THE COMPARATIVE STUDY OF THREE AGRO-CLIMATIC ZONES IN WEST BENGAL, INDIA

Karabi Dutta (UGC-NET, Geography)
EX-STUDENT :VIDYASAGAR UNIVERSITY

ABSTRACT

West Bengal as state in eastern bottlenecks of India.It lies 85.50ºE to 89.50ºE longititude and 21.25ºN to 27.13ºN latitude.West Bengal is a gifted the holistic landforms .Stretching from the Himalayas in the North to the Bay of Bengal in the South.Upland of the plateau in the West.For this features West Bengal has varities of landuse and geographical condition and different types of soil structure.for this variation,economic condition is not good in this state.so,we have discuss a cluster of varied physical features of three agro-climatic zone(ACZ) of West Bengal.In this study,we have focused on the following aspects:

- Various land use of three ACZ.
- Changing of soil structure of three ACZ.
- Different geographical condition of three ACZ.

The following have been found out from such study.our study as stated as revealed that-

- To show economic condition of three ACZ.
- Status on soil condition and irrigation system.
- To measure poverty level of districts.

From the facts as stated, it can be concluded that management the infrastructure of all aspects of three ACZ and growth economic development.

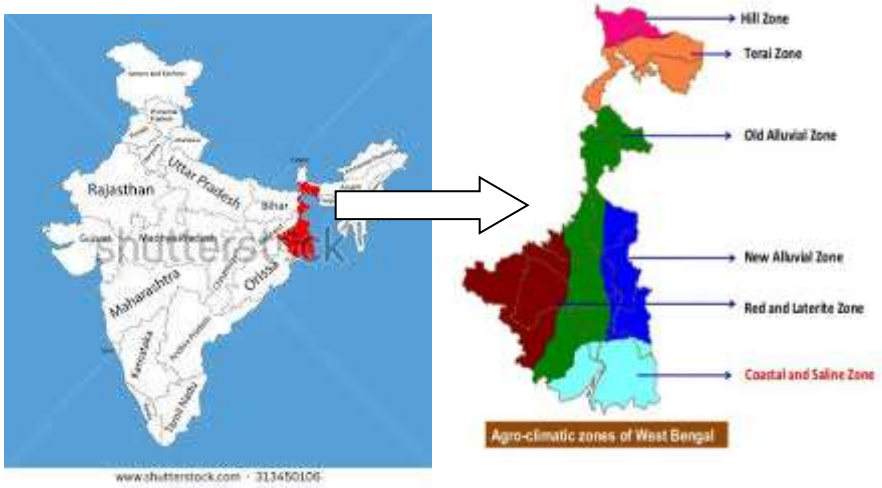
KEY WORDS: Landuse pattern, Geographical condition, Soil properties (physical, chemical, biological), Economic structure, Poverty.

INTRODUCTION :-

West Bengal can be divided into six ACZ.West Bengal is a cluster of varied physical features.The climate of West Bengal is hot and wet tropical monsoon.Someplace suffer cold climate but not support profitable agriculture.Anywhere suffer hot climate but not support profitable agriculture.Even some place suffer hot and wet climate but increase net sown area and decrease gross sown area and productivity.Nasim Aktar stated in his article that agriculture productivity for all crops related with district wise productivity region,West Bengal.Dr. NPS Sirohi stated in his article that nature of topography with related mechanization of agriculture in lower gangetic plain region,ACZ-III in West Bengal. Dr. B.C Rudra and Dr. S.Kole stated in their article that analysis mixing cropping pattern specialy reference with cropping pattern of Terai ACZ in West Bengal.K.S.Gajbhiye and C.Mondal st6ated in their article that soil resource,cropping system,land use with 19 ACZ in India.So we have decide that we have discuss compare of land use,soil condition and geographical condition and its effect on economic condition of three ACZ of West Bengal.

STUDY AREA –

The study area held on three agro-climatic zones of West Bengal. Research work" **The Comparative Study Of Three Agro-Climatic Zones In West Benga , India".** The state West Bengal can be divided into six broad division of agro climatic zone.Three of them such as - (1) The Terai and Teesta alluvial region of north bengal.(2) The Gangetic alluvial region in the west.and (3) The lateritic .red or gravely undulating region in the west have been selected as a study area which are located 2.149 lakh ha.(Terai region).15.304 lakh ha (Gangetic region).24.842 lakh ha (The undulating Red and Lateritic and gravely region).The Terai region consists Jalpaiguri.Coochbehar.Alipurduar and some part of Uttar Dinajpur districts.The Gangetic alluvial region specially new alluvial zone consists Nadia.East Bardhaman.Howrah.Hooghly.Kolkata. Murshidabad.South 24pgs.North 24 pgs.East Medinipur districts etc.The Lateritic.Red or Gravely undulating region consists Purulia.Bankura.West Bardhaman and West Medinipur. River,soil,natural vegetation,biological diversity (flora and fauna),climate,agriculture, are natural resources of west Bengal.Agriculture of west Bengal depends on soil and climate.Agriculture,soil and climate are interrelated.Depending on soil and climate variation west Bengal can divided six ACZ.Our study area based on three ACZ.



THREE AGRO-CLIMATIC ZONES OF WEST BENGAL AS A STUDY AREA.

AGRO-CLIMATIC ZONES	*DISTRICTS*	*AREA (LAKH. HA)*
The terai and Teesta alluvial region of north Bengal	*1.Coochbehar* *2.Jalpaiguri* *3.Alipurduar* *4. North Dinajpur (Islampur)*	*2.149*
The gangetic alluvial region in the south-east	*1.East Bardhaman* *2.Hooghly* *3.Howrah* *4.Kolkata* *5.Nadia* *6.Murshidabad* *7.North 24 pgs*	*15.304*
The lateritic red an gravely undulating region in the west.	*1.Purulia* *2.Bankura* *3.Birbhum* *4.West Bardhaman* *5.West Medinipur*	*24.842*

STATEMENT OF PROBLEM :-

AGRO-CLIMATIC ZONES	PROBLEMS
The Terai And Teesta Alluvial Region Of North Bengal	Soil is steep gradient,can not support agriculture,Very thin layer of soil,Soil horizon is not development,Most important barrier of agriculture is leaching-minerals are down ward movement.Bacteria process are slow for cold climate,Soil is acidic in nature (pH 4.2 to 6.2),Higher rainfall (2000-3200mm),Lack of irrigation system.,Problem of crop conservation
The Gangetic Alluvial Region In The South-East	Poor in plant nutrients and organic matter,Unscientific and inequality uses of irrigation system and other agricultura lmaterials like seeds. fertilizer. chemicals. substance. agricultural loan and scarifier etc,Increase Net Sown Area and low level of productivity,Over depend on ground water and misuse it.,Lack of knowledge to reclaim the land.

Undulating Red And Lateritic Zone In The West	Undulent topography,.Soil is light textures.porous,Acidic in nature (pH 5.5 to 6.2),Erosion prone area,Small nodules of iron concretion are found in the surface layer,Poor in organic matter,Low nitrogen and phosphate,Difficiency of irrigation system,Uses agricultural materials are very low,Sporadic deficiency of micro nutrients,Not support agriculture,Rain-fed region,depend on irrigation system,Soil is hardy,fertility level is low

RESEARCH QUESTIONS :-

- What are the landuse of three agro-climatic zone.W.B ?
- How are the geographically conditions of the three agro-climatic zones?
- What are the soil conditions of three agro -climatic zones .W.B?
- How much interrelated soil types and crop varities of three agro -climatic zones ?

AIMS AND OBJECTIVES :-

- .To asses interrelations with soil conditions and varieties of crops .
- To take future action of all dimension of three agro climatic zone.
- To analysis the economic condition of three ACZ.
- To measurement of poverty.

RESEARCH METHODOLOGY:-

The methodology required the study is sample based.First,the data are collected from different secondary sources.Secondly,some techniques are choosen to arrange them in such way and analyse the data properly.

(a) DATA BASE :-

The necessary data and information are collected from primary data is depend upon by field study with prepaire questionnaire and agricultural officers also. Different secondary sources like research article,books,census 2011,Govt.report,W.B.Google Emage data.Microsoft office.

(b) METHODS:-

To fulfill the objective of the study some quantitative techniques . The collect information has been studied through different analytical and interpretative methods.Stratified sampling method.and Spearman's rank correlation co-efficient methods are applied for this article.Statistical techniques like climograph,bar graph,line series map,area graph and pie diagram are used for this journal.Finally the collected data and information have been assimilated for the presentatrion of final thesis.

LITERATURE REVIEW:-

- From the book *"Geography of India" by R.C.Tiwari* has analysed physical,geological,biological;, agricultural,economical and others aspects of India. Specific details in agro-Climate zone with agro-ecoregion which are can divided agro-climate zone and agro-eco-region of West Bengal.This book is used for all purpose.
- It is evident from the book *"Nadiar Nadi O Jalabhumi Katha" by S.Karmakar* has stated that many rivers like Jalangi,Churni,Mathabhanga, Ichhamati flow on new alluvial zone. These river change their direction and create delta on new alluvial places.
- It is evident from the book *"Paschim-Banger Bhougolik Parichay" by S.Chatterjee* has stated that all dimension like Physiography, soil, climate, naturalvegetation, flooded report and other of West Bengal.Specially analysed that Jalangi river carries sediment. This book has analysed how is created hydro-morphological evolution.
- It has been observed from the book *"Bharat and Paschimbanger Bhugol" by K.C.Mandal* has stated that this book has analysed all aspects of India with state wise and all aspects of West Bengal with districts Wise and all dimension of world will all conditions wise. This book has analysed on details of district wise physiography, Soil,agricultural part,economic part of west Bengal.

- From the book "*Paschimbanger Bhougolik Ruprekha " by S.Tikader* has analysed that all aspects of West Bengal on details like Physiography division,geology, details on soil. Natural vegetation, agro-climatic zone and specific agricultural part and crop varieties with year wise and percentage of growth rate and geographical condition.
- According *to Dr.Sk.J.Ali, and in his book "Falar Bonate Chaser Mati o Tar Parichay "* (in bengali) has stated that soil, growth of crops and geographical condition,properties of soil, soil types of West Bengal, food nutrient of West Bengal agriculture, way to production of crops like Paddy, its effect and also explained soil fertility, productivity, problem and soulution of soil of West Bengal and organic farming.
- According *to A.Gupta and his book "Sahaj Kathai Sabji Chas"* has analysed various types of crops like Brinjal, Parbal, Basil, Coriander, Onion, Cabbage, Cauliflower and other crops and vegetables and their Soil condition, soil pH,different kinds of crops and vegetables and fruits.
- According to *"Mati Saar Fasal " by B.L.Jana* has stated that varities aspects of soil and interrelated with agro-eco-region of West Bengal and also included socio-economic condition of farmers. This book is stated of production and productivity and also included precision farming on details.
- From the book *"Krishir Pratham Path (Matir Swastha oh Sar Prayog)" by Dr.Sk.J.Ali* has analysed that soil and properties of soil, problem and solution of soil of West Bengal, and varities of soil of West Bengal and also included sustainable farming and organic farming and experiment of soil for varities of crops production of West Bengal.
- According to Gajbhiye.K.S. and Mandal. C. and their article "Agro-Ecological zones, their Soil Resource and Cropping System has analysed that 19 agro-eco-region with interrelated agro Climatic condition,Soil condition and land use pattern of India and their constrains. This article has stated that major group of soil of each agro-eco region, varities of crop in different agro-ecological region, physicalproperties of soil of different agro-ecological region and geographical situation of different agro-ecoregion of India.
- According *to Dr.B.C Rudra and Dr.S.Kole in this article "Changes in crop mis and cropping pattern in different agro-climatic zones of West Bengal with Special reference to Terai zone*" has analysed that to compare geographically condition like rainfall, temperatuire month wise on three agro-climatic zone and also analysed special reference to The Terai zone and its Climate condition. This article has been analysed varities of crops, vegetables on three agro-climatic region specially Terai region of West Bengal.
- According *to Dr. NPS Sirohi and his article "Long term Stategies and Programmes for Mechanization of Agriculture in Agro-Climatic-Zone-III,Lower Gangetic plain Region"* has stated that sub agro-climatic zone with their characteristic such as Borind Plains, central Alluvial Plains,Alluvial Coastal Saline Plains and Rarh Plain.Also stated that general topography of the zone with brief historical background of agricultural development.Population and population density of the zone and infrastructural facilities of the zone and also analysed agricultural mechanization programof the region.
- According *to Nasim Aktar in his article "Agricultural Productivity and Productivity region in Wesr Bengal*" has analysed that oroductivity region under cereal crops, Pulses, Oil seeds crops, Cash crops of West Bengal (2010-2011) districts wise. And also shown varities of crops and their productivity of West Bengal map.

DATA COLLECTION AND INTERPRETATION :

CHAPTER (A) – STUDY ON THE LAND USE PATTERN

Agro-Climate Zone	**Districts**	**Area (lakh-ha)**	**Geographial area**	**Agro –eco region**	**Depth (cm)**
Terai Region	Jalpaiguri, Coochbehar, Kalinpong	2.149	1.9%	Hot Subhumd To Humid (Inclusion of Perhumid)	Gently To moderate Shallow (25-50)
Gangetic alluvium Region (New alluvium zone)	Nadia,Murshidabad N.24 pgs, Hooghly, Howrah,Kolkata Bardhaman, S.24 pgs	15.304	55.7%	Hot Subhumid (moist) to Humid (Inclusion of per humid)	Very Deep (75-100)

	East Medinipore				
Undulating Red and Lateritic Region	Bankura ,Birbhum Purulia,Bardhaman(W) Medinipur (W)	24.842	22.3%	Hot sub-humid	Shallow To Very Deep (50-75)

- **The Terai and Testa Alluvial Region of North Bengal :** It represents the area of the Himalaya range Stretching South-Wards to about 38 km,covering foothills of Himalayas like Jalpaiguri, Coochbehar, some part of Uttar Dinajpur and Alipurduar districts with an are of ***0.17 million hector*** occupying ***1.9 percent of*** geographical area of the state
- **The Gangetic Alluvial RegionIn The South-East :** It represents the area of the Whole of Murshidabad, Nadia, Kolkata, Hooghly and Howrah and the Northern part of S.24 pgs, N.24pgs, East Bardhaman and East Medinipur with an area of ***4.93 million hector*** occupying ***55.7 percent*** of geographical area of the state.
- **Undulating Red and Lateritic Region In The West :** It represents the chotonagpur highlands covering the Western pant of the region –Purulia, Bankura, Birbhum, West Bardhaman, pant of West Medinipur with an area of ***1.98 million hector*** occyping ***22.3 percent*** of geographical area of the state.

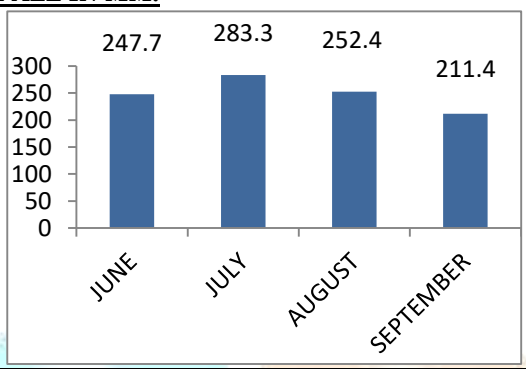
CHAPTER (B)—STUDY ON THE GEOGRAPHICAL CONDITION

Agro-Climate Zone	**Districts**	**Climate**			**Soil moisture Regimes**	**Soil temperature regimes**	**Agro-ecological zone**
		Rain(mm)	**Temp**				
			Max	**Min**			
Terai Region	Jalpaiguri Coochbehar	2000 To 3200	31.1ºc	10.5ºc	Udic	Thermic To Hyperthermic	Hot subhumid to Humid (Inclusion of Perhumid)
Gangetic alluvium Region (New alluvium zone)	Nadia,Murshidabad N.24 pgs, Hooghly, Howrah,Kolkata Bardhaman, S.24 pgs East Medinipore	1350 To 1450	35ºc	15.6ºc	Ustic	Hypertheramic	Hot Subhumid (moist) to Humid (Inclusion of Per humid)
Undulating Red and Lateritic Region	Bankura ,Birbhum Purulia,Bardhaman(W) Medinipur (W)	1100 To 1400	27.6ºc	15ºc	Ustic	Hyperthermic	Hot sub Humid

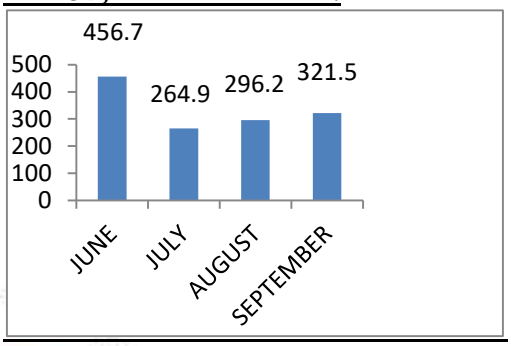
- **The Terai and Testa Alluvial Region of North Bengal:** This region is characterized by hot subhumid to humid (inclusion of per humid) with maximum temperature 31.1°c and minimum temperature 10.5°c and mean annual rainfall 2000 to 3000 mm. The precipitation covers equal of the mean annual PET (Potential Evapotrans Piration). The area qualifies for ***Udic*** soil moisture regime and ***thermic to hyperthermic*** soil temperature regime with length of growing period ***(LGP) of 270 to 300 days in a year***.
- **The Gangetic Alluvial Region In The South-East :** This region is characteristic by hot subhumid (moist) to humaid (inclusion of per humid) with maximum temperature 35°c and minimum temperature 15.6°c and mear annual rainfall 1350 to 1450mm. The precipitation covers 70-80%of the mear annual PET. The area qualifies for ***Ustic*** soil moisture regime and ***hypertheramic*** soil temperature region with ***LGP of 210 to 240 days in a year.***

- **Undulating Red and Lateritic Region In The West :** This region is characterized by hot subhumid with maximum temperature 45°c and minimum temperature 9°c and mear annual rainfall 1100 to 1400mm. The precipitation covers 80-90% of the mear annual PET. The area qualities for ***Ustic*** soil moisture regime and ***Hyperthermic*** soil temperature regime with ***LGP of 150 to 180 days in a year.***

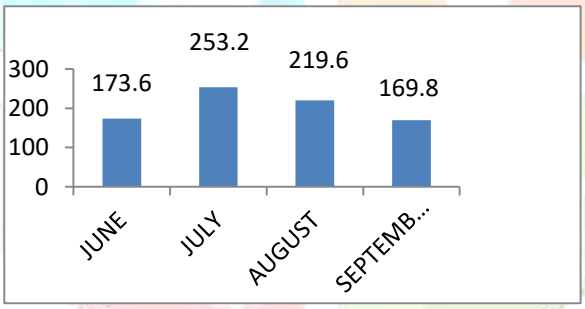
GANGETIC ALLUVIAL ZONE IN THE SOUTH-EAST(DISTRICT-NADIA) POINT –KRISHNAGAR(2005-2015):MONSOON PERIOD RAIN FALL IN MM.



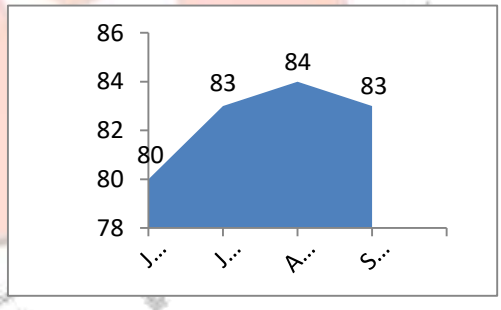
THE TERAI AND TEESTA REGION IN THE NORTH,(DISTRICT-COOCHBIRAR), POINT-RANGPUR(2005-2015),MONSOON PERIOD,RAINFALL IN MM.



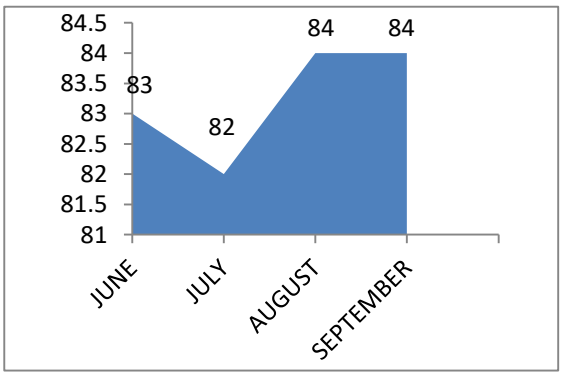
UNDULATING RED AND LATERITIC ZONE IN WEST, (DISTRICT-PURULIA) POINT-JAMSEDPUR(2005-2015),MONSOON PERIOD RAINFALL IN MM.



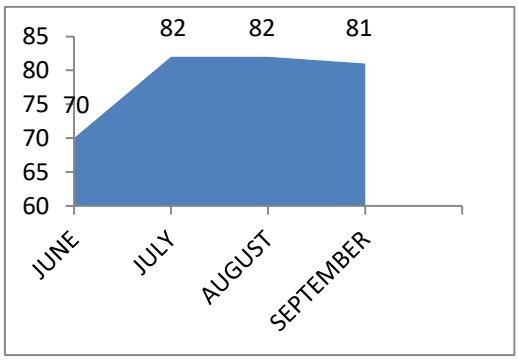
GANGETIC ALLUVIAL ZONE IN THE SOUTH-EAST(DISTRICT-NADIA)POINT – KRISHNAGAR(2005-2015):MONSOON PERIOD HUMIDITY(%)



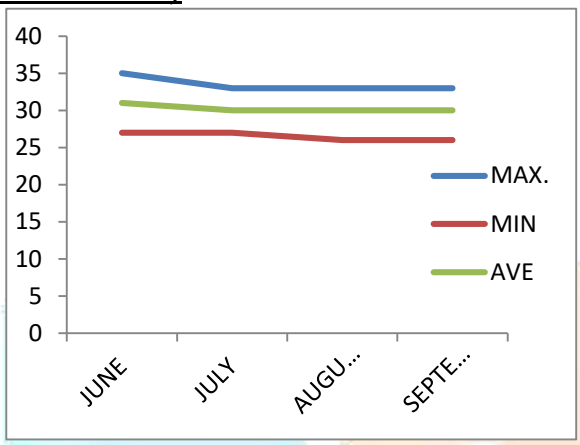
THE TERAI AND TEESTA REGION IN THE NORTH,(DISTRICT-COOCHBIRAR), POINT-RANGPUR(2005-2015),MONSOON PERIOD,HUMIDITY(%)



UNDULATING RED AND LATERITIC ZONE IN WEST, (DISTRICT-PURULIA) POINT-JAMSEDPUR(2005-2015),MONSOON PERIOD HUMIDITY (%)

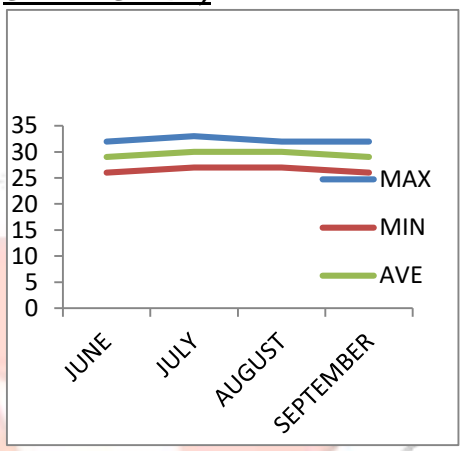


GANGETIC ALLUVIAL ZONE IN THE SOUTH-EAST(DISTRICT-NADIA)POINT –KRISHNAGAR(2005-2015):MONSOON PERIOD TEMPERATURE(DEGREE CENTREGRADE)

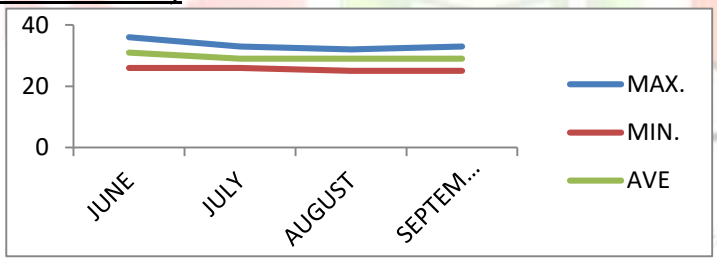


T

HE TERAI AND TEESTA REGION IN THE NORTH,(DISTRICT-COOCHBIRAR), POINT-RANGPUR(2005-2015),MONSOON PERIOD,TEMPERATURE(DEGREE CENTREGRADE)



UNDULATING RED AND LATERITIC ZONE IN WEST, (DISTRICT-PURULIA) POINT-JAMSEDPUR(2005-2015),MONSOON PERIOD TEMPERATURE(DEGREE CENTREGRADE)



CHAPTER : (D) STUDY ON THE SOIL CONDITION

Table :1- (Physical properties of soil , W.B)

Agro Climatic Zone	Districts	Soil Colour	Soil Texture	Water holding Capacity	PET	Depth
Terai Region	Jalpaiguri Coochbehar	Grey	• Fine loamy to clay • Sandy to sandy loamy	100-150 mm/mt	Equivalent	Shallow To Moderate Shallow (25-50 cm)
Gangetic alluvium Region (New alluvium zone)	Nadia,Murshidabad N.24 pgs, Hooghly, Howrah,Kolkata Bardhaman, S.24 pgs East Medinipore	Greyish	Loamy To Clay	150-200 mm/mt	70-80%	Very deep (75-100cm)
Undulating Red and Lateritic Region	Bankura ,Birbhum Purulia,Bardhaman(W) Medinipur (W)	Redish And Yellowish	Loamy to Clay and Undulating soil	100-150 mm/mt	80-90 %	Moderate Shallow To deep (50-75 cm)

Table : 2 (Chemical Properties of soil)

Agro Climate zone	Districts	PH	Soil Reaction
Terai Region	Jalpaiguri Coochbehar	4.2 to 6.2	Acidic
Gangetic alluvium Region (New alluvium zone)	Nadia,Murshidabad N.24 pgs, Hooghly, Howrah,Kolkata Bardhaman, S.24 pgs East Medinipore	5.5 to7.0	Neutral
Undulating Red and Lateritic Region	Bankura ,Birbhum Purulia,Bardhaman(W) Medinipur (W)	5.2 to 6.2	Light Acidic

(Percentage of elements on dry air)

SOIL	pH	CaO	K_2O	P_2O_5	CARBON	N_2
Terai soil	4.7-6.8	0.1-0.2	0.1-0.2	0.1-0.2	0.8-3.0	0.09-0.2
Ganga flat land soil	7.0-8.0	1.0-6.5	0.4-1.0	0.1-0.15	0.3-0.5	0.04-0.06
Ganga low land soil	7.0-8.2	0.6-3.0	0.1-0.8	0.6-0.1	0.5-1.0	0.05-0.09
Ganga riverine soil	7.5-8.2	1.0-5.0	0.3-0.7	0.1-0.15	0.1-0.3	0.02-0.05
Red soil	6.0-6.6	0.1-5.0	0.1-0.8	0.1-0.05	0.05-0.5	0.01-0.05
Laterite soil	5.5-6.5	0.1-0.4	0.1-0.4	0.01-0.5	0.05-0.5	0.01-0.8

Source :Paschimbanger Bhougolik Ruprekha,(April,2017).S.Tikader

Table : 3 (Microbial properties of soil)

Agro Climatic zone	Districts	Biological diversity Flora
Terai Region	Jalpaiguri Coochbehar	• Tropical deciduous Forest → Shal • Corifrous tree→Sirel • Shrub → Rauwolfia serpertina
Gangetic alluvium Region (New alluvium zone)	Nadia,Murshidabad N.24 pgs, Hooghly, Howrah,Kolkata Bardhaman, S.24 pgs East Medinipore	• Tropical warm deciduous→ Coconut tree Date tree,Banian tree,puple tree. • Grass→ Elephant grass,Cork plant • Mangrove tree→ Heritiera (Sundari), Rhizophora (Garan), Nypa Fruticans • Hydrofite tree→Water hyacinth, Acquatic herb • Betelnut,Mango tree,Banana tree etc. • Medicinal plant→Mangosa tree,Aloe, Mysobalan, Drumstick, Turmeric tree
Undulating Red and Lateritic Region	Bankura ,Birbhum Purulia,Bardhaman(W) Medinipur (W)	• Tropical dry deciduous forest→ Butea frundosa, Bassia Latifolia, Plum tree, Teak tree, Emblic mysobalan, Hog plum • Shrub→ Soapnut tree, Lantana tomana • Mulberry (Purulia, Bankura)

Source: Different agricultural books

- **The Terai and Testa Alluvial Region of North Bengal:** Terai soils are found only in the districts of Jalpaiguri, Coochbehar and Alipurduar.The total area covered by this soil is about 16,19,443 acor.These types of soil are mostly lighter in texture with lower base content, good amount of mixture of fully decomsed organic matter. For this reason the colour of the soil is from deep black to grey black. Due to the above factors, the soil is acidic in nature and available plant nutrient and also deficient in micro-nutrient.The terai soil are classified into Great Groups of ***Haplaquents, Dystrochrepts, Ustochrepts and Eric Haplaquents.***
- **The Gangetic Alluvial Region In The South-East :** This soil is covered the area 39,92,776 acor.This types soils are deep, mostly neutral in reaction and festile. The Ganga alluvium poor is plant nutrients and organic matter. Relatively greated leaching of clay mottling characteristic the flat land soils of the tract.These are midly acidic in reaction. Relatively mature profile and higher leaching have affected the ceplands of the tract. They one classified into great groups of typic ***Ustifluvents, Fluaquents, Pssamaquents, Haplaquents, Erical Vertic Haplaquents, TypicUstochrepts***. The depth of soil deep (75-100cm). The interfluvial zones are covered by soils clavey to sandy in texture, depending on the location.
- **Undulating Red and Lateritic Region In The West::** Laterite soils are found only in the districts of bankura, Birbhum, West Bardhaman, part of West Medinipur. The total area covered by this soil group is about 14, 72, 057 acor. Read soils are found only Purulia district and some part of Bankura and Birbhum districts. The total area covered is 12, 40, 864 acor. This types of soil light textured, porous and acidic in nature regarding plant nutrient. The soil are low in organic matter and available Phosphorus, available potassium and bases. Small nodules of iron conection are found in the surface layer and its

number increases with depth. In these soils, both nodular iron and calcium carbonate ghooting are found. The % of base saturation of red soil is more than the lateritic soilbecause of higher base saturation and loamy texture. The red soil becomes more responsive to fertilizer application than the lateritic soil .The depth of soil shallow to deep colour of soils are Reddisch and Yellowish. Soil are gravelly coars texture. The major soil groups are ***lithic Haplustalfs, Aquick, Altic and Rodic Paleustalfs, Tipic Ochraqualf, Plirthustalfs, Tipic Rhodustalfs, Lithic Rhodustalfs, Ustor***

Table : 4 (Soil and Crop Varieties)

Agro Climatic zone	**Districts**	**Types of soil**	**Crop Varieties**			**Major soil group**
			Food crop	**Cash crop**	**Plantation crop**	
Terai Region	Jalpaiguri Coochbehar	Fine loamy to clay Sandy to sandy loamy	Summer Rice, Wheat	Jute, Tobacco, Oilseeds	Vagetables	• Haplaquents • Dystrochrepts • Ustochrepts • Eric Haplaquents
Gangetic alluvium Region (New alluvium zone)	Nadia,Murshidabad N.24 pgs, Hooghly, Howrah,Kolkata Bardhaman, S.24 pgs East Medinipore	Loamy To clay	Autumn rice, Summer rice, Winter rice	Jute, Suger cane	Winter veg-Brinjal,cauliflower, Cabbage, Tomato, Peacod, Fruit-Mango, Banana,jackfruit, Guava,papaya	• Typic Ustifluvents, • Fluaquents, • Pssamaquents, • Haplaquents, • Eric, vestic Haplaquents, • Typic Ustochrepts
Undulating Red and Lateritic Region	Bankura ,Birbhum Purulia,Bardhaman(W) Medinipur (W)	Loamy To Clay Undulating soil	Maize	Sugercane , Cutton, corn	Lakhha,	• Lithic Haplustalfs, • Aquick,Altic and Rodic paleustalfs, • Typic Ochraqualf, • Plirthustalfs, • Typic Rhodustalfs • Lithic / Rhodustalfs Ustorthents

- **The Terai and Testa Alluvial Region of North Bengal:** The agro-Climatic zone shows sparse forest-specially tropical deciduous forest , coniferous tree etc. The major pant of cultivated once is under vegetables-Pineapple, Jackfruit, Orange, Banana, Guava,Tomato, Cashew, Tumeric. However there are tea plantation and some fruit on the high land and paddy, Wheat and vegetables cultivated on the low land
- **The Gangetic Alluvial Region In The South-East :** The agro-climatic zone shows densely forest-Tropical warm deciduous, Grass and Hydrofyte trees. Major part of the cultivated area in under crops Paddy, Wheat, Potato, Jute, Oil seed, fruits are Mango, Banana,Litchi, Guava and vegetables one-Onion, Tomato, Cabbage, Cauliflower, Papaya etc.
- **Undulating Red and Lateritic Region In The West:** The agro-climatic zone shows dispersed forest. Sal, Butea Pisondosa, Mahua tree grow in these soil. This area is tropical dry deciduous forest. The major part of cultivated area is under vegetables-Onion, Tomato, fruits are- Guava, crops are Paddy is cultivated on rainfed area, slope of mountain, pulse, Oilseeds (peanut, Mustard seed) are cultivated on high and low lane. The landscape of this zone is Undulent topography. Mostly they have been brought under cultivation after deforestation which has accelerated the process of erosion.

MAIN WORKER AND NON WORKER OF COMPARISION AMONG THREE AGRO-CLIMATIC ZONE

Zone	District	Main Worker (%)		Total (%)	Marginal Worker(%)		Total (%)	Non Worker (%)		Total (%)
Terai Zone		Male	female		Male	Female		Male	Female	
	Coochbehar	51.66	9.98	31.44	6.58	10.69	8.57	41.76	79.33	59.99
	Jalpaiguri	46.50	12.25	29.79	8.53	10.05	9.27	44.97	77.69	60.94
	N.dinajpur	44.4	9.3	27.4	7.15	9.64	8.36	48.45	81.04	64.23
	Nadia	52.95	7.59	30.88	5.61	3.89	4.77	41.44	88.52	64.34
	Murshidabad	45.83	10.34	28.46	8.91	7.04	7.99	45.26	82.62	63.34
Gangetic Alluvial Zone (New Alluvial)	N.24 pgs	51.39	8.68	30.53	6.14	4.12	5.15	42.47	87.19	64.32
	Bardhaman	46.35	8.75	28.08	11.45	7.73	9.65	42.19	83.52	62.28
	Hooghly	51.99	9.29	31.07	8.89	6.95	7.94	39.12	83.76	60.99
	Howrah	52.16	8.17	30.07	7.75	5.53	6.67	40.09	86.31	62.48
	Kolkata	54.92	13.19	30.85	5.02	4.73	4.88	40.07	82.09	60.07
	S.24 pgs	41.90	6.39	35.06	14.56	8.85	11.17	43.54	84.76	63.68
	E.Medinipur	38.03	5.15	24.50	19.62	10.83	25.37	42.35	84.01	62.15
Undulating Red and Lateritic Zone	Purulia	32.95	8.38	22.12	22.90	20.58	21.71	46.48	68.71	57.35
	Bankura	41.46	8.77	20.93	15.71	14.85	15.29	42.83	76.38	59.23
	Birbhum	43.46	7.43	25.48	13.63	10.2	11.96	42.50	82.36	61.98
	W.medinipur	41.63	8.89	25.58	16.79	16.9	16.8	41.57	74.13	57.57

Source: Census 2011,Govt. of W.B

MAIN WORKER (X)	MARGINAL - WORKER (Y)	R_X	R_Y	$d=(R_X-R_Y)$	$d^2=(R_X-R_Y)^2$
29.79	9.27	2	3	-1	1
31.44	8.57	3	2	1	1
27.4	8.36	1	1	0	0
					$d^2=2$

RESULT AND DISCUSSION:

ECONOMIC CONDITION COMPARISION AMONG THREE ACZ

THE TERAI AND TEESTA AGRO CLIMATE ZONE

Spearman's Rank co-relation co-efficient method: (r)

$$r = 1- 6 d^2 / n(n^2-1)$$
$$=1- 6x2/3(3^2-1)$$
$$= 1-12/3(9-1)$$
$$=1-12/24$$
$$=1-0.5$$
$$=0.5$$

GANGETIC NEW ALLUVIAL ACZ

MAIN WORKER (X)	MARGINAL-WORKER (Y)	R_X	R_Y	$d=(R_X-R_Y)$	$d^2=(R_X-R_Y)^2$
30.88	4.77	6	1	5	25
28.46	7.99	3	6	-3	9

30.85	6.67	5	4	1	1
31.07	7.94	7	5	2	4
35.06	4.88	8	2	6	36
28.08	9.65	2	7	-5	25
30.53	5.15	4	3	1	1
24.50	11.77	1	8	-7	49
					d^2=150

Spearman's Rank co-relation co-efficient method: (r)

$r = 1 - 6\{d^2 / n(n^2-1)$

$=1- 6x150/8(8^2-1)$

=1-900/8(64-1)

=1-900/504

=1-1.78

=-0.78

UNDULATING RED AND LATERITIC ACZ

MAIN WORKER (X)	**MARGINAL-WORKER (Y)**	**R_X**	**R_Y**	**$d=(R_X-R_Y)$**	**$d^2=(R_X-R_Y)^2$**
26.06	11.96	4	1	3	9
25.48	15.29	2	2	0	0
20.93	21.71	1	4	-3	9
25.54	16.8	3	3	0	0
					d^2=18

Spearman's Rank co-relation co-efficient method: (r)

$r = 1 - 6\{d^2 / n(n^2-1)$

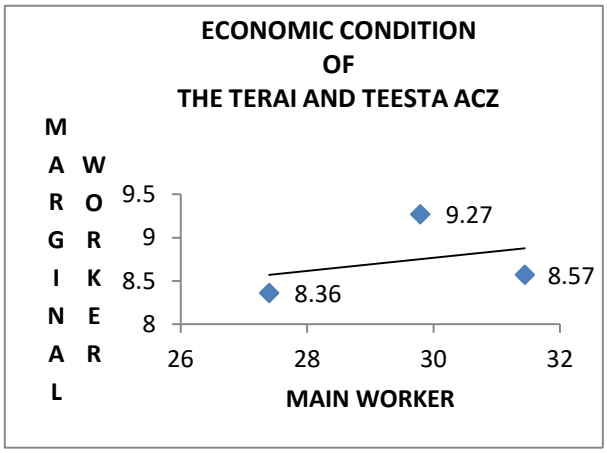
$=1-6x18/4(4^2-1)$

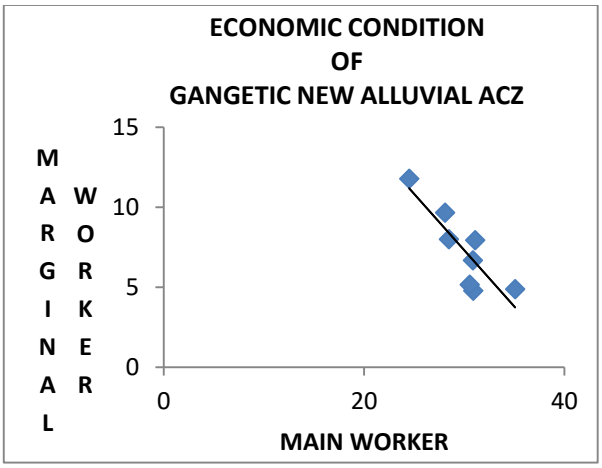
=1-108/60

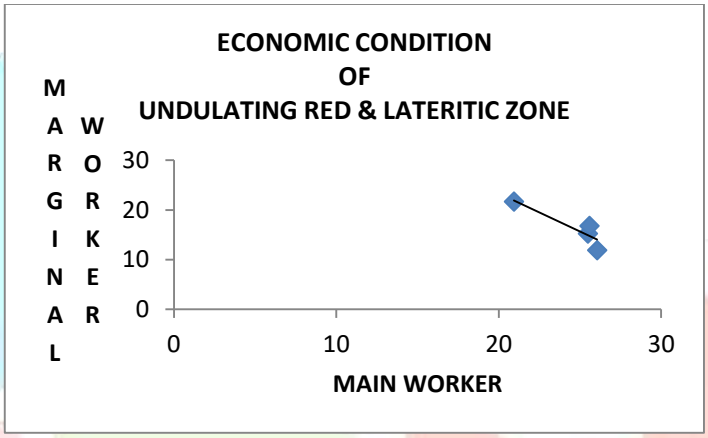
=1-1.8

=-0.8

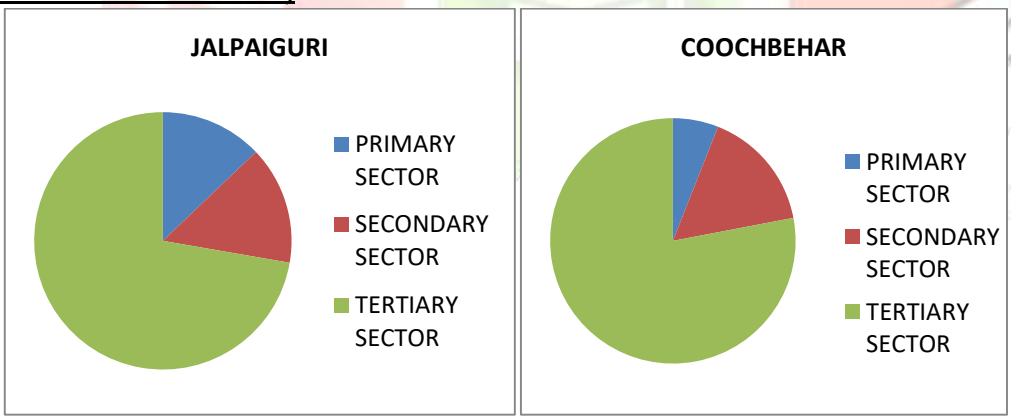
Based on Spearman;s rank co-relation co-efficient method show economic condition of three ACZ.The Terai and Teesta ACZ has been conducted positive co-relation between main worker and marginal worker.Average main worker of W.B is 28.14%.Main worker of Coochbehar is 31.44%,Jalpaiguri is 29.79% and Uttar Dinajpur is 27.4%.So,main worker of three districts are high than average worker. This ACZ has no sufficient scope of work.Most of main worker are engaged in tea planatation.They are main woker,they are engaged in work more than 6 months but their earn is very low. Rate of education is low.Lack of knowledge for use technology.So production is low.So positive relation between main worker and marginal worker coz two types worker is equql position in this region.The Gangetic new alluvial ACZ has been conducted negative co-relation between main worker and marginal worker.In that, growth of main worker and decrease of marginal worker.Average of main worker of W.B is 28.14%.Kolkata is 35.06%,Hooghly is 31.07% and Nadia is 30.88%.There have scope of work.Most of population are engaged in work.So,relation between main and marginal worker are stronghly negative.Undulating Red and Lateritic ACZ has been conducted Negetive co-relation between main and marginal worker.Average of marginal worker of W.B is 9.9%.Purulia is highest marginal worker zone 21.71%.Birbhum is 11.96% and Bankura is 15.29%.Most of population are marginal worker in this region.This area is minning belt area.So most of worker are engaged in this work and depend on it.



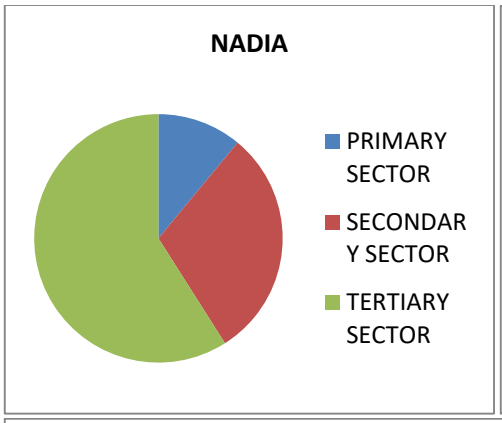


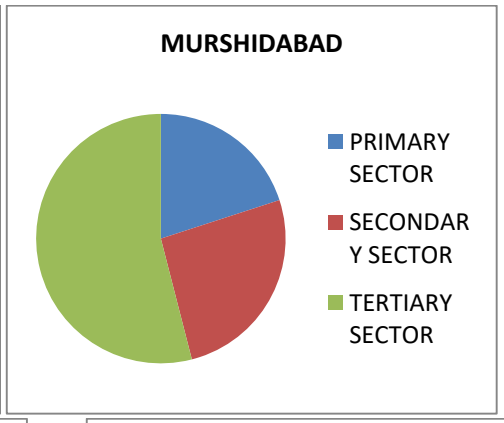


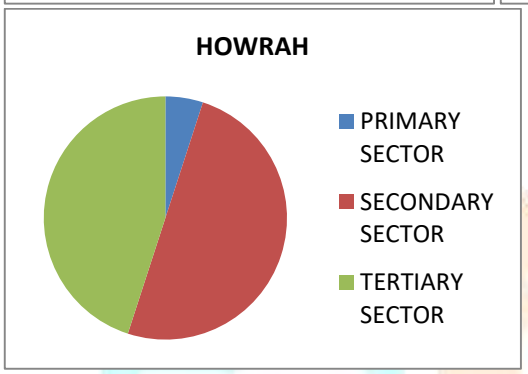
THE TERAI AND TEESTA ACZ (ECONOMIC CONDITION-PERCENTAGE OF EMPLOYEE ENGAGED IN DIFFERENT SECTORS)

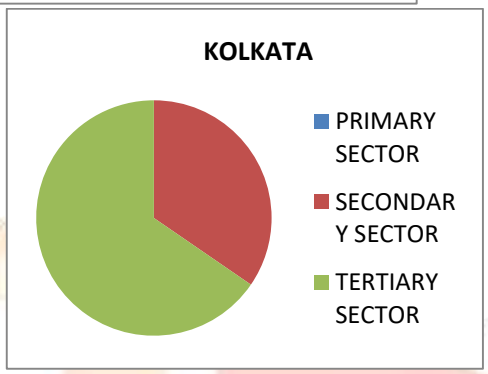


GANGETIC NEW ALLUVIAL ACZ (ECONOMIC CONDITION-PERCENTAGE OF EMPLOYEE ENGAGED IN DIFFERENT SECTORS)

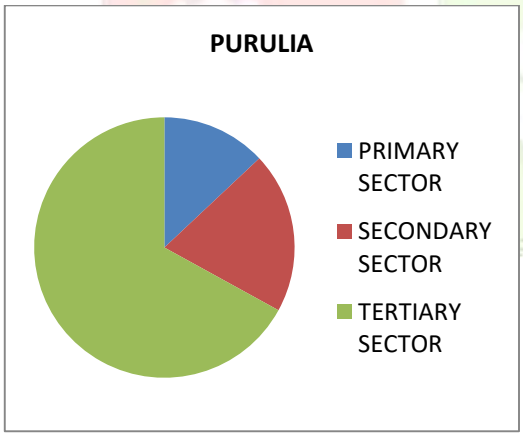


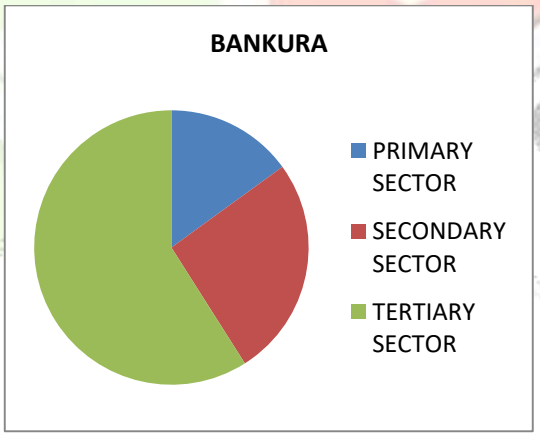


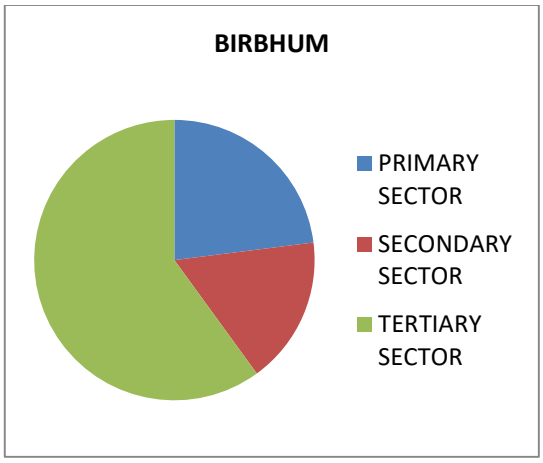




UNDULATING RED AND LATERITIC ACZ(ECONOMIC CONDITION-PERCENTAGE OF EMPLOYEE ENGAGED IN DIFFERENT SECTORS)





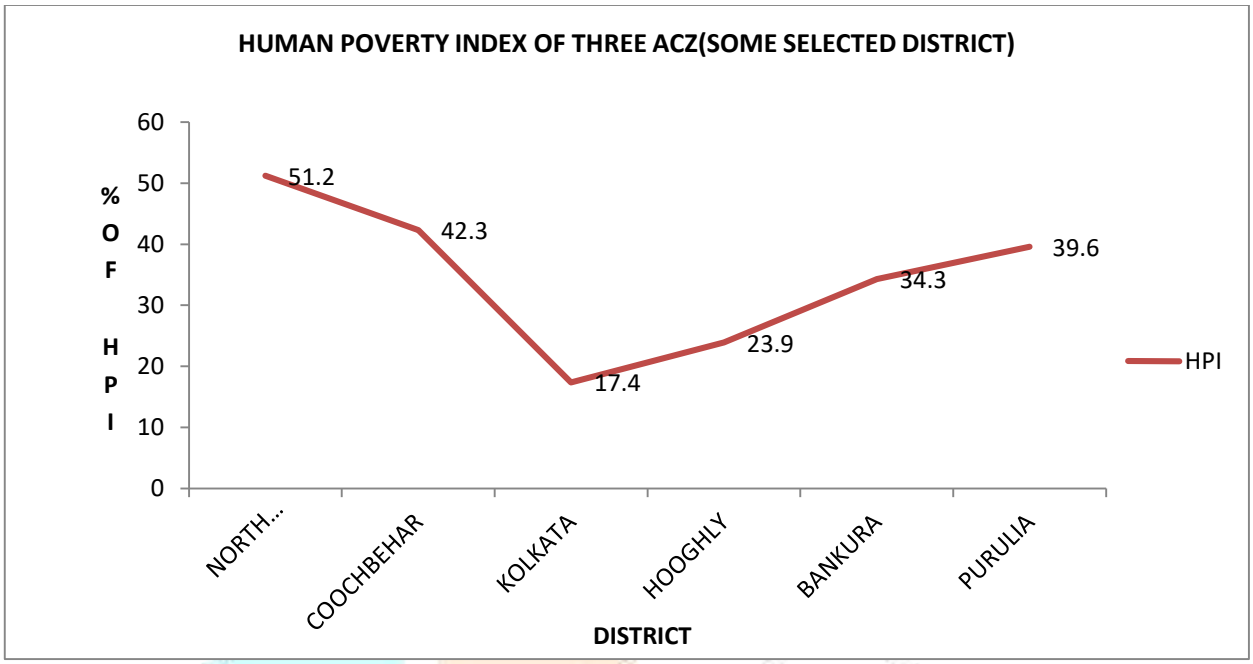


West Bengal ranked 9th among 15 major states in India in Human Poverty Index (HPI),measure by using National Family Health Survey-3 data for the year 2005-2006.HPI for each district in West Bengal.Based on Time series graph to show percentage of poverty level help with West Bengal Development Report,Govt. of India.The Terai and Teesta ACZ has been conducted highest percentage of poverty level.North Dinajpur has highest percentage of poverty (51.2%),followed by Coochbehar(42.3%).The Gangetic New Alluvial ACZ has lowest percentage of poverty.Kolkata has lowest percentage of poverty(17.4%),followed by Hooghly(23.9%),Howrah(30.3%),Nadia(30.7%).Increase of unemploy is the important reason for poverty.Undulating Red and Lateritic ACZ has suffer poverty. Purulia district has been conducted (39.6%) of poverty,followed by Bankura(34.3%),Birbhum(40.5%).

POVERTY ZONE	**HPI**	**DISTRICTS**
LOWPOVERTY ZONE	Below 30%	Kolkata,Hooghly,N.24 PGS
MODERATE POVERTY ZONE	30% to35%	Howrah,Bardhaman,Bankura,Nadia,
HIGH POVERTY ZONE	Above 35%	N.Dinajpur,Murshidabad,Purulia,Coochbehar,Birbhum,Jalpaiguri,Medinipur,S.24 PGS

Souce: West Bengal Development Report, Census 2001,(calculate by scholar)

POVERTY LEVEL IN DIFFERENT DISTRICTS



Source: West Bengal Development Report,Planning commission Govt. of India

RESEARCH OUTPUTS :

The Terai and Testa Alluvial Region of north Bengal	• Conservation of rain water in gully, dug etc. • Recruited women worker in tea plantation. • Training arrangement for agriculture based. • To tillage the cropland and cultivated many crops. • To management contour farming. • To arrangement terrace farming • To arrangement basin listing. • This region can support grassed of scrubs. • Forestry and lumbering are good in this region
The Gangetic Alluvial Region In The South-East	• Shifting of crops in river erosion area. • Black gram, Musterd are cultivated in flood proane area. • Water melon, Cucumber are cultivated in some selected area where ground water level is low • To conservation water of flood which is used unnecessary by farmer • To management artificial recharge and rain water harvestind of ground water. • Use relay farming and strip farming process for agriculture
Red and Lateritic Region In The West	• To cultivate Tapioca and Cashew nut which are suitable for iron based soil. • To plantation tea, coffee, rubber with fertilizer area. • Storage of heavy rainfall and management irrigation system. • Management Tank irrigation system,this is suitable for in this region. • Find out the erosion prone area and management it for agriculture favourable condition.

CONCLUSION :-

After the data analysis we see that,The Terai and Teesta ACZ has been conducted a positive co-relation between main worker and marginal worker but negative impact on economic condition.The Gangetic New Alluvial ACZ has been conducted a poor strongest negative co-relation between main worker and marginal worker but condition on economic development is medium.And Undulating Red and Lateritic ACZ negative co-relation between main worker and marginal worker.Eventhough it should not be natural phenomena.So,if properly use the economic variable of three ACZ,then change economic structure and developed economic condition and positive infrastructure of West Bengal.

CHAPTERISATION OF PROPOSED RESEARCH WORK :-

- **Chapter-1 :** Introduction- it will include on the headline of six agroclimatic zones,research problem, study area (three agroclimatic zone), review of literature,and objectives and methodology.
- **Chapter-II :** Data base – data collection of sand use pattern, geographical condition, soil condition and economic structure and their interpretation.
- **Chapter-III :** Geographical materials – rain fall, temperature, humidity of New alluvial zone (specially three delta)
- **Chapter-IV :** Planning – take formula for various problem on three agroclimatic region.
- **Chapter-V :** Conclusion.
- **Chapter-VI :** Poverty – to measurement poverty.

REFERENCE :-

❖ **Books**

- Tiwari. R.C (2013) “Geography of India”.
- Chatterjee. S (Auh-2011) ISBN=81-87500-57-3 “Paschimbanger Bhougolik Parivhay (in Bengali)”
- Dr. Ali.Sk.J (Aug-2013) “Krishir Pratham Path (Matir Swastha oh Sar Prayog)” (in bengali) ISBN=978-81-923816-1-9
- Dr Ali Sk.J (July-2014) “Falar Bonate Chaser Mati o Tar Parichay” (in Bengali).ISBN=978-81-922480-7-3.
- Jana.B.L (Nov-2017) “Mati Saar Fasal” (in Bengali) ISBN=978-81-922479-3-9.
- Gupta. A (Jan-2017) “Sahaj Kathai Sabji chas” (in bengali).
- Dr. Tikadar.S (Apr-2017) “Paschimbanger Bhougolik Ruprekha” (in Bengali), ISBN=978-81-8064-248-7.
- Mondal.K (Aug-2015) “Bharat and Paschimbanger Bhugol” ISBN=978-93-82886-00-6

❖ **Articles :-**

- Gajbhiye.K.S and Mandal.C (Jan-2000), “Agro-Ecological zones, their soil Resource and cropping systems” (National Bureau of soil Survey and land use planning Nagpur).
- Dr Rudra.B.C and Dr Kole.S (Aug-2013) “Changes in crop-mix and cropping pattern in different Agro-Climatic zones of west Bengal with special reference ti Terai zone”.ISSN=2319-4421, Vol-2, No-8.IJMSSR.
- Dr Sirohi.NPS ”Long-term strategies and programmes for mechanization of Agriculture in Agro-Climate-zone-III,Lower Gangetic Plains region. (Indian Agriculture Research Institute.)”
- Aktar.N (July-Dec 2015) “Agricultural Productivity and Productivity region in West Bengal”, ISSN=0972-8406, The NEHU Journal,Vol-XIII, No-2, PP=49 to 61.