	190	5.88	0.78	14.39	56	13
Bazanapathar	178	2.65	0.87	13.36	46.6	14
Kuruwa	164	3.89	0.57	6.22	2	9
Ganeshkuwari	157	6.67	0.51	3.97	17	3
Garukhuti	173	6.04	0.79	11.78	38	12
Dumunichowki	145	5.93	0.5	5.85	9	2

Table 3: Z Scores (Levels of Agricultural Development in Sipajhar revenue circle, 2015-16)

Gram Panchayat	Zc1	Zc2	Zc3	Zc4	Zc5	Zc6	Composite Index
Hazarikapara	1.03	0.69	0.67	0.24	0.53	0.85	4.03
Debananda	0.76	0.34	0.54	0.21	0.13	-0.36	1.64
Ghorabandha	-0.64	-0.72	-1.92	-0.67	-0.14	-0.6	-4.73
Lokrai	-1.23	-0.15	-0.99	-0.58	-0.97	0.6	-3.33
Sipajhar	-0.19	2.47	-0.22	-0.29	-0.56	-0.12	1.07
Byaspara	-1.05	0.68	-0.58	-1.2	-0.097	-1.58	-3.83
Bordoulguri	-1.91	0.66	-0.85	-0.16	-1	0.12	-3.15
Maroi	-0.19	0.62	0.2	-1.03	-0.96	-0.85	-2.21
Sanoa	1.57	-0.56	1.23	1.99	2.11	1.34	7.69
Bazanapathar	1.03	-1.47	1.76	1.7	1.57	1.58	6.19
Kuruwa	0.39	-1.12	-0.1	-0.25	-0.97	0.36	-1.7
Ganeshkuwari	0.08	-0.34	-0.49	-0.86	-0.12	-1.09	-2.84
Garukhuti	0.8	-0.51	1.27	1.27	1.08	1.09	5.02
Dumunichowki	-0.46	-0.55	-0.52	-0.35	-0.57	-1.34	-3.8

6.1 Cropping Intensity:

The study of cropping intensity is very much essential to examine the disparity of agricultural development.

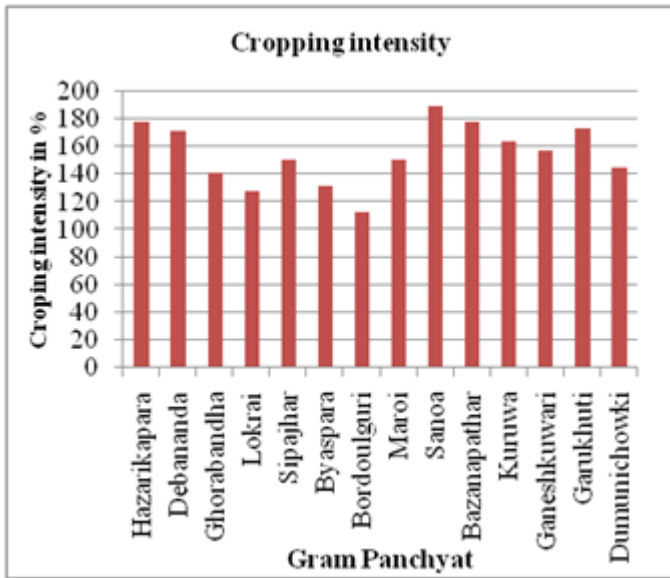


Figure 4 Cropping Intensity in Gram panchayat

With the increase of population density, there is a need for expansion of land to use for agricultural purposes. As there is little scope for expansion of agricultural land, the only way to enhance production through proper intensive use of land. As reflected in fig. 4 it is seen that Sanowa (190%), Bazanapathar (178%) and Hazarikapara (178%) G.P. recorded the highest degree of cropping intensity followed by the G.P. of Debananda (172%), Garukhuti (173%), and Kuruwa (164%).

6.2 Physiological density:

There is also a significant variation of physiological density in the study area wherein persons per hectare cultivable land are examined. Sipajhar (17), Hazarikapara (10), Byaspara (10), Bordoulguri (10), and Maroi (10) can be placed in high physiological density while Bazanapathar (3) and Kuruwa (4) recorded the lowest physiological density of persons per hectare (fig.5). It is to be noted that higher physiological density maintains a medium and lower scope for crop mechanization and diversification in some panchayats of the circle. In other words, higher is the average farm size; greater is the degree of mechanization and agricultural diversification. Therefore the net sown area is to be increased for lowering the physiological density or a substantial proportion of the workforce is to be channelized to other non-agricultural occupations.

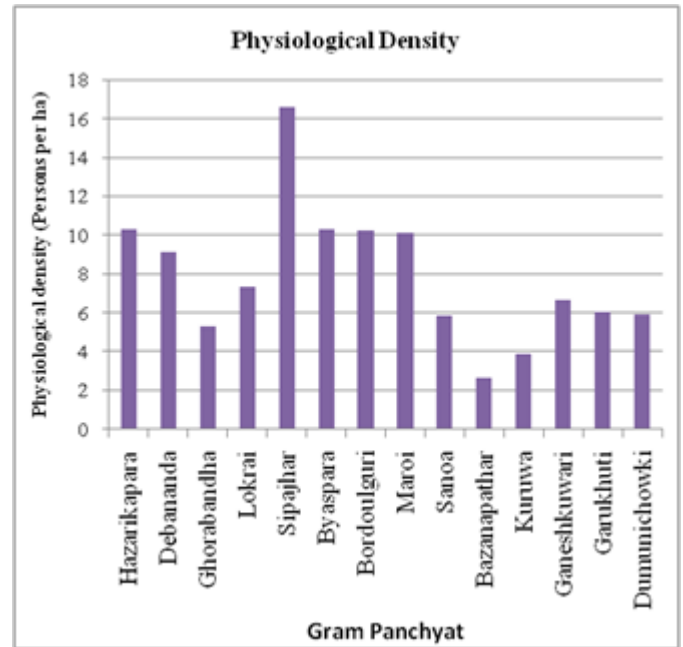


Figure 5 Physiological Density in Gram panchayat

6.3 Crop Diversification :

It also reveals a spatial variation of agricultural practices concerning gram panchayat. It has been observed in fig. 6 that Ghorabandha G.P. (0.31) recorded the least diversification of crops indicating a tendency towards crop specialization.

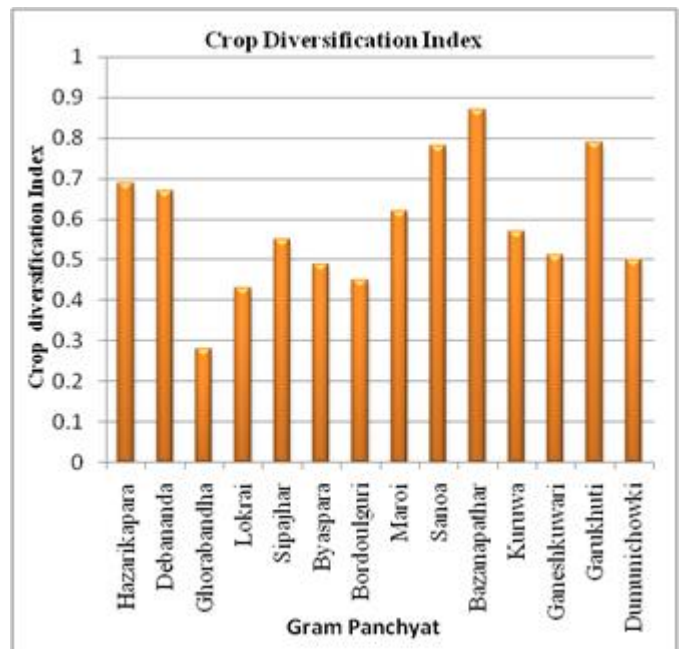


Figure 6 Crop diversification in Gram panchayat

The low medium diversified region comprises Lokrai (0.46), Sipajhar (0.57), Byaspara (0.56), Bordolguri (0.45), Kuruwa (0.53), Ganeshkuwari (0.51), and Dumunichowki (0.57). Hazarikapara (0.65), Debananda (0.62), and Maroi (0.59) are the three G.P. that constitute the high medium diversified crop region of the circle. The most diversified

crop regions are found in the area where winter paddy is less dominant than other crops. Sanowa (0.81) and Bazanapathar G.P. (0.87) populated mostly by non-indigenous Muslim and Garukhuti G.P. (0.79) of O.B.C. and indigenous Muslim constitutes the most diversified crop region.

6.4 Farm Mechanization :

The level of farm mechanization in the Sipajhar revenue circle varies significantly from one G.P. to other. This is quite evident from the range of the composite index values of farm mechanization that varies from 2.75% to 14.46% (fig.7). Among all the gram panchayats, Sanowa registers the highest degree of farm mechanization (14.46%) followed by Bazanapathar (13.36%) and Garukhuti (11.78%).

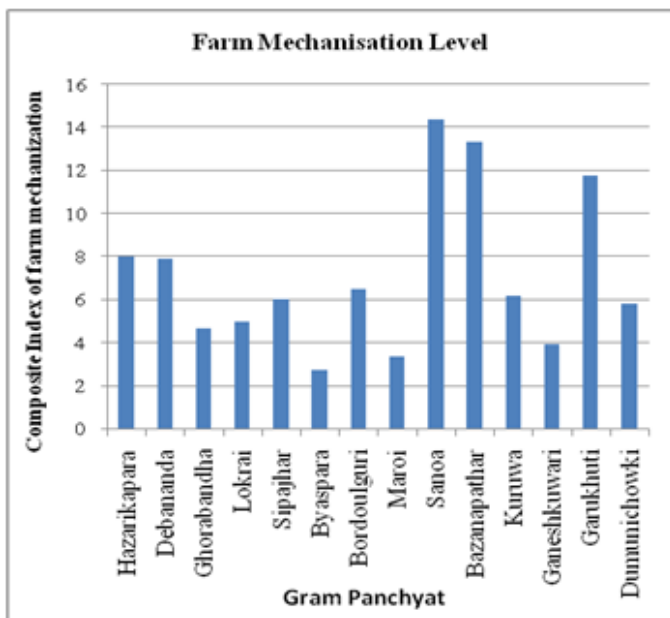


Figure 7 Composites of Farm Mechanization in Gram panchayat

In these three gram panchayats, the proportion of input of farm machinery is comparatively higher than that of other G.P. It is observed that Sanowa, Bazanapathar, and Garukhuti G.P. have been a pioneer in adopting various means of agriculture modernization.

6.5 High Yielding Variety :

The adoption of H.Y.V. by several gram panchayats and its diffusion across the area is examined to have remained fairly limited as represented in fig.8. Of all the gram panchayats, Garukhuti, Maroi, and Sanowa are the first three G.P. units accounting for respectively 57%, 54% and 37% of the net cropped area under H.Y.V. followed by Dumunichowki (22%), Hazarikapara (20%), Debananda (19%) and Kuruwa (15.9%) while the rest of the gram panchayats constitute the least percentage (below 10%) of the net sown area under that category.

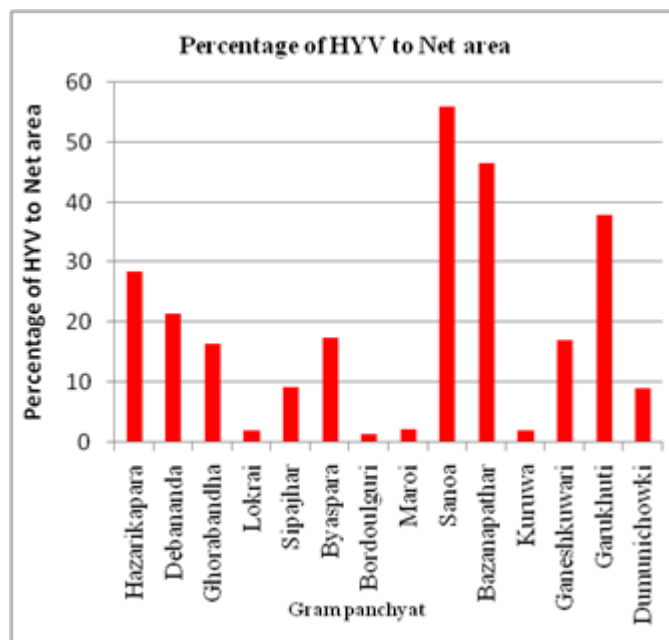


Figure 8 Percentage of HYV to NET area in Gram panchayat

6.6 Agricultural Productivity :

The measurement of agricultural productivity helps in knowing the input-output ratio. Using Kendall's ranking method, high agricultural productivity is found in Bajanapathar (33), Sanowa (40.3), and Garukhuti (43.3) gram panchayats (fig.9). These three-gram panchayats mostly stretch over the Char and the transitional belt between char and built-up areas of the river Brahmaputra.

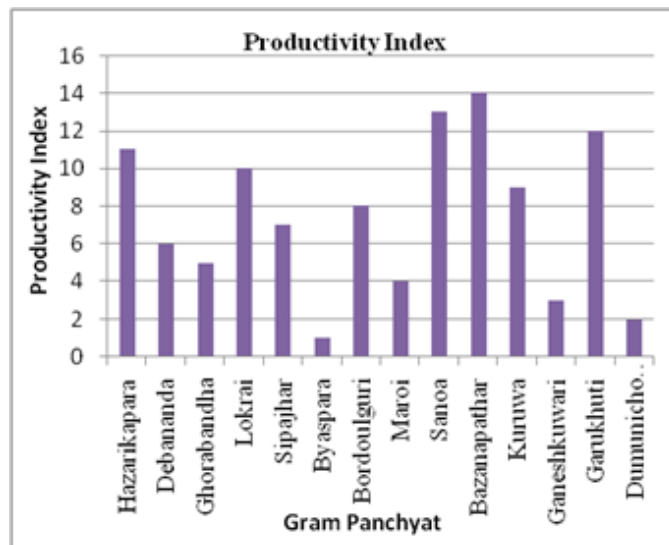


Figure 9 Productivity Index in Gram panchayat

The gram panchayats in which the agricultural productivity recorded high medium are found in Hazarikapara (47.5), Lokrai (48.3), Bordoulguri (49.8), Kuruwa (49.5) and Sipajhar (51.3). Medium productivity areas are by and large juxtaposed with the regions of high medium and low productivity. Debananda (54.5), Ghorabandha (55.8), Maroi (56), and Ganeshkuwari (57) are the gram panchayats that

exhibit the medium productivity. Levels of agricultural productivity in the G.P. of Byaspara (75) and Dumunichowki (61.5) are low as compared to the productivity levels of other gram panchayats.

6.7 Spatial Variation of Agricultural Development:

All the aforesaid indicators are chosen for preparing a data matrix for calculation of Z scores to determine agricultural development regions as shown in table3. After processing the data, some positive and negative Z score values are derived (X variable – Mean/Standard Deviation). All Z scores are summed up, resulting in some composite index values. From these composite index values, three categories of agricultural development regions have been delineated. The index below 0 has been assigned the 'Low', between 0.00 to 5.00 'Medium' and above 5.00 'High'.

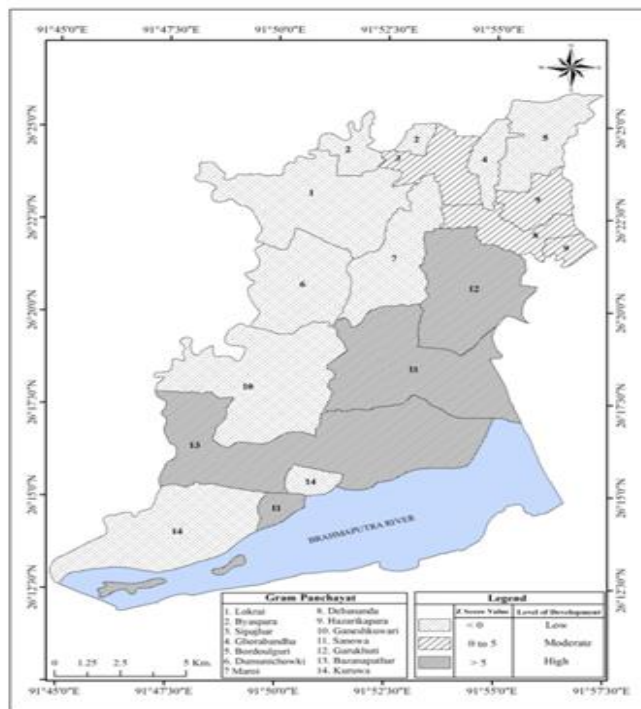


Figure 10 Sipajhar Revenue Circle: Agricultural Development Region, 2015-16

A perusal of Table 3 & Fig.10 reveals the fact that as many as eight-gram panchayats, namely Ghorabandha, Lokrai, Byaspara, Bordoulguri, Maroi, Kurua, Ganeshkuwari, and Dumunichowki possess low level overall agricultural development. Hazarikapara, Debananda, and Sipajhar gram panchayats are characterized by medium level while remaining Sanowa, Bazanapathar, and Garukhuti gram panchayat recorded a high degree of overall agricultural development. It is evident that in the Sipajhar revenue circle of Darrang district there is marked spatial variation in the level of agricultural development. Thus the study area has been categorized into three Agricultural Development Regions as shown in fig 10.

6.7.1 High Agricultural Development Region:

It is observed from the above analysis that the Sipajhar revenue circle is still to attain the status of the agriculturally developed circle as a whole. Still, it is evident from the

analysis presented above that there prevails a spatial variation in agricultural development. There are only three gram panchayats, namely Sanowa, Bazanapathar, and Garukhuti which register high-level agricultural development. It is to be noted that comparatively high farm mechanization and diversification of agricultural activities places these three panchayats in the higher level of overall agricultural development in Z score criteria. Sanowa and Bazanapathar are the two panchayats mostly populated by the Bengali speaking Muslim community and Garukhuti by other backward class and Assamese speaking Muslim community. So far as Garukhuti G.P. is concerned it is exceptional in respect of agricultural development. Unlike the other G.P. of indigenous non-tribal community in the circle, it is the only one that comes to that level next to Sanowa and Bazanapathar. Garukhuti panchayat being located in the flood-prone and transitional zone between char and built-up areas is influenced by the cultural environment of char areas. These three panchayats register the highest farm mechanization, crop diversity, and crop productivity among the panchayats of the Sipajhar revenue circle which put them comparatively in higher levels of agricultural development. It is an unequivocal statement that the char dweller Muslim community is traditionally a skilled cultivator and wherever they are settled they create an environment congenial for agricultural practice. It is to be noted that despite frequent flood occurrence and low connectivity in char areas the farming people of this area are comparatively more progressive than that of other places. Ahu, boro, mustard, maize, jute, and rabi crop are the first ranking crops practiced in this belt. The farming community of this physiographical unit seems to follow the rhythm of the floodplain ecology. So physical hardship may not always be a cause of hurdles in farming for those char dwellers. Despite flood hazard, pro-farming socio-cultural circumstances give a welcome boost for high agricultural productivity in this belt.

6.7.2 Moderate Agricultural Development Region:

As observed from Z score analysis Hazarikapara, Debananda, and Sipajhar gram panchayats identify itself in a moderate level of overall agricultural development with boro, Sali, potato, and sugarcane crops. It is because; these three panchayats are characterized by medium farm mechanization, high medium to medium productivity, and low medium crop diversification. Other backward class and high caste are the dominant group of indigenous non-tribal communities inhabiting these panchayats. Out of them, Sipajhar G.P. being a major nodal center of the circle recorded the highest percentage of the population engaged in activities other than cultivation and having a declining trend in the participation of agriculture during the last 10 years. On the other hand, there is positive growth of peasant participation in the main cultivation of Hazarikapara and Debananda. These panchayats have brought in a noticeable change in the agricultural sector in terms of cropping diversity and productivity. Especially, Hazarikapara and Debananda G.P. have been to some extent innovated and seen rays of modernity in agriculture over the last decade. These areas being located close to char areas there develops an inter-community exchange of ideas and services in the field of farming practices between char and built area. That is why a positive perspective

towards agriculture has been developed in the mindset of the caste- community living there.

6.7.3 Low Agricultural Development Region:

Ghorabandha, Lokrai, Byaspara, Bordoulguri, Maroi, Kuruwa, Ganeshkuwari, and Dumunichowki panchayats are the eight panchayats belonging to different castes of indigenous non-tribal Hindu and Muslim community, scheduled tribe (Bodo) and Nepali community. Out of these panchayats, Bodo and Nepali community are highly concentrated in Ganesh Kuwari panchayat. There is a significant spatial variation of agricultural practices across these panchayats. Medium to low farm mechanization, high medium to least crop diversity, and high medium to low productivity induce these panchayats in the lowest category of overall agricultural development. It is noteworthy that the cultivators belonging to different caste and community settled in these panchayats are traditionally mono-crop farmers, especially engaged in winter paddy (Sali) cultivation. The fact is that despite having comparatively flood-free areas, better road connectivity, high literacy and earliest settlement, the panchayats of this built-up zone are still lagging in respect of agriculture. The objective and perspective of farming communities are reflected in their farmland upon which socio-cultural background plays an important role. The low agricultural development in this part of the built-up area implies a weak anchor of farming communities in their fields. It is the most alarming situation that during the last decade a striking feature of the negative growth rate of main cultivators is recorded as many as in six panchayats out of the eight G.P. The percentage of farmers of some caste and communities in these panchayats is gradually declining over the years which also reflect the degree of commitment and cultural ties of farmers to their farmland. This is quite paradoxical that in these areas the aging group of cultivators has been taking the responsibility of feeding the masses of the society.

7. CONCLUSION:

The foregoing discussion reveals the fact that there exists considerable potential for regionalization of agricultural development regions in the circle. The major findings of the study can be summarized as follows:

- i. The level of agricultural development is not equally pervasive across the circle. The flood-prone char areas of high agricultural development regions that bear the brunt of the flood are potentially the areas of high crop productivity despite having poor road connectivity and other hardship.
- ii. Char dweller farmers are well accustomed to the low and medium magnitude of the flood that rejuvenates the soil fertility, but occasional high flood causes the devastating effect in Kharif crops.
- iii. Unlike char areas, Hazarikapara and Debananda gram panchayats of moderate agricultural development region in the built-up physiographical unit have become comparatively more progressive in farming.
- iv. Byaspara, Lokrai, and Ganeshkuwari Grampanchyat are the areas wherein scarcity of water compel the farmers to lay their land fallow and resort to mono-crop cultivation. The canal irrigational facility of the area is practically absent in the circle even though it is flanked

by Saktola river in the east and Nanoi and Barnadi in the west. These rivers should be turned into an asset through proper planning strategy.

- v. The study area is composed of diverse castes and communities, it traditionally possesses some distinguished agricultural and its allied practices in these three agricultural development regions which bear great potentialities for sustainable economic growth. It is essential to identify those areas with their own traditional farming practices.
 - Assamese speaking Muslim communities highly concentrated in Bordoulguri, Maroi, and Dumunichowki Grampanchyats of low agriculture development region are characterized by growing of paddy and oilseeds, rearing of poultry, cattle, and buffalo.
 - Bengali speaking Muslims of Sanowa and Bazanapathar G.P. of high agriculture development region can be identified by growing of vegetables, maize, ahu paddy, fishing, rearing of poultry.
 - The Other Backward Class of Garukhuti and Lokrai G.P. by raising indigenous rice variety, bamboo craft, silk rearing, beetle nut and leaf growing, cattle rearing, and weaving.
 - Scheduled Caste of Sipajhar and Maroi G.P. traditionally practices pottery, gold smithy, and fishing rather than farming;
 - Nepalis of Ganeshkuwari G.P. in low agriculture development region grow arum, ginger, and have rearing of cattle and buffalo for dairy products. Scheduled Tribe (Bodo) in Ganeshkuwari G.P. itself sustains their livelihood by piggery, orchards of beetle nut and leaf, bamboo craft, and weaving.
- vi. There is a declining trend in the participation of agriculture practices among young farmers of low and medium agricultural development regions. The average age of the farmer in the circle is 55 years or older. The aging group of cultivators has been taking responsibility for raising crops in the field. That is why the present agriculture needs to attract more young people and it is high time to add agriculture to the school curriculum to encourage the young generation to perceive agriculture as a future career after schooling.

A qualitative agricultural transformation has to be viewed more holistically in terms of rural transformation (Dev, 2018). Therefore, there should be a separate planning strategy for rural farmers belonging to different castes and communities of three agricultural development regions. This process empowers local communities to voice their opinion and strengthen skills and confidence to participate in development incentives. Therefore local planning should fit into the regional planning network retaining its individuality. Finally, it can be concluded that recently the progress of urbanization and industrialization due to economic development has increased the demand for non-agricultural uses on farmlands. Therefore, agricultural development regions are worthy of its formulation and must help the formulation of agriculture plans which go a long way in ensuring sustainable agricultural productivity in such regions.

REFERENCES:

- [1]. R. Barman, and M. M. Das "Crop Combination Regions of Assam," North Eastern Geographer, Vol. 10, Pp. 15-22, 1978.
- [2]. United Nations Department of economic and social Affairs, "World population Projections", 2017.
- [3]. S. M. Dev, "Transformation of Indian Agriculture? Growth, Inclusiveness, and Sustainability" Indira Gandhi Institute of Research, Mumbai, 2018.
- [4]. D. Whittlesey, "Major Agricultural Regions of the Earth," Annals of the Association of American Geographers, 1936.
- [5]. R. Barman and S. Barthakur "Spatial Distribution Pattern of Rural Settlement in Tezpur Subdivision of Darrang District, Assam" M.Phil. Dissertation, Department of Geography, Gauhati University.
- [6]. P. M. Bezbaruah, "Technological Transformation of Agriculture-A Study from Assam," Mittal publication, 1995.
- [7]. K. Bhagabati, "Levels of Agricultural Productivity in the Brahmaputra Valley: A Geographical Analysis," unpublished.
- [8]. K. Bhagabati, "Pattern of Land Utilization in the Brahmaputra Valley," Indian Journal of Landscape Systems and Ecological Studies, Vol.18, No. 2, Pp. 62-69, 1985.
- [9]. K. Bhagabati, "Spatial Analysis of small-scale Agriculture in Assam: A Case Study of Nalbari District," Ph.D. Dissertation, Department of Geography, Gauhati University.
- [10]. K. Bhagabati, and D. C. Dutta, "Innovation in Farming Practice and Dynamics of Crop Productivity in Malybari area of Kamrup District" Journal of Geography, Vol. 2, Pp. 18-32, 1999.
- [11]. S. S. Bhatia, "Spatial Variation, Changes and Trends in Agricultural Efficiency in Uttar Pradesh" Indian Journal of Agricultural Economics, Vol. 22 (1), pp. 66-80, 1967.
- [12]. C. Bolman, "Wet Rice Cultivation in Indonesia, A Comparative Research on Differences in Modernization Trends," Ph.D. dissertation, Wageningen University and Research Centre, Netherlands, 2006.
- [13]. M. M. Das, "Problems of Agricultural Growth in Assam," Geographical Review of India, Vol. 40, No. 2, 1978.
- [14]. M. M. Das, "Agricultural Land Use and Cropping Pattern in Assam," Geographical Review of India, Vol. 44, No. 4, Pp. 32-39, 1982.
- [15]. M. M. Das, "Peasant Agriculture in Assam," Inter-India Publications, 1984.
- [16]. M. M. Das, "Agricultural Regionalisation of Assam: A Quantitative Analysis," The North-eastern Geographer, 1985.
- [17]. R. Gasson, "Occupations Chosen by the Sons of Farmers," Journal of Agriculture Economics, Vol.20, 1968.
- [18]. M. Ghosh, "Agricultural Development, Agrarian Structure and Rural Poverty in West Bengal," Economic and Political Weekly, Nov. 21, 1998.
- [19]. C. Goswami, "Pattern of Sediment Yield from River Basins of the Brahmaputra System, North-East India," The North Eastern Geographer, Vol. XVII, No. 1 & 2, Pp. 1-11, 1985.
- [20]. C. Goswami, "Floods and their Impact on the Agriculture of Assam," Institute of Development Studies, Guwahati, Pp. 191-207, 1989.
- [21]. N. Goswami, and M. M. Das, "Peasant's Response to Agricultural Innovation in Backward Area of Assam," Journal of Geography, Vol. 2, Pp. 54-69, 1999.
- [22]. R. Knowles, and J. Wareing, "Economic and Social Geography," Rupa publication, 1996.
- [23]. L. Nath, "Growth and Development of Peasant Agriculture in Mangaldai Region," M.Phil. Dissertation, Gauhati University, Guwahati.
- [24]. P. K. Nath, "The Castes and Communities of Farmer and their use of Modern Inputs in Agriculture - A Study in Sipajhar Revenue Circle of Darrang District, Assam," Jnanam- A Trilingual Academic Journal, Vol.1, No.2, Pp.106-116, 2014.
- [25]. J. Patil, "New Technologies in Agriculture," Proceedings, First Agricultural Science Congress 1992, National Academy of Agricultural Sciences, New Delhi, Pp.116-21, 1993.
- [26]. L. Shrestha, "A Socio-Economic Study of the Nepali in Darrang District with particular reference to Sipajhar Area," Ph.D. Dissertation, Gauhati University, 2009.
- [27]. J. Singh, "An Agricultural Geography of Haryana," Vishal publications, Kurukshetra' 1976.
- [28]. J. Singh, and S. S. Dhillon, "Agricultural Geography," Tata Mc Graw-Hill Publishing Company limited, 1995.
- [29]. J. Singh, and V. K. Sarma, "Determinants of Agricultural Productivity," Vishal Publications, Kurukshetra, Part II, 1985.
- [30]. M. Taher, "Regional Basis of Agricultural Planning in the Brahmaputra Valley," North Eastern Geographer, Vol. 7. 9-18, 1975.