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LAND MANAGEMENT AND PERSPECTIVE PLANNING OF LANDUSE: A REMOTE SENSING AND GIS APPROACH - A CASE STUDY OF MULUGU DIVISION, WARANGAL DISTRICT, TELANGANA

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Abstract

Crisis is a very typical term that we discuss everywhere in our day to day life. Amongst all kinds of crisis, 'Land Crisis' is associated with various dimensions of socioeconomic issues, being one of the Elementary Resource of livelihood now a day. It plays the most vital role for the survival of a sustainable life for every living being on the planet. Addressing this issue in a subcontinent like India encompasses several causes and consequences of the resource management practice and planning, in perspective view of development. According to the statistical reports, at present the country shares approximately 17.83% of the world population, while its land is only 2% of the total geographical area of the world. This clearly indicates the pressure on the land is far beyond its carrying capacity. Productive lands, especially the arable agricultural lands are in a constant process of various degrees of degradation, transition, transformation, fragmentation and are unexpectedly turning into wastelands, built-up lands and other lands. Even it has been observed very frequently, that the Landuse pattern also has become complicated and dynamic. Unprotected non-forestlands, suffer the maximum degradation because of the excessive biotic pressure on it. In the last five decades, India's lush green village forests and woodlots have been deforested to the maximum level. Somewhere the deforested lands have been found to be used for agriculture or for settlements. Thence, a thorough study of the landuse and land cover and its optimal utilisation has become the ineluctable part of the developmental planning in the recent times. Through careful land use planning the available land resources must be optimally utilised.

Keywords: Landuse, Action Plan, Degradation, Agriculture, Resource

Introduction

Developmental planning is a process by which we try to achieve our objectives with the limited resources available to us. This means we must select our objectives and set priorities in a rational manner. The planning process is therefore a process of decision making about rational choices. Although ideally, we should try to use resources in the

optimal way to achieve our objectives, in practice we rarely do that especially at local level. Human response to various resources is affected by the socioeconomic structures of the communities' concern. The problems related to conservation and rational utilization of resources should be examined in this context. Mandal level planning is an aerial study and supplementing the nation and state plans. It implies evolving a developmental scenario consistent to the specific needs of the people, the growth potentials of the area and the budgetary allocation available. The task is to bring about an effective functional linkage and coordination among various agencies for optimal resource utilization. The natural phenomena such as land systems, soil, climate and water resources etc… have almost instantaneous effect on environment of the society and hence be reflected while planning for sustainability of the natural resources. This increasingly will affect the sound and efficient use of present expertise available.

The selected geographical extent i.e. Mulugu Division in Warangal District of Telangana is amongst those areas which always has been showing a low economic growth although the Division is rich of various resources. The laxity of knowledge-based approach and technical skills in management planning has become the remarkable barrier in the development of the region. A majority of the population of the study area depends on the capacity of the crop pregnancy of the available cultivable lands. But the notable retarding factor for the agricultural sector in contributing to the GDP of the Division is the existing improper land management. Hence, it calls for a perspective and adequate developmental plan at the grass root level, which can optimise the actual value of the land. The objectives are to examine the physical determinants and the spatial distribution in the division; to analyse the existing land utilization pattern in the division and to propose a suitable landuse for the division (action plan).

Review of Earlier Works

Singh et al. (2004) have shown with their study that the groundwater potential of an area can be effectively deciphered using geo electrical data combined with GIS and remote sensing. They have integrated various thematic maps and have used IRS-IC-LISS- III Scenes, geo–electrical data and litho–log data to detect zones that have groundwater potential. Weight factors were assigned to the selected features in each thematic map based on their infiltration characteristics and the groundwater potential zones in the Nagar block of Mirzapur District in Uttar Pradesh was differentiated. Their study revealed that a combination of all attributes helps in procuring more concise results in plotting out groundwater potential zones.

A comprehensive study of the basic theories, concepts and models in agricultural geography and physical and socioeconomic variables that affect agriculture has been undertaken by Majid Hussain (1979) in his work titled 'Agricultural Geography'. He has also dealt with agriculture mosaic at all spatial scales in an exhaustive manner. Beaty et al. (1978) dealt with scientific information on approaches adopted by different authors on planning and also information on effective land management and land use in their volume

titled 'Planning the Uses and Management of Land'. Shafi (1984) in his book entitled 'Agricultural Production and Regional Imbalances' worked on the concept of agricultural productivity and the various approaches adopted to measure agricultural productivity.

Database and Methodology

In the current paper, the data, for the taken set of periods between 2000-01 and 2010-11, has been collected from two major sources *viz. primary and secondary*. The third type of data is derived from the primary and secondary data after several processing and evaluations. The primary data was collected from the study area through GPS and DGPS survey as well as statistical surveys. Then the secondary data was further subdivided into four sub categories and were collected from different Government Authorities. Those are statistical, geological, topographical and remotely sensed data. The agricultural data was collected from the Directorate of Agriculture, AP. The water resources and irrigation data were collected from the Central Water Commission and Irrigation and Cad Department (Irrigation Wings, AP). Most of the other statistical data and the soil Information were collected from the Directorate of Economics and Statistics, AP. The forest data was collected from the 'AP State Forest Report, 2011' published by 'State Forest Department, AP'. The topographical and geological information was extracted from the toposheets of 1:50000 scale, collected from the Survey of India (SOI) and Geological Survey of India (GSI) respectively. Remotely sensed satellite scenes were acquired to extract the resource information and to prepare the database for Resource Information System (RIS). Multi-seasonal scenes of the Landsat-7 Enhanced Thematic Mapper (ETM^+) and Landsat-5 Thematic Mapper (TM) were collected from the official United States Geological Survey (USGS) database, for the period of 2000-01 and 2010-11 respectively to prepare the Landuse Land Cover (LU/LC) maps.

The 'Derived Data' is a result of several complex processing and management of these primary and secondary data, which includes most part of the methodology and its stages. The satellite scenes were processed using 'supervised and non-supervised' classification techniques in ERDAS Imagine, the scenes were processed and the possible landuse/land cover classes were extracted from raster to vector format for further vector analysis in ArcGIS. There the specific spectral signatures of different earth features were used to distinguish the various classes from the sample training sites, which were collected during the field DGPS survey. Multi temporal LU/LC data were compared for the change detection and percentile calculation.

For the study of the terrain, the relief, slope are generated from the Global 1^cs (30m) ASTER (Advanced Space borne Thermal Emission and Reflection Radiometer) Satellite DTM rectified by the GHPs (Ground Height Point) of the SOI Toposheets which helped understanding the flow direction of the surface water within the study area. Geological toposheets were used to study the chemical contents and the pH condition of

the soil of the agro-fields which means the Fertility Information System of the Agricultural Lands (FISSAL Database), to identify the Fine Cultivable Soil Covers (FCSC) within the study area.

Political Overview of the Study Area

The study area i.e. Mulugu Division, situated in Warangal District of Telangana, is bounded by Karimnagar District in the North, Medak District in the West, Nalgonda District in the South and Khammam District in the East of its borders. The study area extends between 17.9957°N to 18.6097°N latitudes and 79.5593°E to 80.6665°E longitude on the Decan plateau in central region on Gondwana Land of Indian Subcontinent. Thirteen Mandals constitute the Division's administrative jurisdiction *viz. Bhupalpalle, Mogullapalle, Chityal, Bhupalpalle, Ghanpur, Venkatapur, Eturnagaram, Mangapet, Tadvai, Govindaraopet, Mulug2, Regonda and Shayampet.* Geographically the Division occupies 4,48,949.75Ha. of land accounting to 34.96% of the total District area and is spread over in the northern part of the District (Figure 1). Eturnagaram and Tadvai are the two largest mandals whereas Mogullapalle and Ghanpur (M) are the two smallest mandals by geographical area in the Division.

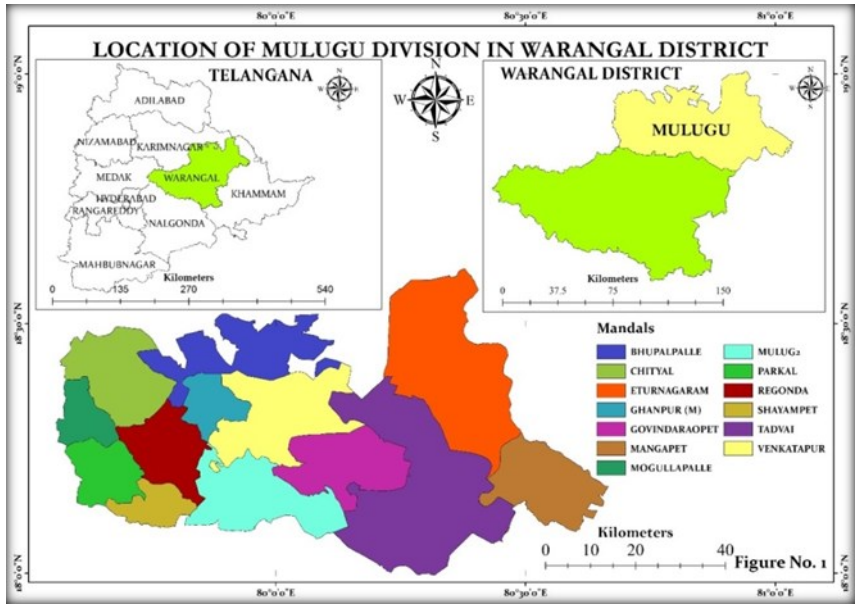

Fig. 1. Location of Mulugu Division, Warangal

Source: SOI Toposheets on 1:50,000 Scale

Geographical Overview of the Study Area

Slope: Most of the central part of the Division extending from north-central to central region of south-east is hilly and hilly and highly undulated (Figure 2). In these regions the lands are elevated from 30°-45° centring round the hill submits which are

elevated maximum up to 61.5° making a range of hills in the central regions of the Division. Some of the high rising sporadic hills are spotted here and there in the extreme north-west, south-west, north-east and south-eastern regions of the Division. Similar to the central hill range, these spotty mountains are also elevated from 40°-61.5° showing steep slope to all directions. But the slope of the range of hills which is diagonally creased through the central regions of the Division is observed to be negative towards the east, which means the western side of the Hill ranges are lofty up to 61.5° and the eastern side is squat from 30°-0° and finally emerges to the Godavari River basin towards the eastern and north-eastern border. These hills are parts of Eastern Ghats on the Deccan Peninsular. Rest of the entire Division is almost flat by nature. Overall, the topography of the Division is undulated. undulation is a bit less in the western half of the Division as compared to the other half.

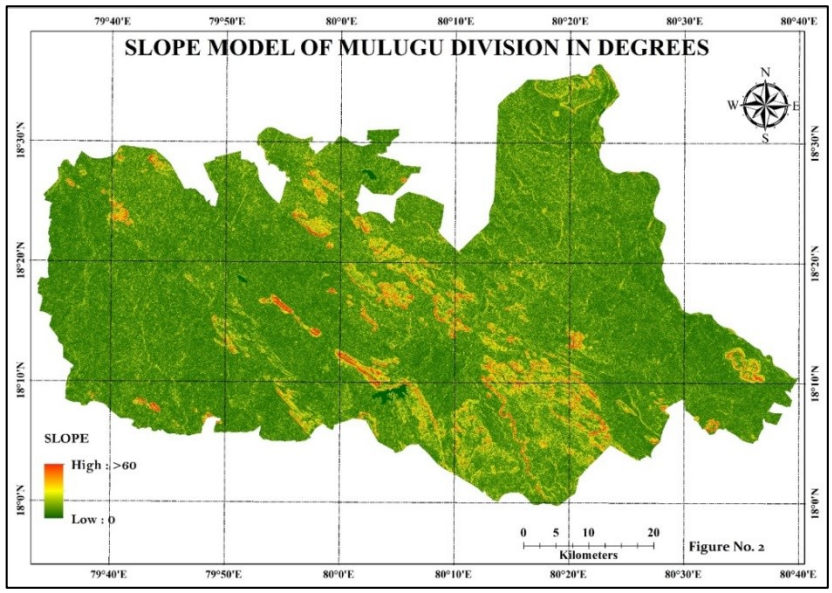

Fig. 2. Slope Model

Source: ASTER Global 30m DTM

Landforms: Nearly 6% of the total geographical area of the Division has been covered by surface waterbodies and drainage system. Apart from this, massive residual hills which are diagonally spread from north-west to south-central region, total occupy nearly 13.5% of the geographical area dividing the study area into two halves (eastern and western). The major surface waterbodies are endowed within these massive hill valleys (Table 1). Next to the hill systems, the inselbergs, structural ridges, linear ridges and dikes constitute the pediment inselberg complex system which occupies nearly 10% of the entire area. These systems are mostly found parallelly spread along both sides of the Hill Systems and along the eastern sides of the river channels and surface waterbodies of the eastern region (Figure 3). Immediate after the inselberg complex, on the western side of the surface waterbodies and the river channels constitute the floodplain, which account nearly 16% of the study area.

These are seen spread through the western part of the river basins both in the eastern and western border of the Division. Some large patches can be seen below a big waterbody within the Residual Hills and within the South-Central region. These are mostly alluvium resting over the bed rock forming Plains. Pedi plain Weathered is spread over the maximum extent within the Division accounting to more than 50% of the study area. Both moderately and swallowed pedi-plain are found everywhere throughout the region.

Table 1. Percentage of Area of Various Landforms in Mulugu Division

Sl. No.	Major Landforms	Class Area in Ha.	Percentage
1	Drainage and Waterbodies	26682.254	5.943
2	Residual Hills	60589.161	13.496
3	Pediment Inselberg Complex	45962.795	10.238
4	Floodplain	70707.937	15.750
5	Pedi plain Weathered	245007.601	54.574
6	Total	448949.746	100

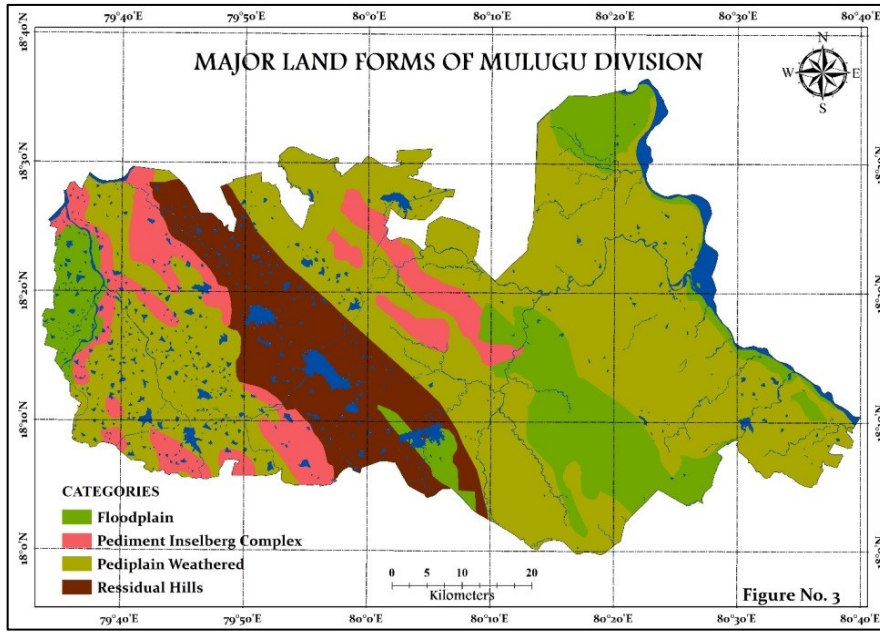

Fig. 3. Major Landforms

Source: Derived from GSI Toposheets and ASTER DTM Slope

Surface Waterbodies and Drainage System: The entire Division is very well webbed with drainage devices including the major rivers like Godavari and Mungeru. The major perennial river that flows along the North-eastern to eastern border of the Division is the Godavari, which because of the obstructing Central and north central and hilly forest

cover the rich resource of water could hardly be used for the purpose of irrigation as most of the agricultural lands are spread through the eastern part of the Division. Another Small perennial tributary of the river Maner known as 'Mungeru', fountained from Buddaram Lake and Ghanpur Lake in Ghanpur Mandal, Ramappa Lake in Mulugu2 Mandal, flows through the agriculturally rich eastern region of the Division. Altogether the rivers, streams and rivulets have educed a number of perennial and seasonal groundwater catchments, lakes, reservoirs and some small artificial projects. The major lakes found in the Division are Bhimghanpur Lake in Bhupalpalle, Buddaram Lake and Ghanpur Lake in Ghanpur Mandal, Ramappa Lake in Mulugu2 Mandal, Laknavaram Cheruvu in Govindraopet Mandal and Chalivagu Project (Artificial Tank) in Shayampet Mandal (Figure 4).

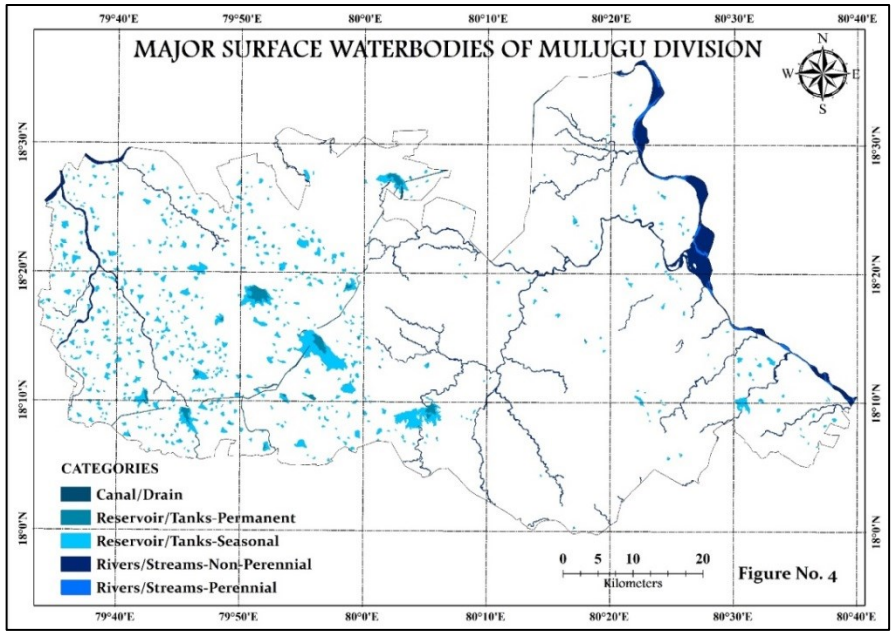

Fig. 4. Major Surface Waterbodies

Source: SOI Toposheets and Landsat-7 ETM$^+$ Multi-seasonal Scenes

Distribution of Soil Types: Constant withering of the pink and grey granites surrounding the residual hills and plateau regions, a large part of the Division has filled the north-central to south-east by shallow gravelly red soil and moderately deep calcareous black soils accounting to 24.36% of the total lands. Moderately deep calcareous black soils are spread over 14.71% of the total Division area. Because of hard soil strata and elevated terrain in these regions, quantitatively the moisture contain is very less. Such soil type is suitable for wheat, paddy, millets, grams, sugarcane, groundnuts, coconut and ragi with an assured irrigation. But the canopy of forest cover and scrubs has led the area under such soil type less of its use. Moderately deep calcareous moist clayey soils are found in some part of the south-west regions of the Division covering 6.69% of the total area. Because of moisture contain such types of lands are useful for wheat, paddy, millets, pulses, rubber and zaid crops. The very next type of soil which counts the second maximum area

within the Division is loamy to clayey skeletal deep reddish-brown soils spreading over 22.86% of lands (Table 2). Being highly fertile, such type of soil, which is mostly found along the foothills or less elevated lands, is more useful than the shallow gravelly red ones. Endowed with cluster of streams, perennial or non-perennial surface waterbodies on such soil type, capacitates the land to crop wheat, maize, sugarcane paddy, fruits, mustard and sunflower. Clayey to gravelly clayey soils, which are moderately deep dark brown, are found in some part of the north central, north-east and west central to south central regions of the Division (Figure 5) spreading over 15.98% of the total available land. Because of surface water availability, the soil is best useful for ginger, chili, grams and paddy cultivation with an assured irrigation. Nearly 6.91% of the total Division area is covered by deep black clayey soil and moderately deep calcareous moist clayey soils, which are found in the south-western part of the Division. Such type of soil is suitable for paddy, sugarcane, watermelons, cottons, black grams and some other zaid crops. light grey deep sandy soils cover the north-east border of the Division, which accounts to the least coverage of area (1.28% of the Division).

Table 2. Soil Taxonomy and Percentage Distribution in Mulugu Division

No.	Soil Categories	Area in Ha.	Percentage
.	Clayey to Gravelly Clayey, Moderately Deep Dark Brown soils	71764.41	15.98
2	Deep Black Clayey soils	31011.39	6.91
3	Fine Loamy Gravelly Clayey Shallow Reddish-brown soils	19519.27	4.35
4	Light Grey Deep Sandy soils	5751.74	1.28
5	Loamy to Clayey Skeletal Deep Reddish-Brown soils	102615.18	22.86
6	Loamy to Gravelly Clay Deep Dark Reddish-brown soils	1058.09	0.24
7	Moderately Deep Calcareous Black soils	66024.66	14.71
8	Moderately Deep Calcareous Moist Clayey soils	30035.43	6.69
9	Shallow Gravelly Red soils	109366.78	24.36
10	Unclassified	9298.56	2.07
11	Water Body	1792.52	0.40
12	Settlement	711.71	0.16
13	Total	448949.75	100.00

Source: Department of Agriculture, AP

Results and Discussion

A. Existing Scenario of Landuse and Land Cover (2010-11)

Broadly the landuse and land cover of the study area has been classified into 6 categories which are shown in the Figure 6. A percentage distribution of various classes

is also given in the Table 3. The major categories of lands which are identified from the interpretation of the multi-seasonal Landsat 5 TM Scenes are as follows:

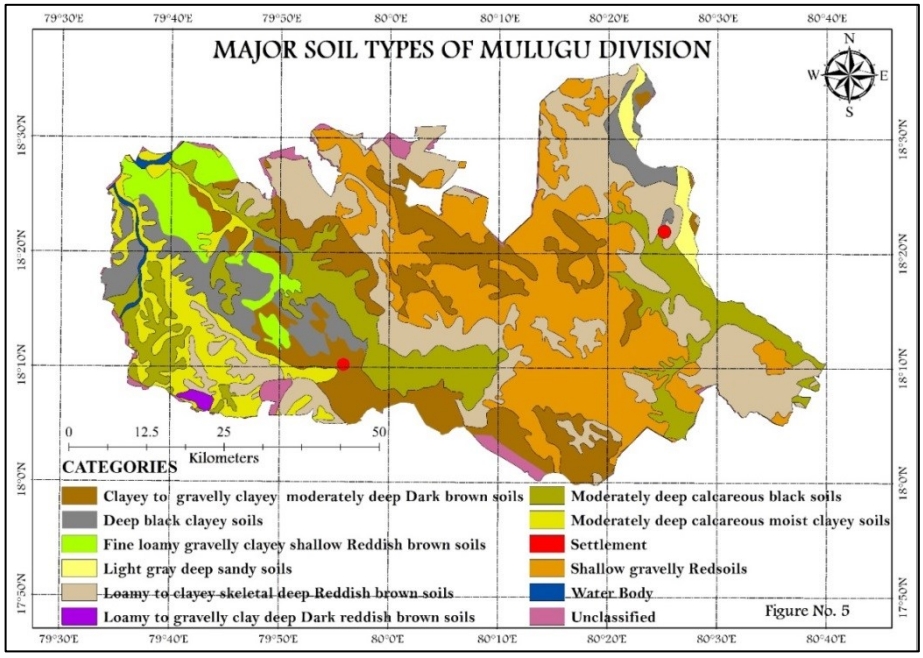

Fig. 5. Major Soil Types

Source: Department of Agriculture, AP

Agricultural Lands: It includes those lands with standing crops on the date of the satellite overpass. The crops may be of kharif, rabi or zaid. interpretation of multi seasonal satellite imageries have enabled us to distinguish the lands under the use of rabi/kharif or both. Further, it resulted in estimating and evaluating all types of lands under agriculture including current and permanent fallow lands and merged to net cropped area. Such landuse accounts to total 35.29% of the total available lands of the Division.

Built up Areas: It's defined as an area developed for human habitation and for non-agricultural use viz. buildings, transport corridors and communication networks, utilities in association with water, vegetation and vacant lands etc. The areal extent of this category of landuse is 10,859.05Ha, which accounts to 2.42% of the total geographical extent of the Division for the years 2010-11.

Forest Cover: It is an area (within the forest boundary) bearing an association predominantly of trees and other vegetation types capable of producing timber and other forest produce. The forest cover is mostly confined to be spread diagonally as a wide vegetal canopy on the residual hills of the Division. According to Champion and Seth, these forests are classified as deciduous dry forests and tropical thorn forests. This covered a total of 2,34,942.10Ha accounting to 52.33% of the total geographic extent of the Division.

Table 3. Distribution of Various LULC Categories (2010-2011)

Sl. No.	Landuse and Land Cover	Area in Ha.	Percentage
2	Agricultural Lands	158419.28	35.29
1	Built up Areas	10859.05	2.42
3	Forest Cover	234942.10	52.33
4	Tree Clad Area	8369.14	1.86
7	Open Vegetation	78.72	0.02
5	Wasteland Scrubs	9601.84	2.14
6	Surface Waterbodies and Drainage	26679.61	5.94
8	Total	448949.75	100.00

Source: Landsat 5 TM Image Analysis

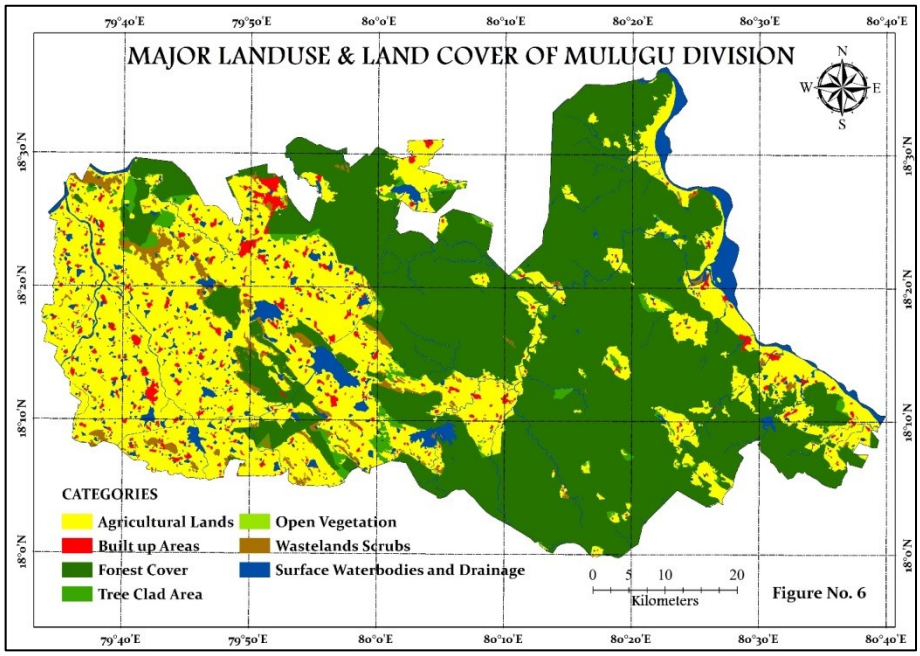

Fig. 6. Major Landuse and Land Cover

Source: Classified from Landsat 5 TM Multi-seasonal Scenes (2010-11)

Other Vegetations: Other vegetal Covers includes any vegetation other than agriculture and forest cover usually are often found surrounding the settlements as mottled or blotchy greenery including small bushes, shrubs, meadowlands, open scrubs and attired tree crops etc. such vegetations are classified as tree clad areas, open vegetation and wasteland scrubs for the convention. The Division has very negligible percentage of tree clad areas and open vegetation accounting to 1.86% and 0.02% respectively.

Wasteland is defined as 'The land which is degraded and presently lying unutilised except for current fallows due to different constraints'. Under this type of land two categories were identified and delineated *viz.* land with / without scrub and barren rocky stony waste, Land with/ without scrub: These are the areas, which occupy relatively higher topography like uplands or high grounds with or without scrub and are generally prone to degradation or erosion. These are exclusively hilly terrain and are clubbed to one category of land cover. A remarkable percentage of area (2.14%) is covered by wasteland scrubs in the division.

Surface Waterbodies and Drainage: The total area covered by this category within the division is 26,680.54Ha. The major river flowing along the north-eastern border of the division is the Godavari. Further the Division is drained by few of its tributaries towards the western margin of the Division. The details are already discussed before.

B. Suggested Action Plan

Land is the most important productive resource amongst all other available resources on the planet. An adequate and proper utilisation of it can give the optimum benefit for the livelihood and sustainability of human beings on earth.

Apart from the built-up areas and waterbodies of the division, rest of the land resources are divided into four categories, based on the land elevation (i.e. plain, 15^{o} to 30^{o}, 30^{o} to 45^{o}, 45^{o} to 60^{o}), forest coverage in varying densities and tree clad areas. Since forest lands can't be used for crop yielding but best suited for wildlife, animal husbandry and poultry farming, as, very good surface water and drainage is present there within.

From the Figure 7, it can be seen that the first category of lands is covered by deciduous dry dense forest with thorn trees and the lands are elevated ranging from 30^{o} to above 60^{o}. So, these areas are best suited for wildlife habitats. The second category of lands identified are mostly covered by dense tree clad, scrub forest and reserved forest plantation, wastelands scrubs on red soils where the elevation ranges from 15^{o} to 45^{o}. Since adequate drainage devices and surface water is available in these areas hence can be used for pastures and poultry farming. Although surface water facilities are existing nearby but because of the soil infertility these can be suggested so as. The third type of lands have 15^{o} to 30^{o} elevation and covered by open deciduous forest. This type of canopy has grown on infertile red soil and is not suitable for cropping. Even agroforestry can't be suggested there because of several forest protection regulations to conserve the deforestation of southern plateau deciduous dry/moist open forest. So, these lands need to be conserved for wildlife as the forest has started shrinking because of over grazing of domestic cattle. So only poultry farming can be practiced instead of pastures. The fourth and only one category of lands are found to be spread over plain lands covered by open vegetation. These areas are mostly nearby the human settlements and the area is not much spread over as compared to the other types of land classes. These lands could also be suggested to be used for pasture grazing. Although the first three types of land classes

are based on the terrain elevation, but qualitatively these are suggested under three types (first three classes) of landuse which can be seen in the Figure 7.

The fourth category based on the elevation below 15^{o} form the plains. These plains are further subdivided into six classes on the basis of soil types, existing cropping pattern and surface water. These are confined to the western part of the division, which are mostly agricultural lands. Every other type of soil is meant for some special types of crop to be cultivated with assured surface water and irrigation facilities. So, the productivity gets widely affected if the appropriate crops are not cultivated on those lands. The soils covered by the fourth class of the landuse class are identified as 'clayey to gravelly-clayey and moderately deep dark brown soil' and 'loamy to gravelly-clayey deep dark reddish brown soils' with assured surface water, drainage and irrigation facilities. These soils are mainly found in the deforested lands transformed into agricultural lands. These are usually highly fertile with forest biomass and have a very good moisture content in the soil. So, the best suitable crops suggested here are paddy, pulses, grams, chili and cotton. The fifth class of lands are confined to have a very good drainage facility *viz. rivers and streams* flowing within and the soil is of deep black clayey type. So, these types of soils are suitable for paddy, wheat, groundnuts and ragi farming. The soil type found underneath the sixth type of landuse class is "fine loamy gravelly clayey shallow reddish brown soils" with good surface water facility scattered here and there. The best crop combination suggested here for these types of soils are paddy, wheat, millets and pulses. Although these types of soil quality are found in a large coverage within Regonda Mandal, but lack of irrigation and surface water retards the suggested crops to be cultivated there. So, improvement of irrigation can increase the productivity and change the crop combination on those types of lands. The seventh class of lands identified are nearby river banks. Hence, the 'light gray deep sandy' soils are found there. These types of lands are best for cropping potato, sweet potato, sugarcane and bananas. Even mulberry plants can be grown for silkworm farming. No other crops can give optimum benefit on cultivating. The soils of the eighth type of land classified as per 'loamy to clayey skeletal deep reddish brown soils, moderately deep calcareous black soil'. These types of soils are usually found near by the mountain foot. So somewhere a very good drainage is seen and somewhere moist soil with cold temperature is found. These types of lands are best suited for paddy, wheat, sunflower and mustard cultivations. Again, it is suggested for honey bee farming in the mustard and sunflower farm fields. This type of mixed farming can be practiced therein. Also, these types of soils are found nearby the plateaus with scrub cover blended with the agricultural lands near the non-perennial surface water catchment areas. With an assured irrigation facility dry land agriculture like paddy, wheat, millet and pulses can be cultivated very well. Or otherwise on the less irrigated lands rubber plants can be grown as well. The ninth and last type of lands are identified nearby the deep mountain valleys and dried river or stream valleys. So, the soil found there are of ravine type. These lands are also identified as ravine wastelands and are highly undulated with low elevation. So, no food crops can be suggested for these types of lands. Only *bamboo* and *anjan* grass can be suggested there. Also, agroforestry can be suggested for the best use of these lands.

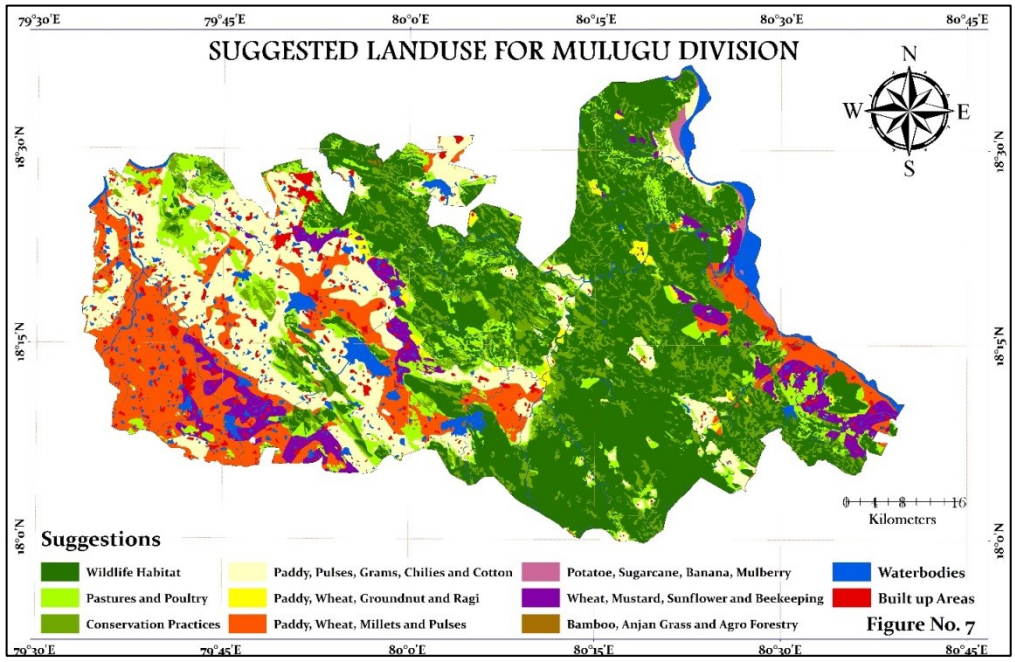

Fig. 7. Suggested Landuse for Mulugu Division

Table 4. Action Plan for Optimum Landuse in Mulugu Division

Sl. No.	Landforms		Geology	Slope	Soil	Surface Water	Present LULC	Proposed Landuse
1	The Hill System	Group of Massive Hills occupies the North-West to South-Central region with Broad Valley Floors accounting to 13.5% of the area.	Peninsular Gneiss and Granites.	Varying from 15° to 45° except on the Steep Hill Submits (>60°) and Valley Floors 0°.	Dark Brown, Gravelly and Deep Black Clayey Soils cover surrounding the Hilly Regions. Deep Sandy Soil spread is found along the Valleys and Surface waterbodies. Skeletal Deep Reddish Brown Soils are seen along the Hills.	Zones of Heavy run off are mostly perennial and Major Three Perennial and non-perennial surface waterbodies fall within this zone.	Landcover with few patches of Dry to Moist Deciduous Forest and Scrubs are also found here and there. Rest of the plain land agriculture is encroached.	Suitable for Conservation and Development of Vegetation Cover- Natural and Manmade Plantation.
2	Pediment Inselberg Complex	These are found in the North-West region along the River Basin and the Residual Hills and towards the North-Central region. These complexes are composed of Inselbergs, Structural Ridges, Linear Ridges and Dikes.	Granite	Moderate Slopes ranging from 5° to 20° from River basins towards Residual Hills.	Calcareous Reddish Brown and Deep Clayey Skeletal Soils are mostly found in these areas.	Zone of Run off and form drainage devices.	Mostly undulating rock out plain with small hills and crops supporting degraded vegetation mostly corresponding to Dry Deciduous Species.	Suitable for the Development of the Pastures and Poultry and Conservation Practices.
3	Pedi plain Weathered	Spread everywhere throughout the Study Area. Both Moderately and Swallowed Pedi plain are found.	Peninsular Gneiss and massive Granites traversed by joints, fractures and faults.	Mostly Undulating slope ranging between 15° to 60°.	Deep black clayey soils, Loamy to clayey skeletal deep Reddish-brown soils and Shallow Gravelly Red soils.	Zones of Run off and form drainage pattern within the Forest areas and small patches of water tanks are seen within the Agricultural lands.	Towards the western parts mostly under agriculture. Towards the Central and eastern region of the Study Area is covered by Forest.	The central part of the forest cover is suitable for Wildlife and the surrounded degraded forest should be under conservation practices. For the cultivable regions, intensive agriculture can be practiced.
4	Flood Plain	Alluvial Plains	River borne Alluvium resting over bedrock, found as a narrow stretch Major River/ Streams.	Nearly level plains.	Alluvial Soils with fine texture and clay base.	Canal Network from the River Godavari and Natural/Artificial Reservoirs proximity to the tanks to the surrounding areas.	Intensive Agriculture under canals, mostly seen under Paddy, Cotton and Maize.	Other than Paddy and Cotton, the land is suitable for Commercial Crops like Sugarcane, Sunflower, Mulberry, Bee Keeping, other crops like Wheat, Millets, Pulses and Plantation like Banana.

Conclusions

The study highlights, the need for an overall development of the Division based on a scientific and integrated approach. The approach of integration aims at a synthesis of contrasting aspects such as physical, socio-economic and ecological development. Envisaging the lacunae in the resource management studies, a potential resource base

pattern of the Division is thoroughly analysed. The basic objectives kept in mind in preparing an action plan (Table 4) based on the parameters of physiography, soil, drainage, groundwater potential and existing landuse patterns is to delineate landuse categories for their usage for which they are well-suited. This study endeavours to aim planners with a detailed insight of the available resources and their locations so that smooth management planning for the development of the division can be implemented.

References

1. Bajaj Sumbangan, David M Chapman and Deirdre Dragovich (2002): Using GIS-Based Continuous Methods for Assessing Agricultural Land-Use Potential in Sloping Areas, Environment and Planning B: Urban Analytics and City Science, 29 (1), pp.3-20.
2. Jabir Singh and Dhillon, S.S., (1994): Agricultural Geography, Tata McGraw Hill Publications Company, New Delhi.
3. Krishna Kumar, K., (2009): Impact of Climate Change on Indian Monsoon Climate and Development of High-Resolution Climate change Scenarios for India, Presentation Made to Hon. Minister of MOEF, on 14th October, New Delhi.
4. Madhava Rao, V., (2008): Agro-Climatic Planning and Information Bank (APIB) for Uttarakhand State, India, The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. Vol. XXXVII. (B7), pp.1451-1455.
5. Miller F. P. and Wali M. K. (1995): Soils, Landuse and Sustainable Agriculture: A Review. Can. J. Soil Sci., 75, pp.413-422
6. Pathak, H., Prasad, S., Bhatia, A., Singh J.S. and M. C. Jain (2003): Methane Emission from Rice, Wheat Cropping System of India in Relation to Irrigation, Farmyard Manure and Dicyandiamide Application, Agricultural Ecosystem. Environ., pp.309-316.
7. Ravishankar, T. and Sreenivas K. (1991): Soil and Land Degradation, Remote Sensing Applications, National Remote Sensing Center, ISRO, pp.35-48.
8. Ruhul Sarker, A., Saifullah Talukdar and Anwarul Haque, A.F.M., (1997): Determination of Optimum Crop Mix for Crop Cultivation in Bangladesh, Appl. Math. Modelling (Elsevier Science Inc.), 21 pp. 621-632.
9. Shah, P.B. and Schreier, H., (1985): Agricultural Land Evaluation for National Land-Use Planning in Nepal: A Case Study in the Kailali District, Mountain Research and Development, 5, (2), pp.137-146.
10. Sinha, S.K. and Swaminathan, M.S., (1991): Deforestation, climate change and Sustainable Nutrition Security of India, Climate Change, 19, pp.201-209.
11. Tersteeg, J.L., (1993): Land Resources and Production Systems in Agricultural Land Use Planning in Botswana, Paper, Presented at the SADCC Workshop "Land Evaluation For Land Use Planning", Gaborone.

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SPATIAL DIMENSION OF INCLUSIVE DEVELOPMENT OF TRIBALS IN MANIPUR

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Abstract

The paper aims to study the spatial dimensions of development in the context of inclusive development. It emphasises on the aspects of provisioning and accessibility of tribal communities to development programmes. The paper specially focuses on the selected tribes of Manipur and finding shows inter and intra-tribal disparity in the distribution of development benefits and the absence of inclusive growth which is attributed to be the root cause of many problems in the State. This in turn is intensifying the feeling of negligence, alienation and thus increasing the risk of further outbreaks of social disorder, particularly in the form of insurgency and related tendencies.

Keywords: Inclusive Development, North-east India, Manipur, Tribes

Introduction

Equity matters for inclusive development. In effect, the principle of 'economic growth with equity' has long been the chief guiding force of economic planning in independent India which is aimed at ending poverty, inequality and marginalisation in Indian society. However, on the contrary, many groups and individuals remain outside the fold of 'inclusive development'. All through the years of planned development, studies show that the economic growth has often overshadowed social justice. As a result, there is large-scale socio-economic and regional disparity in the country as the economic progress was not equally shared between groups of different environment, regions or level of income; among others, the disadvantaged vis-à-vis the advantaged ones, tribal-non tribal, hills-plains and inter-tribal are the most obvious spatial regimes characterising this variation.

Marginality of Tribals

Despite an integrated approach in tribal development post-independence, socio-economic conditions of tribal communities have not made any significant headway. Rather, in the name of regional and national development, weaker sections of society such as tribals are exploited and subjected to various exclusionary processes in the country. All tribal groups in India, irrespective of their locations and socio-economic diversities, find themselves increasingly subjected to processes of 'exclusive inclusion' and 'inclusive

exclusion'. In north-east alone the disadvantaged groups including tribals are often exploited systematically by the so-called 'advanced social groups' or non-tribals in connivance with the State forces. Discriminations continue unabated on the socio-economic plane in the region. In fact, tribals from North-Eastern Region (NER) suffer from many more disadvantages as they differ widely from the mainstream populace in terms of its geographical location, ethnicity, race, lifestyle, culture, custom, tradition, language, religion/belief, economy etc. Besides, the NER itself is diverse in many respects from within. Among the diversifications are a significant number of tribal populations belonging to over 220 ethnic groups. Moreover, the region itself is virtually in isolation, not only in terms of geographical location but also in development index, hence perpetuating its status of being a socio-economically backward region. Various development programmes also fail to reach the eligible beneficiaries for lack of awareness and improper monitoring and implementations.

Likewise, on several occasions the tribal groups and those other weaker sections of population in the State of Manipur have to bear the brunt of injustices unleashed by partisan State forces, while many non-tribals including some advantaged tribals, residing mainly in the State capital have become affluent at the cost of the poor. As a result, the gains of development in the State have not percolated down effectively to Tribal Sub-Plan (TSP) areas despite the allocation of TSP funds in huge sums over the years. No perceptible improvement has been observed in tribal areas mainly because the benefits have failed to go beyond the conglomeration of sectarian schemes coupled with poor implementation and monitoring of the development programmes vis-a-vis misappropriation of funds, consequently affecting the whole discourse of development as it is strongly influenced by political and community affiliations.

Speaking of which, the State of Manipur is a small State with an extent of 23º 50´ to 25º 41´ N and 93º 2´ to 94º 47´ E covering a total geographical area of 22,327 sq.km constituting about 0.7 percent of the total land surface of India. Among the three major ethnic groups in the state, Meiteis are numerically dominant in the valley accounting over 60 percent of the State population and the other two major groups are the Nagas and the Kuki Chins who inhabit the hills constituting about 34 percent of the State total population. The marked differences in their socio-cultural and religious affiliations have only weakened the feelings of integration and unity among the people of the State. For several decades and until today, partly because of its peripheral location and large scale intra socio-cultural diversities Manipur has witnessed a series of separatist and identity movements.

The development pattern in Manipur is also highly skewed and strongly urban biased as most of the development activities are concentrated in the valley, which also means favouring the non-tribals, often negating the potentials of the hills resulting in huge rural-urban and valley-hill divide. Moreover, the more critical issues like health, education, agriculture, insurance, micro-finance and other sectors that lean towards social justice remain a neglected lot in development pursuits.

Having said that, it does not mean all tribals are disadvantaged; there are group formations even among tribes. The advantaged tribals, usually with economic and political clout, manage to reap the benefits of government development schemes even at the cost of the tribal poor and the needy.

Against this backdrop, the paper aims to study the spatial distribution of development, especially in the context of inclusive development. Besides analysing the forms and causes of exclusion, the paper also tries to suggest some alternative strategies for inclusion. The reasons for neglect of tribals in north-east India may be substantiated with the work of some scholars. However, despite having a vast literature on various aspects of Manipur, studies dealing with Manipur tribal development are sporadic and limited. Yet there is enough evidence to suggest that there is absence of inclusive development in north-east India, wherein Manipur is a composite State, with diverse levels of development and the several socio-economic inequalities.

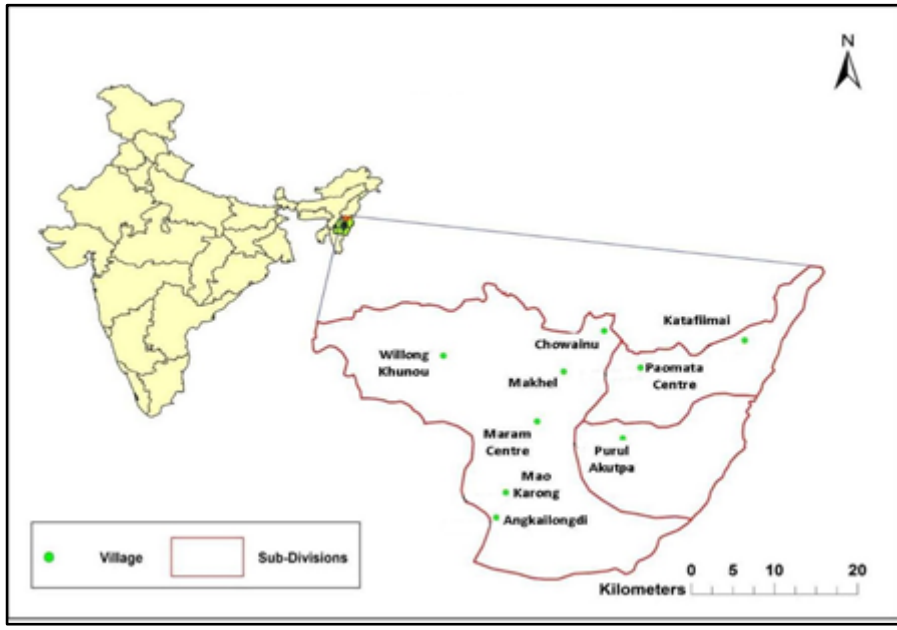

Fig. 1. Senapati District with Sample Villages

Literature Review

Given the strategic and peripheral location of NER, its low level of development, immense physical and socio-cultural diversities yet coupled with a sense of neglect and alienation have resulted in perceptions of marginalisation, deprivation and identity loss, all adding up to separatist tendencies in the garb of regionalism, sub-nationalism and ethnic politics, most often verging on extremism and secession (Das, 2009). In similar case, Manipur is ridden with longstanding ethnic conflicts among different ethnic groups on issues of exclusivity, dominance and integration (Oinam, 2003), primarily because the

implementation of economic development programmes is not carried out equitably across the State. Furthermore, tribal are rural economy based which is marked by absence of industrialisation and urbanisation. Thus, they are characterised by poverty, large-scale unemployment, economic exploitation, social deprivation, poor health, illiteracy and lack of adequate infrastructure which is a matter of serious concern. There is huge development gap between hills and valley districts and such divergent gap is attributed to coordination failure of the concerned agencies and constant politicisation of development discourse on ethnic lines rather than going deeper into 'hard facts' of economy and on verifying various 'development yardsticks' (Singh, 2005).

Decades of economic planning has not made any significant headway in improving the socio-economic conditions of tribals in India. The whole impact of development measures for tribal development has been slow and protracted. It is ironical that the national plan projects are marginalising the socio-economically backward tribal communities, rather than developing them in a sensible and equitable manner (Singh, 2004). The failure is primarily because the planners did not take into consideration the genuine needs of tribals (Singh, 1993).

Thus, from the literature review, one can understand the need and importance of inclusive development in India, especially in NER as the region has witnessed a longstanding issue of ethnic mobilisation and marginalisation.

Relevance of Inclusive Development: A Theoretical Framework

Inclusive development is the process of ensuring that all marginalised or excluded groups and individuals are included in development pursuits by empowering them. It is referred to a kind of development that is inclusive of all groups of people - development that goes against the spirit of discrimination and exclusion.

Inclusive development is based on two concepts - *inclusion* and *development*. The term 'inclusion' focuses attention on the *equitable distribution of well-being* in society, while 'development' brings into play *dimensions of well-being beyond simply income*. Inclusion is thus both a process and a goal. It is about society and the administrative system changing to accommodate differences and combat discrimination. However, inclusive development can be made possible only by mass participation, which also can be possible only through the process of inclusion. Development can thus be inclusive and reduce poverty only if all individuals and groups of people contribute to create opportunities, share the benefits of development and participate in decision-making and implementation. In essence, inclusive development is based on the premises of equity or growth with distributive justice.

Conceptually, inclusive development follows UNDP's human development approach and is founded upon three key principles of human rights: participation, non-discrimination and accountability.

The UNDP advocates for inclusive development that can play a major role in stimulating growth and reducing poverty - hence attaining growth with distributive justice.

It is imperative to enforce inclusiveness as the main thrust in development discourse because many individuals or groups of people across the globe are discriminated on the basis of caste, gender, ethnicity, age, religion, income, ignorance, morality, sexual orientation, disability or poverty and the effects of such social exclusion are staggering, deepening inequality among different groups of people thus posing a serious threat to the social cohesion.

In India, inclusion and exclusion are deeply rooted in society and it is influenced by both economic and non-economic factors, such as political system, norms, culture, beliefs and historical legacy. Thus, the approach towards inclusive development varies depending upon the situation, country, culture, history and political economy. Besides, there are many other factors influencing inclusive development such as inequity, social exclusion, poverty, deprivation, disparity, and displacement. All of these factors are not distinct from each other. Rather they are interrelated and affect each other in a number of ways. Inclusive development is the counter force to such inequities and undesirable development.

Development can be meaningful only through collaboration and participation with all sections of society irrespective of their socio-economic differences. Thus, to achieve inclusion in development process, a twin track approach is needed - *first*, mainstreaming the excluded groups and *second*, adopt capacity building measures through effective interventions. Therefore, the key processes to inclusion include social, economic, political and infrastructural inclusion.

Database and Methodology

The present study has been carried out with the research hypothesis 'geographical areas of relative isolation will exhibit lower level of development and hence higher degree of social exclusion compared to areas with better accessibility'. Since there is no standard formula agreed upon to measure inclusive growth or inclusive development, the idea of a social responsibility function was used while deciding on the indicators and variables. Considering the specification of the region and the importance of community bond over family and village, four tribal groups have been selected as the unit of study. In total, nine villages from three sub-divisions of Senapati District in Manipur have been selected as samples namely, Mao-Maram, Paomata and Purul wherein four tribal groups Mao, Maram, Paomai and Thangal - are predominant. Village samples were selected based on two main criteria as given under:

i) *Areas of relative isolation*: those villages which are located in places devoid of easy accessibility such as national/state highways, health and educational centres, administrative centres, market etc. namely, Willong Khunou, Katafiimai, Chowainu.

ii) *Areas of better accessibility:* those villages in spatial proximity with the nodal points such as Angkailongdi, Mao Karong, Maram Centre, Makhel, Paomata Centre, Purul Akutpa.

Primary data has been gathered from nine sample villages through the medium of interview, questionnaire and group discussion with 40 respondents from each village. Information gathered includes demographic and economic characteristics; health status and education of family members; awareness of and participation in development programmes; housing, water, and sanitation conditions of families; availability of credit to finance poor family; family income and expenditures, etc. This exercise was necessitated by the fact that people's participation forms an important feature of inclusive development.

Selection of Inclusive Development Indicators

Consistent with the imperative to enforce inclusiveness as the main thrust in development domain and since there is no definite research method to measure inclusive development, attempts have been made to measure inclusive development taking into account the following indicators -social, economic, political and infrastructure. Literacy rate, access to health, education and social welfare schemes are some of the social variables selected for the analysis. The economic variables include work participation rate, access to employment schemes like MGNREGA and financial knowledge. Political participation of the people in local bodies constitutes the main variable in studying political inclusion. Whereas infrastructure include electrification, roads and communication, water supply, health and education. Hence, they are all taken together as components in determining inclusive development.

Research Tool

Findings were drawn using simple statistical percentage, and represented in the form of figures and dot maps. Besides, method of *composite index* has been employed to map out spatial character of regional development as this method helps in capturing the multi-dimensional aspects of development in a single dimension. To make the indicators comparable with each other, the variables have been standardised by subtracting the mean of every indicator and divided by their respective standard deviation. It is calculated using the following formula:

$$ci = \frac{x - \bar{x}}{SD}$$

where, *ci* is the composite index, *x* is the unit of observation, $\bar{x}$ is the mean of each variable and SD is the standard deviation.

Thus, the standardised data is added to find out the aggregate development factor score. Final calculation is interpreted as higher the index, higher is the level of development and vice-versa.

Level of Inclusive Development

Social Development

The spatial variation in the composite indices of social development reveals striking patterns. It is indicated in Figure 2 that not all the villages situated in nodal points indicate a higher level of social development than their counterparts in relative isolation (remoteness); similarly, not all villages situated in relatively remote areas show low level of development. Angkailongdi, for instance, accounts for highest composite index in social development with 9.14 followed by Paomata centre and Chowainu with 4.99 and 2.77 values of the composite index. Similarly, villages situated relatively near the important centres like Purul Akutpa accounts for composite value of 1.27. Katafiimai, on the other hand, accounts for lowest level of social development indices with -7.62 followed by Maram centre, Makhel and Mao Karong with -5.59, -2.59 and -1.29 composite index values, respectively.

However, in contrast to the hypothesis, Willong Khunou village that is situated in a remote area has shown a higher level of social development with -1.09 composite index values as compared to the villages with locational advantage like Maram centre, Makhel and Mao Karong that have shown a lower level of social development in terms of the selected indicators. A factor that contributes to this phenomenon could be chiefly attributed to good transport connectivity though it is located far away from the district administrative headquarters, and improvement in literacy also helped in mobilising awareness about the development programmes among the village people. Thus, this finding nullifies the hypothesis that 'the villages situated in areas of relative isolation will exhibit lower level of development and hence higher degree of social exclusion compared to areas with better accessibility'.

The role played by spatial proximity to the district or sub-divisional headquarters and improvement in literacy have contributed to obtaining higher level of social development in villages like Angkailongdi and Paomata centre; and the reason for Chowainu attaining a relatively high composite index is attributed to local factor. Though the village is located some distance away from the main centres it is well connected by all-weather roads which is also situated close to bigger villages that are offering better educational facilities (few private schools and a private college) and also the community health centre is within their reach but with a distance of about 5 km between the villages.

The underlying determinants for obtaining the lowest composite index value by Katafiimai village are attributed to spatial factor (remoteness) and low literacy, compounded by poor road connectivity and lack of adequate public schools and healthcare services. On the contrary, the spatial factor (remoteness) is not responsible for low composite index values obtained by Makhel, Maram Centre and Mao Karong, but the reason may be attributed to weak intra and inter-linkages in acquiring some of the development schemes by the rural population.

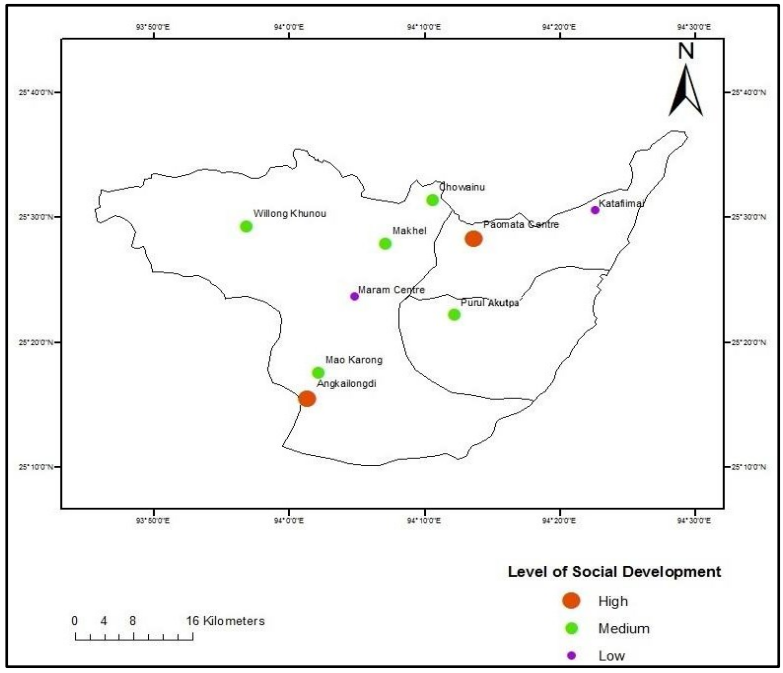

Fig. 2. Level of Social Development in Sample Villages in Senapati District

Economic Development

With Figure 3 showing the spatial variation of economic development in the sample villages, drawing a similar conclusion as social development, it can be presumed that not all villages situated in areas of relative isolation will exhibit lower level of development and hence indicate higher degree of exclusion, compared to areas with better accessibility. The calculated value shows that Willong Khunou and Chowainu villages which are situated in the relatively disadvantaged areas of the region have obtained higher composite index scoring 1.49 and 2.64 values respectively, as compared to the villages located in geographically and administratively advantaged areas like Purul Akutpa and Makhel with 0.26 and 0.20 values of the composite index, respectively. The other villages showing relatively more developed economic indices include Angkailongdi and Mao Karong and the composite index value for these villages are 3.33 and 3.4 respectively. On the other hand, Katafiimai accounts for lowest composite index value in economic development with -8.58 followed by Paomata centre with the value of -2.53. Maram centre also figures among the lowest level of economic development with the composite index value of -0.33, indicating that it is not only the spatial factor that determines the households' access to economic elements but there are other factors responsible for poor economic performance. This also indicates that the areas with easier access to better infrastructure such as roads and educational facilities do not necessarily stimulate a higher level of economic development and vice-versa in the present context.

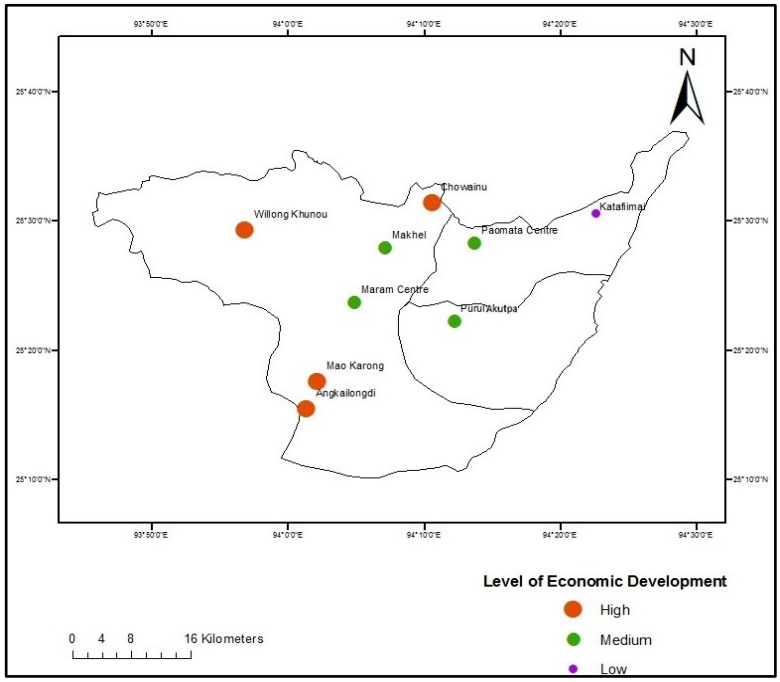

Fig. 3. Level of Economic Development in sample Villages in Senapati District

The underlying determinants of the varying level of economic development are many and Figure 3 depicts that it is not only the physical proximity that influence economic development but, there are also other factors that can play a significant role in determining it. For example, improvement in literacy also equips people to be more conscious of their rights. Besides, on account of a favourable agro-climatic condition for agriculture and allied activities coupled with all-weather roads connectivity, it attracts farm assistance from the government agencies (though a rare case) and middlemen / women traders who buy the agricultural produce from the producers and market it to central places.

As for Katafiimai village, which has not scored well even in indices of economic development, obviously it is attributed to its remote location coupled with poor roads which adversely affects the process of economic integration with the central places. The village may be producing surplus agricultural produce but for lack of adequate infrastructural services, the inhabitants are thus further subjected to different forms of exclusion, rather than just geographical isolation.

However, there is no evidence of weakened spatial interaction influenced by ethnic territorial boundaries and conflicts. Rather, it is mainly the geographic variable / remoteness and poor administration that determine its low level of economic development.

Political Development

Lack of representation or participation of people in the political arena determines the kind of policies that affect them and they are constitutive of the substantial voice that can affect the regional development policies.

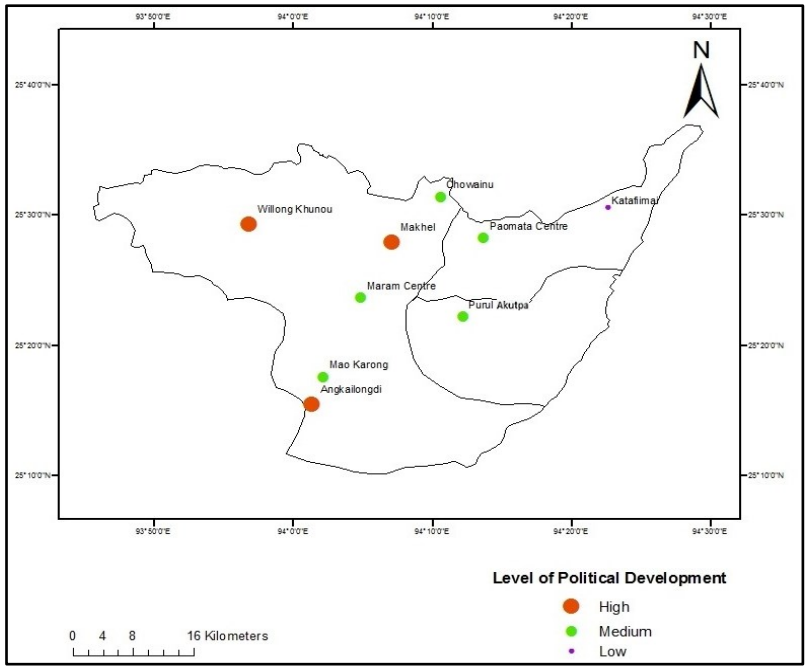

Fig. 4. Level of Political Development in Sample Villages in Senapati District

The Figure 4 illustrates the level of political inclusion of the sample villages which shows Makhel and Angkailongdi villages having obtained first and second rank scoring 5.75 and 3.34 values of the composite index respectively. Greater political awareness and mobilisation, high literacy and easy accessibility to service centres may have contributed towards their high level of political development. Willong Khunou village is at the third position among the 9 sample villages with 2.18 values of the composite index.

Though this village is located in areas of relative isolation, improvement in literacy rate has played the chief role in determining its high level of political participation. Moreover, remoteness of the village only necessitated their political assertion which got influenced by active political mobilisation among the people under their own leadership. Therefore, one observes that, community loyalty weighs heavily in these tribal areas, sometimes contributing to tribal conflicts; the situations are particularly worrying if they are aligned along political or ethnic divisions.

The other villages showing a relatively low political participation include Maram centre, Mao Karong and Paomata centre. The composite index values for these villages are 0.41, 0.37 and 0.12 respectively. These villages are situated near the centres of better spatial interaction thus providing them better environment for political awareness and campaigns. On the other hand, the level of political inclusion is lower in the rest of sample villages. Katafiimai has recorded the lowest level with composite index value of -7.56 followed by Purul Akutpa and Chowainu with -1.54 and -3.08 values of the composite index respectively. Spatial factor, poor literacy and lower level of awareness are the major determining factors responsible for obtaining low value of the composite index in political participation. These villages thus attract less of the development opportunities and so therefore, there is also a danger of political influence by persuading the less literates to simply accept the existing system which can pose a serious threat to social cohesion and the relational features in a place where community loyalty weighs heavier than any other thing. Besides, it is also found that women in the region are not seen participating politically though economically they are seen actively participating in every sphere in contrast to their counterparts elsewhere in the country; one of the main reasons being the existing tribal customary practices which exclude women's entry and participation in governance starting from grassroots level.

Infrastructural Development

The composite indices of the infrastructure component of spatial dimension are represented in Figure 5. It reveals that among the sample villages Angkailongdi village accounts for highest composite index value with 8.78 followed by Makhel and Mao Karong with 6.53 and 4.68 values of the composite index respectively. Relatively higher infrastructure base of these villages can be attributed to higher degree of accessibility to nodal points. This is in contrast to the villages that are placed more or less at equal footing. Maram centre, Paomata centre and Chowainu are such villages that have recorded a relatively lower level of infrastructure development with 2.63, 0.72 and-0.33 composite index values respectively as compared to Angkailongdi, Makhel and Mao Karong. Level of infrastructural development is very low in the remaining areas, Katafiimai village in particular with the composite index value of -13.36. Willong Khunou and Purul Akutpa are the two villages that have shown the next lowest level of infrastructure and service development with composite index of -5.15 and -4.50 values, respectively. Apparently, relative remoteness and lack of health and education infrastructure can be held responsible for this poor development because the nearest primary schools and health centres from both of the villages Katafiimai and Willong Khunou are located at a distance of over 5 km. Thus, it is evident from the indices that villages showing high level of infrastructural development such as Angkailongdi, Mao Karong, Makhel, Maram Centre and Paomata Centre are located in close proximity to the national and state highways, central markets, educational and financial institutions and administrative headquarters; and those villages which have shown low level of infrastructural development such as Katafiimai and Willong

Khunou are located in the interiors wherein good quality infrastructure specially healthcare and educational facilities is inadequate.

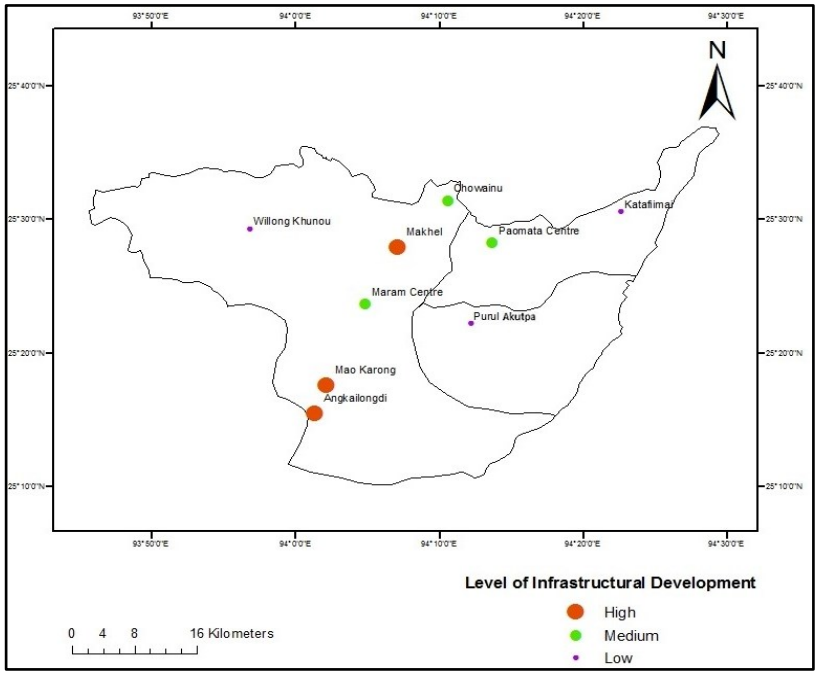

Fig. 5. Level of Infrastructural Development in Sample Villages of Senapati District

Overall Development

The Figure 6 shows a wide spatial variation in overall development composite index values. The village Angkailongdi village which is situated close to urban centre has obtained the highest composite index scoring 24.6 values while Makhel and Mao Karong occupy the second and third positions respectively with 9.89 and 7.26 composite index values. These villages enjoy the advantage of linkages where it attracts most of the development activities and hence helped them in acquiring some of the modern socio-economic and infrastructural amenities in contrast to the counterparts. However, Maram centre, which is supposedly in the same category accounts for relatively lower overall development index as the village appears to have weak inter and intra-regional linkages with respect to different socio-economic development parameters. The other villages which are showing relatively developed overall development level are Paomata Centre and Chowainu with the composite index values of 3.30 and 2.00, respectively. Better accessibility and proximity to service centres are two possible reasons for acquiring the relatively better development index. Paomata centre is situated within the sub-divisional headquarter and has easy access to a state highway but the bad road condition adversely affects the smooth flow of traffic and thus overall spatial interaction.

Level of overall development is lowest in Katafiimai village scoring as low as -37.14 value of the composite index. Other villages that fall in the lowest rung are Maram centre and Purul Akutpa with composite index values of -2.86 and -4.50, respectively. Remoteness compounded by low literacy rate and poor transport connectivity is mainly responsible for the low development level at Katafiimai village. On the other hand, low level of overall development in Purul Akutpa village can be attributed to poor connectivity and weak inter and intra-linkages of economic development.

Table 1. Overall Development Composite Index

Village	SCI	PCI	ECI	ISCI	OCI
Katafiimai	-7.628	-7.565	-8.58	-13.368	-37.141
Paomata Centre	4.993	0.123	-2.537	0.723	3.302
Purul Akutpa	1.275	-1.547	0.269	-4.502	-4.505
Chowainu	2.772	-3.083	2.643	-0.329	2.003
Makhel	-2.59	5.75	0.207	6.532	9.899
Mao Karong	-1.295	0.377	3.498	4.683	7.263
Maram Centre	-5.578	0.417	-0.335	2.631	-2.865
Willong Khunou	-1.09	2.187	1.498	-5.153	-2.558
Angkailongdi	9.14	3.341	3.337	8.782	24.6

where, CI is composite index, SCI is Social CI, PCI political CI, ECI economic CI, ISCI Infrastructure and Services CI, OCI is overall development CI.

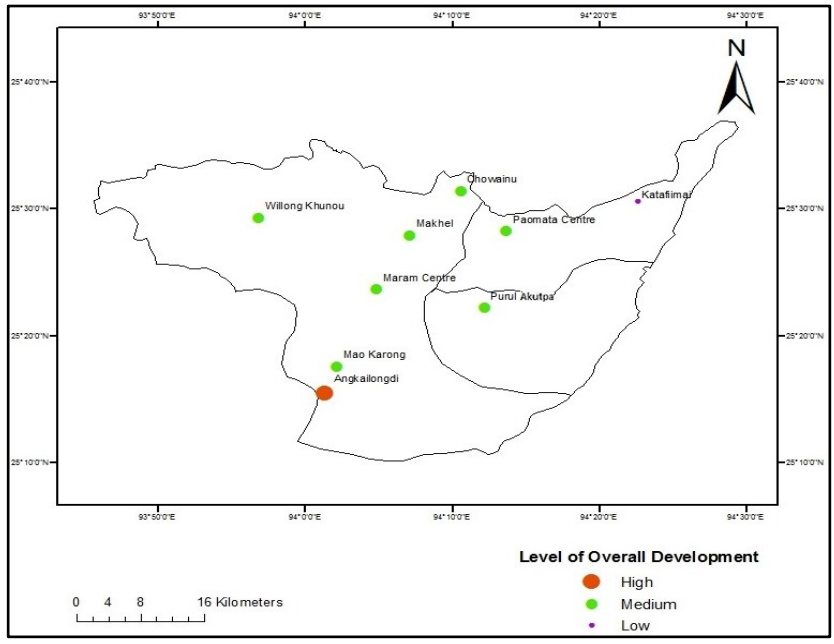

Fig. 6. Level of Overall Development in Sample Villages in Senapati District

In the end, inferences may be made from the preceding discussion that not all the villages or households situated in areas of relative isolation exhibited a low level of

development in social, economic and political indicators and hence subjected to greater exclusionary process. Not all households or villages that are situated in areas of better accessibility and spatial proximity to important service centres always demonstrated a higher level of development in all indicators. Thus, these findings of individual development parameters nullify the hypothesis that 'the villages situated in areas of relative isolation will exhibit lower level of development and hence higher degree of exclusion compared to areas with better accessibility'. Nonetheless, when taken for overall development composite index, the hypothesis is validated to a considerable extent.

Conclusions

In the present study, findings show a greater need of spatial interaction and participation especially in hill Districts, because tribes living in proximity to administrative headquarters have higher level of participation and awareness as compared to tribes living far from it. Thus, taking advantage of good linkages and better facilities, some villages have availed most of the development benefits; whereas, many of the villages in remote areas recorded a very low participation rate in development due to poor linkages and this certainly hampers the process of inclusive development. Thus, addressing regional imbalances and inequalities in socio-economic and other development parameters is a key element of a strategy of removing all constraints to the full realisation of a just society and furthering all causes to promote it through participation in development.

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References

1. Das, Nava Kishor (2009): Identity Politics and Social Exclusion in India's North-East: A Critique of Nation-Building and Re-Distributive Justice. Har-Anand Publications, New Delhi.
2. Kanbur, Ravi and Rauniyar, Ganesh (2009): Conceptualizing Inclusive Development: With Applications to Rural Infrastructure and Development Assistance. Asian Development Bank Occasional Paper No.7.
3. Sen, Amartya (2000): Development As Freedom. Oxford University Press, New Delhi.
4. Singh, E. Bijoykumar (2005): Development Discourse in Manipur: Hills vs. Valley. Eastern Quarterly, 3 (1), pp.160-169.
5. Singh, Ravindra Pratap (1982): Geography of Manipur. National Book Trust, New Delhi.

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COST-BENEFIT ANALYSIS OF TERRACE CULTIVATION IN SIKKIM HIMALAYA, INDIA

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Abstract

Soil and water conservation measures like terraces can reduce soil erosion. The objective of the paper is to understand the cost-benefit analysis of terrace cultivation in Papung-Ben Khola watershed of Sikkim Himalaya. Relevant bio-physical and socio-economic information were collected with the help of both primary and secondary sources. Primary data and information was obtained through a questionnaire survey, key informant interviews, field observation, and focus group discussions. The field survey was conducted with a sample size of 150 households to acquire relevant information in the year 2010-11. Detailed information on cost of labour, management practices adopted, time spent on terracing, amount of inputs used; price of inputs, the output produced, and price of outputs was collected to perform a financial cost-benefit analysis. Results show that terracing is economically profitable as a conservation measure in the study watershed.

Keywords: Terraces, Agriculture, Cost-Benefit Analysis, Watershed, Sikkim Himalaya.

Introduction

Land degradation and soil erosion primarily caused by unsustainable agricultural practices have raised a concern about long term agricultural sustainability (WRI, 2000). Several agricultural practices are beneficial on various grounds and conserve natural resources; provide financial benefits, ecosystem services and contribute in combating climate change (Paoletti *et al.,* 1992; Pimentel *et al.,* 1997; Bjoeurklund *et al.,* 1999) while few practices do not fetch such significant benefits. Although agricultural practices provide both economic and environmental benefits, the benefits of environmental services such as biodiversity conservation, soil conservation are overlooked (Barbier *et al.,* 1994). Failure to recognize the economic value of environmental services of different land-use systems often leads to policies, which provide disincentives to environment-friendly agriculture practices.

Soil erosion is prevented by implementing soil and water conservation (SWC) practices. In the Himalayas, SWC practices like minimum tillage; vegetative practices, strip-cropping; vegetative barriers; terraces and stone barriers are well developed and widely practised by farmers (Rai and Sharma, 1994). Implementations of these practices as per

the requirement of the ecosystem vary drastically and require different cash flow. Few practices are costly for farmers while few conservation measures are better suited than others to specific conditions. The critical question facing by farmers and society as a whole is whether the benefits of given conservation measures or set of measures are worth the costs. Many economists (Graaff, 1996; Enters, 1998; Bunch, 1999) argued that a significant reason for the non-adoption of SWC practices is that they are not cost-effective for the farmers. The farmers less adopt the conservation practices which have high investment costs and low benefits because of uncertainty and long payback period.

Any SWC practice to reduce erosion from agricultural fields will only be successful, if it is well adopted to implement by farmers at the farm level and financially beneficial (Ongley, 1996). Therefore, an identification of the most efficient conservation practices would help reduce cost input as well as sediment and nutrient loss from agricultural fields. While the impact of conservation practices on crop yield is still site-specific (Griffith *et al.,* 1994) it is widely acknowledged by researchers that only yield alone does not control economic success (Uri, 2000). Production costs, including labour and input tools, are also taken into account for an assessment of profitability. Various researchers have previously reviewed the cost-benefit analysis (CBA) of SWC practices. Uri (2000) presented a detailed evaluation of the costs and benefits of conservation tillage. Tenge *et al.,* 2005 have tried to measure the financial efficiency of SWC practices in Tanzania and found it worth implementing. Posthumus (2005) has also carried out CBA of Peruvian terraces in detail and found it economically beneficial for the farmers. In Mississippi delta Yuan *et al.,* (2009) have assessed the effectiveness of management practices on sediment reduction and found worthy and cost effective.

In this paper, a cost-benefit analysis of terracing is performed to assess the financial efficiency in the Papung Ben Khola watershed. CBA was carried out at farm level involving farmers' perspective on profitability because the impact of SWC measures is highly site-specific.

Material and Methods

Data

Relevant socio-economic data were obtained using both primary and secondary sources. Primary data and information was collected through a questionnaire survey, interviews, field observation, and focus group discussions. A sample size of 150 households was obtained from the Papung-Ben Khola watershed in the year 2010-11. Simple random sampling method was employed to select households for the questionnaire survey and followed by a collection of additional information on specific land-use practices such as the area under cultivation, labour cost, inputs cost, the output produced, outputs price, and time spent terracing. The validity of the information provided by individual farmers was further verified with key informants, agriculture extension and forestry officials.

2.1.1 Cost-Benefit Analysis

CBA provides a solid structure for integrating information on the biophysical and economic situation faced by farmers. CBA of the terracing requires in-depth analysis of the efforts to reduce soil erosion and increase the productive capacity of the soil. CBA of terracing as conservation was carried out and included the identification of cost and benefits from the perspective of farmers and society. The costs of terrace establishment, production and regular maintenance for terraces were considered in assessing the costs and benefits of terraces. The benefits included the direct yield return and the indirect soil erosion benefit value from reducing soil loss. The CBA assessed for 1ha of terraced land with paddy cultivation. The CBA of terracing as conservation measures requires an in-depth understanding of the extent of the efforts of the soil and water conservation to reduce soil erosion and to increase crop yields and other benefits. These efforts were translated into financial terms about social and economic factors such as cost of labour, prices of input and outputs and farmer's time preference. Data from field surveys were itemised into costs and benefits. Costs included labour, farm equipment, tools and materials for the establishment, maintenance and production of terracing while all gains such as current and future production caused by construction of terraces were included as benefits. One hectare area of land as the unit was considered for the analysis of CBA. Identification of cost and benefits, net present value (NPV) and internal rate of return (IRR), discount rate and time horizon; and sensitivity analysis was also carried out for calculation the cost benefit analysis of terracing.

Study Area

The present study was carried out in Papung-Ben Khola watershed, located in the south District of Sikkim, India (Figure.1). Geographical coordinates lie between 27º 13' 34" to 27º 1' 12" N and 88º 22' 18" to 88º 27' 15" E. The watershed has an area of 27.77 km^2 and elevation ranges from 326 to 2600m amsl. Major geology belongs to *Gorubathan Formation* and *Lingtse Granite Gneiss* rock formations. The climate of the watershed is sub-tropical to temperate climatic conditions and temperature is very low during the month of December and January. The average annual rainfall is more than 3100 mm and mainly concentrated during July to September. The average annual temperature of the watershed ranges between 0^0 -26 ^{0}C. The terrain of the watershed is primarily hilly covering gentle to very steep slopes, the average angle being 30^0- 40^0 and in the higher ranges exceeds more than 70^0. Vegetation is consists of dense and open forests including a forest reserve namely Tendong Forest Reserved. It is a rain-fed agrarian watershed having 12 settlement blocks/villages. The total population of the watershed was 12,451 as per the 2011 census with an average density of 448 person/km^2. Agriculture and allied activities are the primary sources of livelihood in the watershed. Per-capita land holding in the watershed was 0.27ha for the year 2010-11. Watershed is one of the very prominent watersheds of Teesta basin and characterised by a variety of agricultural activities and famous for agroforestry practices. The primary source of livelihood in the watershed is agriculture and represents most of the human habitation zones that exist in the Sikkim Himalaya. Along with

agriculture, horticulture, traditional agroforestry and floriculture are also widely practiced in the watershed.

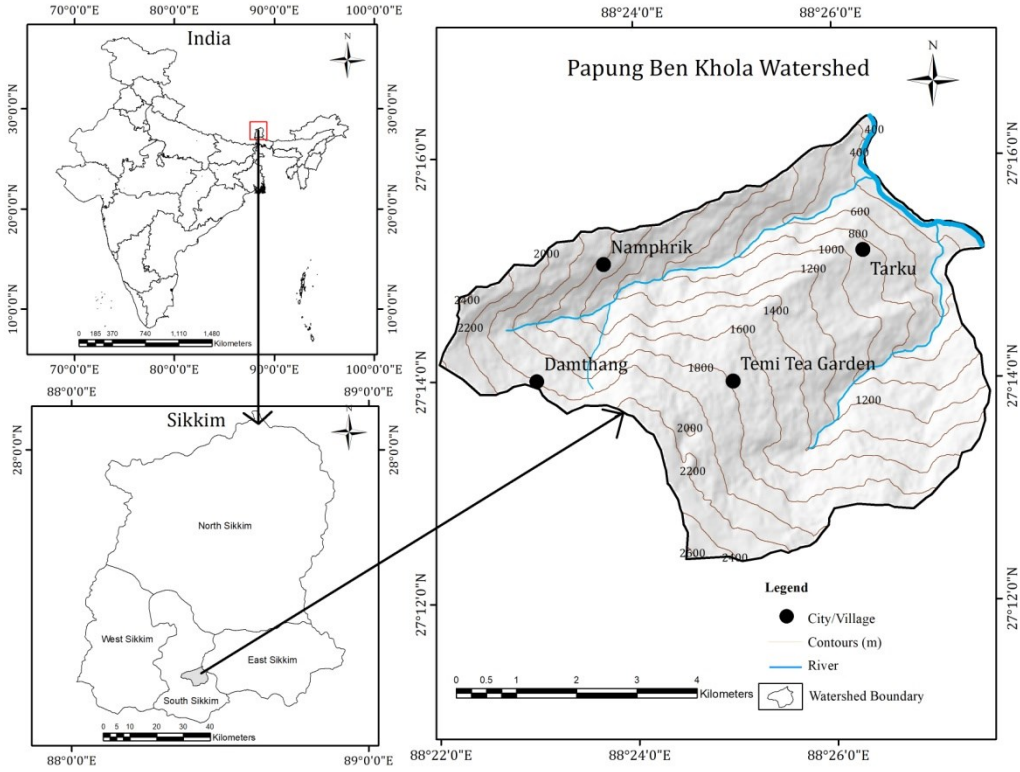

Fig. 1. Location of Papung-Ben Khola watershed in Sikkim Himalaya

Results and Discussion

Famers adopt several SWC measures in the watershed and terracing is one of the prominent mechanical measures to check soil erosion. Various studies show that construction of the terrace is essential for the conservation of soil and nutrients, better productivity levels, the livelihood of the farmers, and in turn promotes the sustainability of agriculture. During the field visit and household survey, farmers opined that terracing is beneficial to the farmers. About 100% of respondents stated that terracing helps in increasing agriculture production, reduces soil loss, and agricultural operation becomes more comfortable as less labour for preparation of the field was required. The majority of the farmers construct terraces as the practice is sustainable and cost effective. Therefore, productivity analysis in terms of cost-benefit of terrace systems is necessary. Terraces are a step-like field/narrow strips along the contour lines generally by half cutting and half filling technique across the hill slopes for the agriculture. The slope degree and length of the steep slope is reduced and helps in checking overland flow. In the watershed terracing on the slopes is done up to 50–60% depending on socio-economic conditions of households. Along with other conservation measures, terracing is time tested agriculture practice

adopted by the farmers of the watershed. Construction of terraces by farmers in the watershed is an indigenous practice and developed through generations of learning. The majority of the farmers were of the view that most of the terraces were constructed in the watershed long back. Some of them were constructed a few decades ago in response to meet the food demand for steadily growing house household size. Construction pf terraces require a massive amount of labour and capital for initial years. The amount of labour required depends on the slope, depth and quality of the soil, availability of raw material for the construction of the terrace wall and the degree of mechanization of the terrace construction. Terraces are constructed with large stones within the fields or surrounding areas and converted into size appropriate for the terrace walls made up of a combination of soil and rocks.

The cost incurred during terracing includes the construction cost of terraces, cost of maintenance, labour cost, and field preparation for paddy cultivation, manure, seed, sowing, weeding and harvesting. Paddy output in terms of grains and straws along with pulses in the contour bunds once in a year is the direct benefit that can be derived by the farmers from the terracing. The average size of the terraces is 0.1ha, where terrace length always exceeds the width. In the context of terracing, considering the cash constraint condition of households, terraces have been constructed in staggered basis that is 0.05ha is terraced in the first year, while the remaining area was converted into a terrace in the subsequent years. There are about 160 man-days of labour required for the construction of 0.1ha terrace made from mixed rock and soil materials, which is divided into two years to correspond with the two year terracing period. For the maintenance of terraces an amount of Rs. 2000/- was required as miscellaneous expenses and estimated to be about four man-days per year throughout the analysis. This cost was also divided to conform to the two-year construction period. Table 1 shows the input and output costs of the paddy cultivation of one hectare of area. Labour is the primary requirement for the preparation of land, which includes ploughing, application of manure, seeds and sowing, weeding, harvesting, plant protection measures. Data has been taken on land preparation, seed sowing and manure application from the household survey. Further, validation of data was carried out by secondary information. The farm inputs included in the production cost are labour, seeds and manure.

Terrace construction is an expensive exercise and demands high capital investment during the initial period in turn, economically beneficial in the long run; profitability is determined by the crops that are cultivated by farmers. The revenue that could be generated from the paddy cultivation on terraces is the crop yield harvested after 120 days of the growing period. Based on the household survey, the average yield is 2500kg/ha per cropping season. Apart from the paddy grains, pulses are also cultivated on the contour bunds but at a very small scale. A total of about 100kg of pulses are also produced which was sold in the market at the rate of Rs. 50/kg.

Costs of terrace construction are incurred in the first few years while the benefits accrue over future years. In initial two -years, the input cost is higher than the output cost,

implying the loss. However, from the third year onwards the output cost exceeds the input cost, implying financial benefit in the production system. As the terrace construction cost is involved only in the initial two-years, the economic benefit starts from the third year. Farmers were of the view that average yield is attained on the fifth year considering that a household has to deal with some constraints in farming such as required inputs for the new farming technology and whatever adjustments on cultural practices that they have to make in new farm enterprising behaviour as a whole.

Table 1. Cost-benefit analysis of terrace with paddy (ha$^{-1)}$ in Papung-Ben Khola watershed of Sikkim Himalaya

Parameters	Labour, man-days/ Quantity	Unit Cost(Rs.)	Total Cost(Rs.) - for Initial two years	Total Cost (Rs.) 3rd year onwards
Input cost				
Terrace construction, per year for 2 years	480 man-days	150/labour	72,000	---
Repair and Maintenance of terraces	50 man-days	150/labour	7,500	7,500
Misc. Expenses, per year during construction period of terraces	---	---	2,000	2,000
Ploughing (twice)	20 bullocks	300/bullock pair	6,000	6,000
Puddling, etc.	20 man-days	150/labour	3,000	3,000
Farm Yard Manure	10 tonnes	750/tonne	7,500	7,500
Application	4 man-days	150/labour	600	600
Seed rate (Per kg)	40 kg	22/kg	880	880
Cost of Nursery Raising/Transplantation	40 man-days	150/labour	5,000	5,000
Weeding	35 man-days	150/labour	5,250	5,250
Manual Harvesting	25 man-days	150/labour	3,750	3,750
Harvesting including Drying, threshing, storage, etc.	15 man-days	150/labour	2,250	2,250
Transportation	----	----	1,000	1,000
Total Cost			1,16,730	44,730
Benefit				
Grain Yield (kg/ha)	2,500 kg	25/kg	62,500	62,500
Pulses Yield (kg/ha)	100 kg	50/kg	5,000	5,000
Straws Yield (kg/ha)	2,500 kg	1/kg	2,500	2,500
Total			**70,000**	**70,000**
Net Benefit (revenue) for the initial 2 years (Net Revenue = Total Input Cost – Total Output Cost)				-46,730
Net Benefit (revenue) after 2nd year				25,270

Economic Analysis

The CBA carried out for terracing yielded wide range of values of profitability. For ten years, the financial CBA with three major indicators (CBR, NPV and IRR) has been calculated. About 6% of discount rate has been considered for calculating NPV. The calculation of the cost-benefit analysis for terracing shows high NPV and IRR. Terracing has a two-year payback period before it can earn a profit. However, eventually, terracing practice is turning out to be profitable prospects to venture into and is worth implementing on financial grounds. Terracing is fetching good financial returns apart from having several environmental benefits. Terrace construction leads to negative returns to the farmers in the initial two years due to the high establishment cost of terrace levelling. Thus, the cost incurred in the initial years is higher than the revenue (benefit). However, from the third year of the construction of the terrace, the cost-benefit ratio comes out to be 1:1.56, which implies higher revenue than the cost incurred in the establishment and construction cost. For ten years of analysis, the estimated NPV of 1 ha area of terrace with paddy cultivation and a discount rate of 6% are about Rs. 3.90 lakhs, while the estimated IRR is 58.09%. Terracing has a payback period of two-years and proves economically profitable with second year onwards.

Sensitivity Analysis

For sensitivity analysis, two scenarios have been chosen, (i) Pessimistic scenario, and (ii) Optimistic scenario. In the pessimistic scenario, the cash flow for each year has been taken lesser than the expected cash flows (present situation cash flow). The pessimistic scenario can happen in a situation where profit margin has been reduced due to several variable factors like increased labour cost, increased seed rate and increase in agricultural tool cost. The pessimistic cash flows have been used to calculate the final Pessimistic value of NPV. Second is the optimistic scenario, where the cash flows for each year have been taken more than the present cash flows. The optimistic scenario can happen in a situation where profit margin has been increased due to several variable factors like decreased labour cost, decreased seed rates and higher production. The optimistic cash flows are used to calculate the optimistic final value of NPV.

Table 2. Sensitivity analysis of terrace with paddy (ha^{-1}) in Papung-Ben Khola Watershed of Sikkim Himalaya

SWC Practice	Pessimistic NPV (Rs. in lakhs)	Present NPV (Rs. in lakhs)	Optimistic NPV (Rs. in lakhs)
Terracing	3.96	3.90	4.63

Thus, for terracing, three NPVs, *i.e.,* pessimistic, expected (NPV calculated from the present situation cash flow) and optimistic NPV has been calculated. Table 2 revealed the pessimistic and optimistic NPV about the expected NPV. The table clearly illustrates that even during the pessimistic situation also terracing is worth implementing on financial grounds and earning profits in both the scenarios. The financial CBA cannot be the only

indicator used by decision makers when selecting practices for the extension. This is because, among other factors, when using high discount rates, NPVs can remain positive if, for example, rapid payback periods compensate for the initial investment. These costs might not have been considered in the financial analysis, even though the degradation of the farming environment could change the economic situation of the farmer in the future. Even if appropriately accounted, these costs, appearing late in the projects time horizon, would be so significantly discounted that they would probably not influence the results of the analysis. This contradicts the idea of sustainable development now incorporated in the programs of most research and development organisations, as they include an environmental component.

Sustainability Analysis

The farmers have identified terraces as one of the most promising land management strategies on the pillars of sustainability in the watershed. All the respondents observed and reported that without terracing, they could not grow much in their fields, which in turn create livelihood problems for the future as the majority of the inhabitants of the watershed depends on agriculture. Besides the terraces as the primary land management practice, more SWC practices are required, which can be quickly adopted by the famers and proves sustainable in the long run. Further, research must also focus on new SWC techniques for sustainable agriculture in the watershed.

Conclusions

The CBA for terracing in the watershed shows that for ten years and with 6% discount rate have a positive NPV and fit in the pillars of sustainability. A sensitivity analysis, which considered two scenarios, optimistic and pessimistic, has shown that the terracing is worth implementing on financial grounds. Terracing not only stops soil erosion but also diversifies the agro-biodiversity and act as a subsidiary source of income, sustain productivity levels and helps to conserve soil and nutrient loss, soil moisture retention and increases crop yield. Terracing has a high initial investment cost in terms of labour and production cost; but is quite effective in conserving soil and nutrient loss in the long run. In this case, if farmers are supported with some incentive to compensate for the high cost of terrace construction, they will be able to sustain their crop yield and promote sustainability for the micro environment.

References

1. Barbier, E.B. (1994) The Economics of Land Degradation and Rural Poverty Linkages in Africa. UNU/INRA Annual Lectures on Natural Resource Conservation and Management in Africa, November 1998. Accra, Ghana.
2. Bjoeurklund, J., Karin, E.L., Torbjorn, R. (1999) Impact of production intensity on the ability of the agricultural landscape to generate ecosystem services: an example from Sweden. Ecological Economics 29: pp.269–291.

3. Bunch, R. (1999) Reasons for non-adoption of soil conservation technologies and how to overcome them. Mountain and Research Development 19 (3): pp.213-220.
4. Enters, T. (1998) Methods for the economic assessment of the on- and off-site impacts of soil erosion. Issues in sustainable land management, IBSRAM.
5. Graaff, J. (1996) The price of soil erosion: An economic evaluation of soil conservation and watershed development. Ph.D Thesis. Wageningen University, Wageningen.
6. Griffith, D.R., Wollenhaupt, N.C. (1994) Crop residue management strategies for the Midwest. In Advances in Soil Science, ed. J.L. Hatfield and B.A. Stewart. Boca Raton, FL: Lewis Publishers.
7. Ongley, E.D. (1996) Control of Water Pollution from Agriculture - FAO Irrigation and Drainage Paper 55. Rome: Food and Agriculture Organization of the United Nations.
8. Paoletti, M.G.; Pimentel, D., Stinner, B.R., Stinner, D. (1992) Agro- ecosystem biodiversity: atching production and conservation biology. Agriculture, Ecosystem and Environment 40: pp.3-23.
9. Pelt, M.J.F. van (1993) Sustainability-oriented project appraisal for developing countries. PhD dissertation. Wageningen Agricultural University.
10. Pimentel, D.,Wilson, C., McCullum, C., Huang, R., Dwen, P., Flack, J., Tran, Q., Saltman, T.,Cliff, B. (1997) Economic and environmental benefits of biodiversity. BioScience 47 (11), pp.747–757.
11. Posthumus H, de Graaff J. (2005) Cost–benefit analysis of bench terraces, a case study in Peru. Land degradation & Development 16: pp.1–11.
12. Rai, S.C., Sharma, E. and Sundriyal, R.C. (1994) Conservation in the Sikkim Himalaya: traditional knowledge and land-use of the Mamlay watershed. Environmental Conservation 21: pp.30-34.
13. Tenge, A.J., Degraaff, J., Hella, J.P. (2005) Financial efficiency of major soil and water conservation measures in West Usambara highlands, Tanzania, Science Direct-Applied Geography. 25(4): pp.348-366.
14. Uri, N.D. (2000) An evaluation of the economic benefits and costs of conservation tillage. Environmental Geology 39(3-4): pp.238-248.
15. WRI (2000) Degraded Agricultural Land Threaten World's Food Production Capacity. http://www.wri.org/press/goodsoil.html.
16. Yuan, Y., Locke, M.A., Gaston, L.A., (2009) Tillage effects on soil properties and spatial variability in two Mississippi Delta watersheds. Soil Science. 174: pp.385-394.

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CULTURAL CHANGES IN THE URBAN FRINGE - THE NISHIS OF ARUNACHAL PRADESH

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Abstract

The rapid pace of development which is taking place everywhere has a remarkable impact on the traditional sociocultural ethics of the people. The process of urbanization is accelerated due technological revolution which has changed the normal way of functioning of the people. It does not have any barrier or limitations in spreading its tentacles far and wide. Here an attempt has been made to realize it's impact on the age old traditional culture of the tribal people of Ganga village which happens to be a sub-urban tribal village of capital city Itanagar of Arunachal Pradesh. The impact of modern gadgates are verymuch in use in most of the houses. A change has been perceived in all aspects of their day to day life starting from their food habits to dress materials.The people of the village old as well as the youths do not like to follow their traditional tribal culture in the long run, rather aspires for a modern comfortable life. In the near future they may not be able to show any symptom of tribal culture.

***Keywords*:** Urbanisation, Nishi, Cultural Change, Food habit, Ganga village

Introduction

Culture is "the sum total of the knowledge, attitudes, and habitudinal behaviour patterns shared and transmitted by the members of a society" (Ralph Linton). Geographers are most interested in how culture and the pattern of behaviour associated with it are imprinted on the landscape. Culture gives the visible character to a region. The people of any culture transform the land they occupy by building structures, creating lines of transport and communication and tilling the soil. One of the most interesting fields in geography is how ideas, inventions and practices spread through population across space and time. Culture gets modified as people always want to adopt more comfortable and luxurious life discarding the traditional culture where manual labour counts much. It is seen in many instances that tribal culture known for nature-drive practices of life changes quickly in the urbanisation and modernisation.

Study Area

Ganga village (27^0 4′ N and 93^0 34′ E) is located at a distance of 5 km to the south of the state capital Itanagar. It is a sub-urban village of the new Itanagar circle of Doimukh

block of Papum Pare District of Arunachal Pradesh. Nishi tribes are the dominant group in this village. The village lies in the *intermontane* valley of the Siwalik range of the Eastern Himalayas at an altitude of 300 m above the mean sea level. The village experiences sub-tropical climate dominated by short summer and long cold winter. The average temperature of the village is 24º C with the minimum temperature of 13º C in the month of January and maximum temperature of 32.5º C in the month of June. The long winter is very cold and the short summer is warm. The climate of the village is modified due to large scale deforestation, thus reducing the duration and amount of rainfall, decreasing winter temperature and increasing summer temperature. The sky remains overcast for most part of the year with high humidity above 80%. The village receives rainfall throughout the year with heavy rainfall during south west monsoon season. The average annual rainfall is 1,300 m., with about 72% received from April to September. The natural vegetation of the village belongs to mixed vegetation of deciduous and semi evergreen dominated by bamboo. The village is well drained by perennial streams and the soils formed from the metamorphism of sedimentary rocks are loamy and rich in nitrogen (Figure 1).

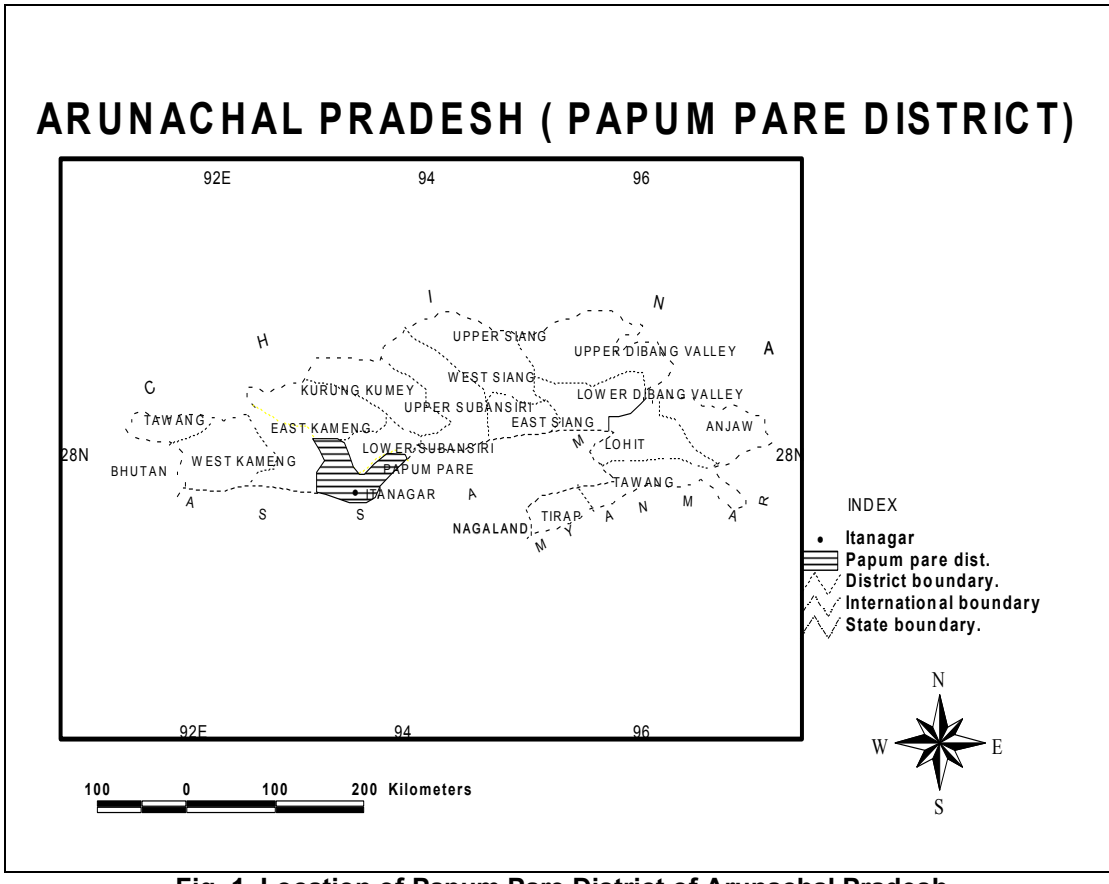


Fig. 1. Location of Papum Pare District of Arunachal Pradesh

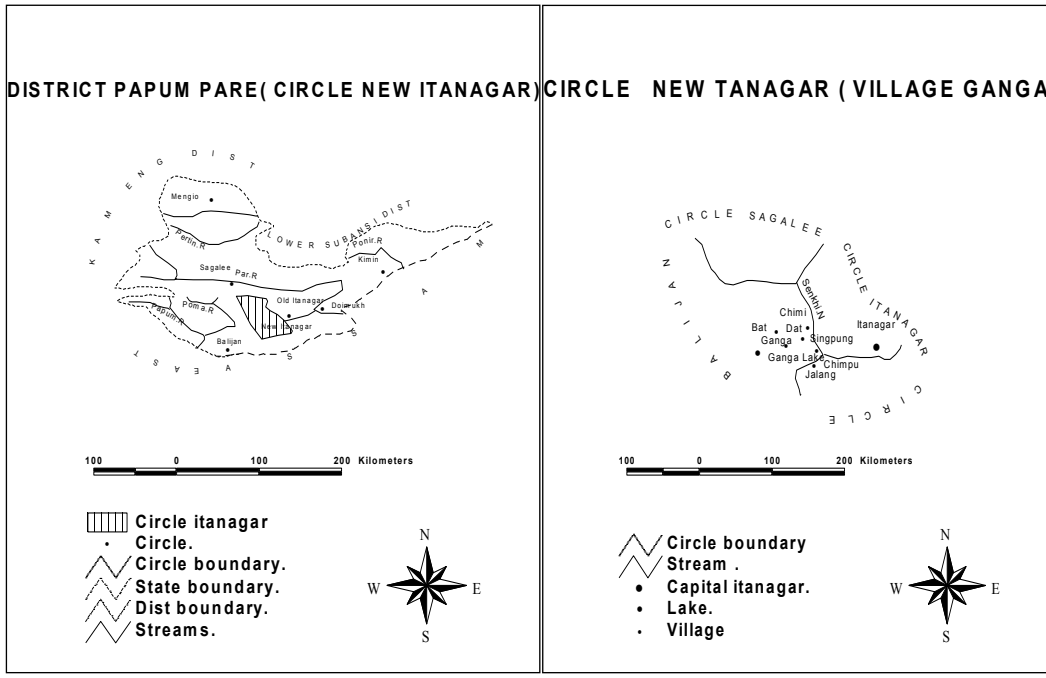


Fig. 2. Papum Pare District - Circle New Itanagar and Village Ganga

Database and Methodology

The study is largely based on field level observations and data collected from household interviews with structured questionnaire. Data were collected on various relevant parameters like housing, sanitation, amenities, transport and communication, drinking water, food habits, health, population, literacy, occupation, religion, marriage, costumes, agriculture, domestication of animals, demography etc. The secondary data collected from official records of the census of India, statistical abstracts, published books etc., were used to get an overview of the situation. Both qualitative and quantitative techniques were used to analyse and represent the data to arrive at specific conclusion.

Population

The population of the village has shown an increasing trend from 78 in 1971 to 508 in 2011, thus the population has been increased more than six times in the last 40 years. Mean decadal growth of population is 72%, with maximum growth between 1971-1981 (138%) and lowest and negative growth of population between 2001-2011 (-2%). The mean annual growth rate of population is 14%. Mean decadal growth rate of male population is 77% with average annual growth rate is 14%. Maximum growth rate took place between 1981-1991 (159%) and lowest and negative growth rate in 2001-2011 (-4%). Mean decadal growth of female population is 69% less than their male counterpart. However, decadal growth of female population was lower than male population before 1991. After 1991

female population growth shows increasing trend than male population much less than earlier growth (Table 1 and Figure 2, 3). The sex ratio is always in favour of the females. Sex ratio declined from 1,167 (1971) to 1,035 (2001), with 2011 showing slightly increasing trend in comparison to the previous decade. However, a decline in sex ratio attributes to the lack of proper maternity and child health care leading to death of more females. In the tribal society girls are preferred than boys due to bride price the girls' parents receive from the grooms. Therefore, girls symbolize signs of richness (Figure 4). Age-sex distributional pattern shows dominating age group of population is between 5-24 years indicating a progressive society. In the age group of less than 4 years less number of children with half female children. Aged people above 55 years of age are lowest about 3% of the total population. Survival of higher age group of population becomes less due to various diseases relating to imbalance nutrition, unhygienic living condition, heavy physical labour and their callousness towards modern health facilities (Table 2 and Figure 5). Literacy rate in the village increased from nil literacy in 1971 to 67% in 2011. Male literacy increased to 74 % and female literacy to 60 %. Increasing literacy rate is due to the government policy of financial incentives, availability of educational facilities and scope for better living imitated in the capital city Itanagar and the impact of the mass media like TV, radio, newspapers etc. Parents are sending their children in large numbers to schools and colleges for study. Parents do not like their children to follow their traditional strenuous profession, the *jhum* cultivation. In many cases, large number of students leaves their schooling to shoulder their family burden as their main bread earners commonly their father dies of diseases. Inspite of various incentives people with higher education are very less due to socio-economic and cultural compulsions (Figure 6).

Occupation

The occupational pattern of the people in the village has been divided in to working and nonworking. The major occupation of the people are cultivation, livestock farming, fishery, construction, trade and commerce, transport, storage, communication and other services. The nonworking population includes students, children and old people. The occupational structure of the population shows 50% decreasing trend of working population from 51% in 1971 to 27% in 2011 and 50% increasing proportion of nonworking population from 49% in 1971 to 73% in 2011.Among male and female working population the trend has been changed from more female workers 28% in 1971 to more male workers 17% in 2011.It indicates more female population are confined to household works and pursue study. According the latest census report maximum population about 66% are engaged in tertiary activities like service and commercial activities. People engaged in household industry works were reduced to 0% in 2011 as compared to 19% in 1991. Among the nonworking population female population exceeds much their male counterpart. Earlier due to lack of alternate scope for work, all the working population were engaged in cultivation. In course of time with changing scenario more people now engaged in non-cultivation works. The capital city provides scope for service and business opportunities to the local people on priority basis. In the service less number of people are engaged due to less number of higher educated people.(Table 3, 4 and Figure 7, 8).

Livestock farming constitutes a major occupation to substantiate their food requirements and sell the surplus in the market. Day by day due to the impact of urbanization and availability of better avenues, the work culture of the village is getting diversified. With increasing demand for vegetables, fruits, meat and fish in the market, the cropping pattern has been changed in favour of market gardening.

Table 1. Population of Ganga Village (1971-2011)

Year	Total Population	Male	Female	Sex ratio	Literacy in %		
					Male	Female	Total
1971	78	36	42	1167	Nil	Nil	Nil
1981	186	87	99	1138	14	4	18
1991	428	225	203	901	14	9	23
2001	514	247	267	1081	67	59	63
2011	508	238	270	1035	72	64	68

Source: Census of India

Table 2. Age-Sex Distribution of Population in percentage in Ganga Village (2011)

Age	0-4		5-14		15-24		25-34		35-44		45-54		55-64	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	M	F
% of population	8	4	39	21	20	45	10	18	8	6	12	6	3	0

Source: Sample Survey by the Author

Table 3. Working and Non-working Population of Ganga Village in Percentage (1971-2011)

Year	Working population			Nonworking population		
	Male	Female	Total	Male	Female	Total
1971	23	28	52	23	26	49
1981	22	24	46	25	29	54
1991	26	17	43	27	30	57
2001	22	21	43	26	31	57
2011	17	10	27	30	43	73

Source: Census of India

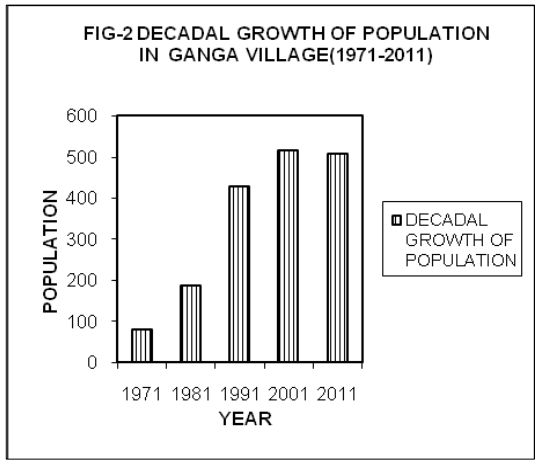


FIG-2 DECADAL GROWTH OF POPULATION IN GANGA VILLAGE(1971-2011)
POPULATION
600
500
400
300
200
100
0
1971 1981 1991 2001 2011
YEAR
DECADAL GROWTH OF POPULATION

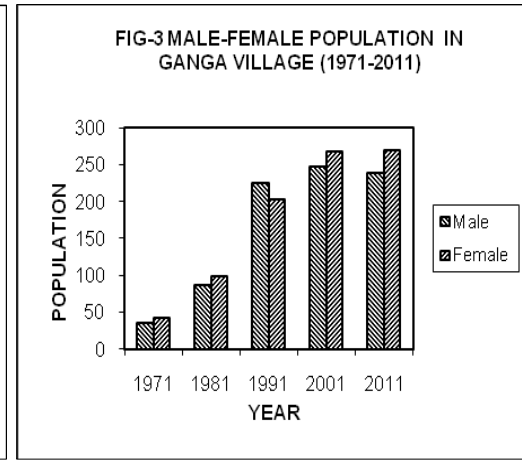


FIG-3 MALE-FEMALE POPULATION IN GANGA VILLAGE (1971-2011)
POPULATION
300
250
200
150
100
50
0
1971 1981 1991 2001 2011
YEAR
Male
Female

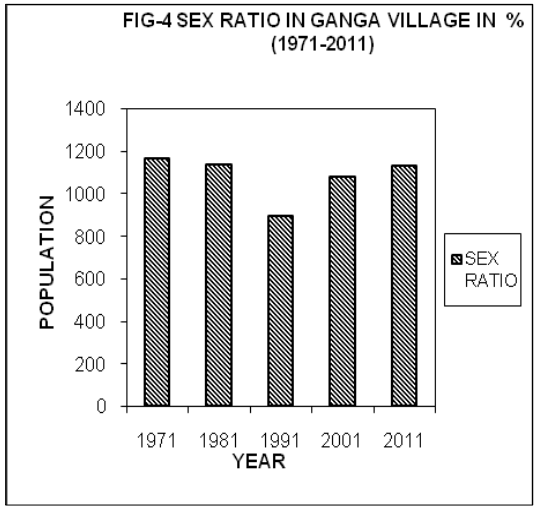


FIG-4 SEX RATIO IN GANGA VILLAGE IN % (1971-2011)
POPULATION
1400
1200
1000
800
600
400
200
0
1971 1981 1991 2001 2011
YEAR
SEX RATIO

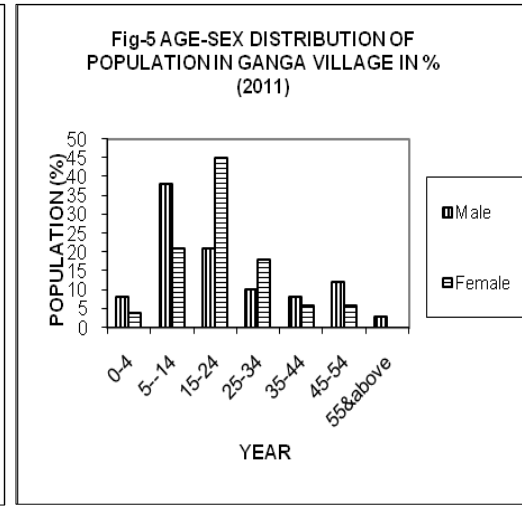


Fig-5 AGE-SEX DISTRIBUTION OF POPULATION IN GANGA VILLAGE IN % (2011)
POPULATION (%)
50
45
40
35
30
25
20
15
10
5
0
0-4
5-14
15-24
25-34
35-44
45-54
55&above
YEAR
Male
Female

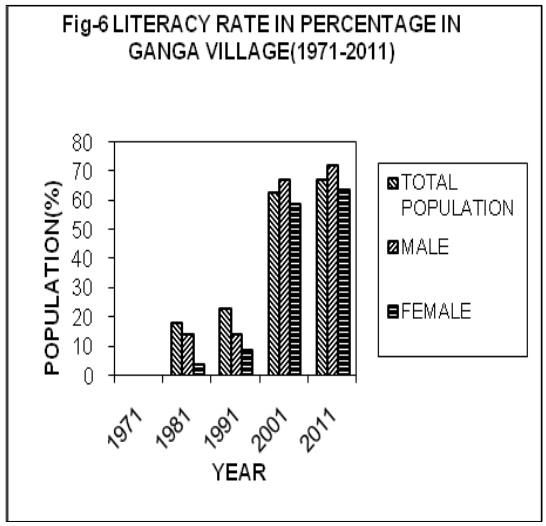


Fig-6 LITERACY RATE IN PERCENTAGE IN GANGA VILLAGE(1971-2011)
POPULATION(%)
80
70
60
50
40
30
20
10
0
1971
1981
1991
2001
2011
YEAR
TOTAL POPULATION
MALE
FEMALE

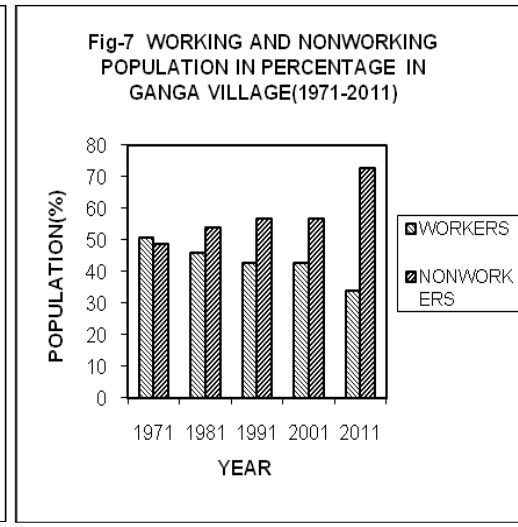


Fig-7 WORKING AND NONWORKING POPULATION IN PERCENTAGE IN GANGA VILLAGE(1971-2011)
POPULATION(%)
80
70
60
50
40
30
20
10
0
1971 1981 1991 2001 2011
YEAR
WORKERS
NONWORKERS

Food Habits

The food habits of the people are guided by their environment. Most of the foods they collect from the forest like wild vegetables, fruits, fish, meat etc. Due to extreme cold climatic conditions and hard physical labour people consume high calorie foods like meat and drinks which are normally affordable as mostly they prepare of their own. The chief items of food taken by most of the people are rice, meat, maize, vegetables, fish and beer. The process of preparation of food may vary among different tribes, but the basic diet remains the same with little variations. Rice is the staple food, it is cooked and the excess cooked water is poured into a bamboo mug for drinking. A meal usually comprises of vegetables and flavoured with chillis and salt. Meat of animals and birds of many kinds is eaten by the people. Fresh meat which is a scarcity is smoked, dried and preserved; and soft meat is roasted in the fire, while smoked meat is boiled in water. Chillis and salt are added before the meat is served. Pork is usually prepared as a roast. Maize and millet are other cereals, which are grinded in to flour to make bread or porridge. Millet or maize or rice is also used for making the liquor. Beer locally called *apung*, is the most favourite and delicious drink and it is an indispensable item at meal particularly with meat. Vegetables, roots, and tubers are also commonly taken by the people. The most important of them are sweet potato, a great variety of *arums*, pumpkins and cucumbers grown in the *Jhum* field and fenced gardens. Wild roots are supplementary to the normal food. Chillis, ginger and leaves of onion locally called *talap* are used as spices. Bamboo shoots are cut into small pieces, fermented and dried in the sun. They are normally added with vegetables for cooking. Fish, frogs, crabs and certain insects found on the bank of streams and rivers also form the common food item of the people. Fish is smoked and dried for preservation when there is abundant supply of it. Frogs are boiled and eaten as curry. Tobacco is grown locally and smoking is common. Pipes and pouches containing dried tobacco leaves are carried by men and women whenever they go out. The food habit of the people is quite traditional. They usually consume more food with high caloric value. They perform heavy manual labour like walking long distances along hillslopes for *jhum* cultivation, hunting, fishing, and collection of firewood, and green leaves, to meet their demands. They used to consume what they produce from cultivation. They collect other necessary materials like salt from the markets of the plains of Assam on barter.

Changes in Food Habits

Now the system has changed due to the availability of large number of attractive alternative food items available in the nearby market. The traditional barter system for exchange of commodities has been changed due to wide circulation of money in the market. Increasing population pressure adversely affected jhum cycle, soil fertility and crop production. Large scale deforestation for timber and jhum resulted in scarcity of wild vegetables and animals. To satisfy their immediate needs, people develop kitchen gardens these days. In addition to the local market the General Fair Price Shops in the village help the people in getting their food requirements at subsidized rates. On the basis of a sample survey a person's daily consumption of food items include major and minor foods. Rice is

the dominating food item followed by vegetables, local made drinks(apung), meat and fish.The major food items accounts for about 82% and the rest are minor food items. Minor food items include flour, pulses, spices, milk, tea, coffee, wine, baby food, fast foods etc each accounts for less than 2% (Table 5 and Figure 8).The consumption of minor food items are mostly used by the youths and children due to the impact of modernization and nearness to the urban center. The usual meat include killings of wild animals as well as domesticated animals like pig, mithun, chicken, goat, etc. (Table 5 and Figure 9).

Health Status

The health conditions of the people reveals the food habits and the prevailing environment of the locality. The people are suffering from various kinds of diseases like skin disease, gastroentities, malaria, toothpain, headache, jaundice, low B.P, backche, eye disease, T.B. etc. The most common diseases are skin diseases, gastroentities, fever, malaria and jaundice (Table 6 and Figure 9). The basic factors responsible for these diseases are unhygienic living, imbalance food habits, excess dependence on traditional healthcare, least conscious about modern health care, and illiteracy. However, due to spread of education the situation is improving. The traditional houses have least provision for ventilation of fresh air, sun light and outlet for kitchen smook. They do not have separate latrins, they use the vacant place below kachha houses with bamboo floor for latrins as well as shades for pigs to consume human excreta. It creates foul smell as wellas the cause of spread of many kinds of diseases. Presently many are using pucca houses with separate latrins with well ventilation.

Table 4. Occupational Structure in Ganga village in percentage (1991-2011)

	1991			2001			2011		
Occupation	Male	Female	Total	Male	Female	Total	Male	Female	Total
Cultivators	34	34	68	14	15	29	20	10	30
Agricultural labourers	6	4	10	0.9	0.5	1.35	4	0	4
Household industry workers	18	1	19	4	16	20	0	0	0
Other workers	2	1	3	33	16	49	38	28	66

Source: Census of India

Table 5. Household consumption of food items in Ganga Village in Percentage

Food Items	Rice	Floor	Pulses	Oil	Spices	Vegetables	Meat	Milk	Drinks	Others (Tobacco etc.)
% of consumption	39	2	2	1	1	19	15	1	19	1

Source: Sample Survey by the Author

Table 6. People Suffering from Different Diseases in Ganga Village in Percentage

Disease	Skin disease	Gastro entities	Fever	Backche	Tooth pain	Low BP	Jaundice	Malaria	Headache
% of people affected	20	20	12	4	4	4	12	16	8

Source: Sample survey by the Author

Table 7. Different types of Crops Cultivated in Ganga Village

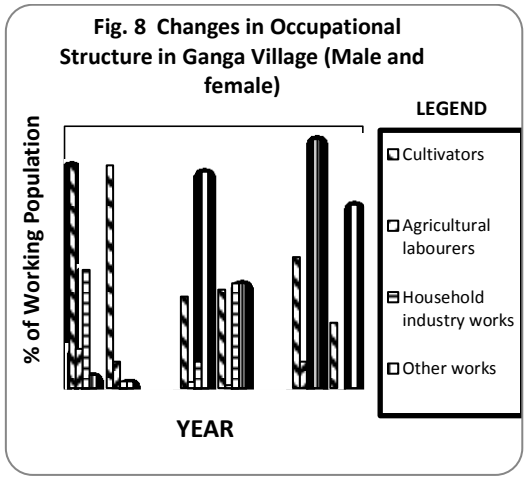
Crops	Rice	Maize	Vegetables	Millets	Potato	Pineapple
% of Area	45	21	17	9	6	2

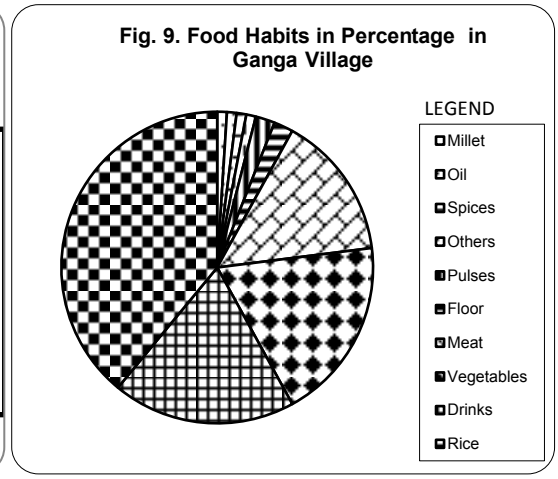
Source: Sample Survey by the Author

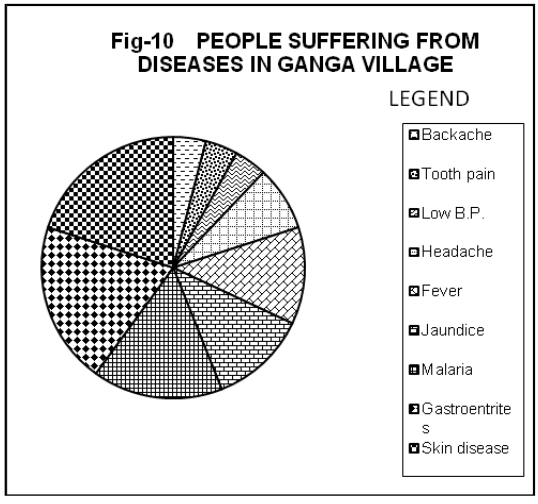
Table 8. Livestock Resources in Percentage in Ganga Village

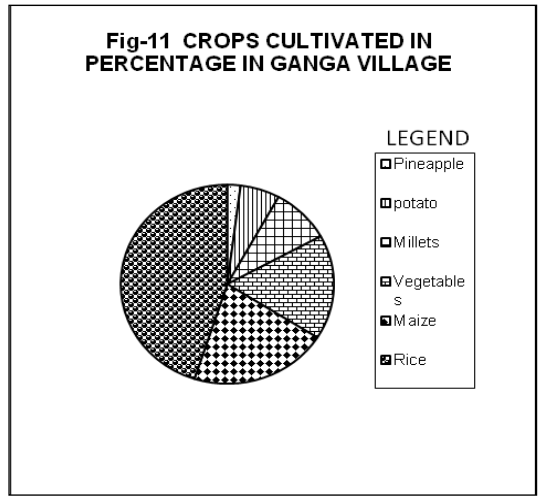
Mithun	Poultry Bird	Cattle	Goat	Dog	Pig
32	40	10	13	1	4

Source: Sample Survey by the Author









Majority of the people drink unfiltered water which causes many water-born diseases. The use of filters for water is widely acknowledged by the people. As per the survey about 67% people use filters. Earlier people used the stream water for drinking and cooking. Bathing was not regular for the people earlier. Taking bath in the contaminate stream water caused skin disease. Malaria is a common disease due to swampy conditions. People are now taking anti-malaria measures like mosquito nets and mosquito repellants. About 92% people use mosquito nets. Family planning measures have become popular to limit the family size, and about 71% people adopt such programmes. The maternity care for safe mother and safe child has been adopted by 52% people using modern health care facilities. Due to availability of modern health facilities in the capital city and increasing awareness among the people, there has been some progress in the health care of the people (Table 6 and Figure 10).

Agriculture and Livestock Farming

The Nishis are agriculturists and commonly practise shifting cultivation (*Jhuming*); permanent cultivation is progressively adopted, wherever it is feasible. There are three kinds of ownership of land, personal land, clan land and village land. The land which is held on indivisual ownership and is inherited through the father is the personal land, the land which is utilized by different villages of a particular clan for burial or grazing purposes is clan land; and the land on the fringes of villages with forests providing to the villagers with firewood, canes, rootes, herbs, hunting and fishing is the village land or the community land. The individual status in the society is determined by his possession of land. The *jhum* lands belong to the community land and the village council allocates to each individual family a plot of land for its use. They prepare the *jhum* land with the help of the community. The male members clear the forest and female members carry out all other farming operations. To supplement the agricultural labour force the Nishis follow polygamy as each wife is considered to be an economic asset. She cultivates a plot of land set apart for her and helps food production to maintain her children. She may also lend a helping hand to her husband in the *jhum* field. They produce from the land whatever they require. Paddy, maize, vegetables, millets, potato, pineapples, pepper, yam and sesamum are the common crops grown (Table-5 and Figure 10). However, due to increasing population pressure on the land the *jhum* cycle has been reduced to three to five years from 24years or more earlier. Changing in the *jhum* cycle and lack of adequate improvement in agricultural practices resulted in the declining of the crop production and people are more dependant on food from the market and government fair price shop in the village. People seem to require more *jhum* land because plain lands are inadequate and *jhum* land does not need irrigation,chemical fertilizer and modern farm equipments. In addition to *jhum* some people practice settle farming for wet paddy on plains or horticultural farming on hill slopes near the village. About 59% people do jhuming and 41% settled farming. Irrigation facilities are available only for 42% of the wet paddy land both from stream and canal. In order to maximize production the government. has taken several measures through its extension programme i.e. supply of HIV seeds and chemical fertilizers. Livestock are important part of the Nishis's life and this defines their economic status in the village. Mithun is the most

common domestic animal living in the swampy areas, other animals they domesticate are cattle, pig, poultry and dog. Mithuns are normally set free in the forest and visits the owner's house at regular intervals. Mithuns are being used for the bride- price and major sacrifice in festivals (Table 7, 8 and Figure 11).

Religion and Festivals

The Nishis idea of religion was exceedingly primitive. They acknowledge the existence of one supreme creature and ruler of the world. But they never worship him. Their religious rites are based on the belief of the spirits inhabited their hills. The spirits were propitiated by offerings and sacrifices. Their worship consisted of invocation of protection for the people, their crops and domestic animals. They considered sacrifices more worthy than offerings. Hogs and fowls were the animals most frequently sacrificed. Feast with apung always follows their sacrifices. They have three great gods namely *Suruk* (the great god), *Sam* (the god of woods and jungles) and *Silik* (the god of waters, heavens and earth). The Nishis worship the sun and moon gods, namely *Donyi Polo*. Their religious rituals largely coincide with the phases of agricultural cycles. The Nishi tribe has its priests for leading the religious rites and sacrifices. A variety of ceremonies and festivals are celebrated by the people on different occasions. Some festivals are observed by individuals or families and some others by the community as a whole. The community festivals are mostly connected with agricultural activities or fertility rites. The biggest festival of Nishis is called Sirom Molo Sochum and is celebrated in the Nishi month of Rain-Po-Lo (December) every year. Before this festival all houses and granaries are built and all crops harvested and stored in the granaries. For the festival households cook rice and meat, and prepare rice beer (opo) and entertain guests and receive blessings for more abundant crops next year. During this festival people sing, dance and drink beer to celebrate. In the month of August every year, Nyokum or the worship of Goddess of crops (Lakshmi) and other Gods and Goddesses is celebrated by the Nishis for plentiful crop harvest. Yuluis performed for the welfare of the society. The ceremony is marked by a sacrifice of mithuns in which the priest collect the blood of the animal in a bamboo tube and hangs it in front of his house as a mark of distinction. People have adopted Christianity in addition to their own religion. They regularly offer prayer in the church in addition to observing their traditional religious festivals. The festivals are mostly related to good harvests and wellbeing of the people from the wrath of the nature. They offer animal sacrifice to please *Donyi Polo*. The important religious festivals observed by the people are Good Friday, X-Mas, in addition to their traditional festivals like Nyokum, Yolu, Siram-Molu-Socu.

Marriage

Marriage in the tribal community of Nishis is of contracted one. One could purchase as many wives as he could afford. The marriage is usually negotiated and the groom has to pay bride- price to the guardian of his wife. The members of the tribe marry within it, but members of the clan outside it. The polygamy is permitted but monogamy is the usual

practice. Polygamy amongst the Nishis is due to a variety of reasons. The main reason is economy; in the Nishi society a woman shares much of the responsibilities for growing food. She works in the field as well as she does the household works. She is indispensable for agriculture. Another important reason for polygamy is the custom for inheritance of widows, where by sons and brothers after the death of a man have a claim to inherit widows. Polygamy helps in agricultural activities as more women workforce in the affordable family with having more *jhum* lands. The dormitories in the village served as meeting places for youths to select their marriage partners. The position of women in Arunachal Pradesh is respectable but not very high. The system of polygamy particularly among the Nishi has lowered their position and sometimes wives are forsaken without being diversed. In the Nishi community widows are well protected either inherited as wives by the dead man's heirs or she may continue to live in the house in case she is too old without being inherited. The impact of modern life has influenced the traditional marriage system. The earlier bride price as *mithun* has been changed to money. The educated youths are selecting their partners within their community and outside. The rigidity of bride price has been reduced. The age of marriage of girls is increased to 18 years and boys to 20 years. The state government is encouraging inter community marriage with financial incentives for better inter community relationship.

Language

Linguistically, Arunachalese are the Tibeto Burmese speakers. Different communities have different languages which hampers their free mixing. They have languages of Assamese, Bengali and Hindi due to free mixing with the people of the plains of Assam. Due to the spread of education with English as medium of instruction and Hindi as communicating language more and more people are well conversant with the modern languages. However the old people still could speak only in their own tribal language as they are least interested and least interacting with the urban people from other regions. The traditional tribal (Nishi) language does not have its own script and yet to be developed. The government is initiating several steps to develop traditional tribal languages and their use in the lower classes.

Customary Laws

Disputes in the tribal society are decided by a tribal council known as *kabang* or *mel* keeping in view of the community interest. The system worked very well, enjoyed the confidence of the people. The disputes which could not be decided by the village councils, if it is against public attracted provision of Article 20(3) of the constitution in which police and court intervene to settle the dispute. The system of administration of justice as prevalent elsewhere in the country was also introduced in a limited way in the community.

Dress and Ornaments

The dress and ornaments of the tribes are unique as they identify and distinguish them from one another. The main garment of Nishis men consists of a coarse loincloth and

a blanket woven from the fibres of a wild plant. Occasionally a man may wear a piece of *mithun* hide to cover his chest. Around the neck are worn numerous strings of beads, white, red, blue, green and grey, inherited and passed down as heirlooms. The left wrist has a coil of hair strings and the right is decorated with a number of bangles. Around the waist are worn a number of cane rings woven with tame fibre, while below the knees are a pair of woven cane, each belonging less than an inch board. Other articles of wear are a big dao and a small multipurpose knife sheathed in bamboo scabbards sometimes to look more attractive monkey skin of silver, ash colour is often wrapped. A long woven ribbon, *jusopus*, either of wool or podu fibre with red and black stripes and a pouch containing tobacco and the smoking pipe. They are very much fond of beads, necklace, and other decorative items. They wore wicked-work helmet with plum of magpie feathers. But some of the chiefs wore a cylinder of thin silver round their heads. The most conspicuous is the head dress which is an admirable helmet of woven cane, surmounted by a crest of hornbill beak dyed scarlet red. The hair is plaited and done in a bun on the forehead called the *podum*, which is wound with yellow thread. A brass skewer of about a foot in length is passed through horizontally. Around the head a thin band of woven cane studded with miniature solid metal bells is worn. The perforated earlobes are decorated with bamboo plugs and earrings.

The women decorate their hair either in a bon at the back or parted in the middle to be plaited around the head as a common style in many parts of India. Neither the women nor the men, use any fat or grease for dressing the hair. This is done with bamboo combs often a simple cold or warm wash. Like men, the women wear numerous strings of multicolour beads. In addition to these they also wear a number of metal bells, brass chains and tea spoons which dangle from the neck over the breasts. In the earlobes, they wear lead rings of large size with or without bamboo blunts. On the hands, they may have a couple of rings of brass or silver on the fingers, while the wrists are always covered with bangles.

The women wear a skirt of woven fibre often with a green border and stripe designs. They also wear a belt of cane decorated with hoofs or disc shaped metal ornaments. Two other ornaments may be seen in common use, one is the metal rings and the other a more prized piece of decoration is a *tajing*, a chain with a number of flat squares metal pieces and blue head strings. On the legs no ornaments are worn except the tight fitting cane garters on the anklets, which more often results in constricting the legs and causing ulcers, rather than adding to the wearer's beauty. The children remain naked in infancy. At the age of three or four, they put on a piece of blanket. The girls above this age cover themselves in the manner of their mothers. Tattooing as an art of decorating the face or the body is absent among the Nishis. There are only a few people, old men and women who have any tattoo marks. They believe that these marks can conveniently be sold in the next world. It appears to be borrowed from the *Apa Tani*. The Gams, or village chiefs, who in addition to their usual dress, put on a red coat as a mark of office and the other in case of priests. As a mark of distinction of his office, a priest not only decorates his *poduni* with soft feathers of birds or a bunch of animal hair, but also carries at his back a fan made of feathers of an eagle. Head dresses of tigers skins often decorated with quaills and tajirr

leaves, are reserved for ceremonies. The impact of modernity has changed the traditional ornaments to modern ornaments available in the market. They are now using mill made clothes, ornaments and various types of cosmetics available in the market at par with the youths in other part of the country. However, the old people still continue with their tradition.

Dances

The tribals dance collectively to express their corporate life. The dances performed on different occasions may be broadly classified as ritual, festive and recreational. The Nishis have four types of dances, namely *buiyasodon, ropsodon, northon* and a dance associated with the worship of a spirit called *yab*. They dress themselves in their best available garments and ornaments when they dance. The *buiyasodon* dance is held on the occasion of a marriage and during the *yulo* ceremony, generally performed after harvest in the months between January and March for the prosperity and welfare of the performer. In the marriage ceremony, when the bride comes for the first time to her husband's place, there is much feasting and rejoicing. The *ropsodon* dance is a reminiscent of the old war dance associated with a ceremony called *ropi*. It was performed to prevent the spirit of the victims from taking revenge on the killers. It is performed after killing a tiger. The *northon* dance performed by the women in the marriage ceremony when the bride comes to live with her husband. The women perform this dance at night inside the bridegroom's house without using musical instruments. The dance connected with worship of *yab* is conducted by a prist. It is believed that *yab*, a jungle spirit causes rheumatic pain. The affected persons perform with a bow and arrow in hand together with a companion holding a sword in his right hand and a bamboo shield in his. The games played are simple, inexpensive and vigorous, and they offer enjoyment, relaxation and recreation to the children as well as elderly people. The snake game, known as *harram peya* is interesting because of its uniqueness. The players do their best to resemble a snake and silently squirm their way out from some mysterious corner, wriggle around the open field and silently disappear again; about ten to twelve players are required for this game. Other games performed are hog's rub, hunting, highjump, boho, stick-wresting, pig hunting, crow race etc. The educated youths in addition to their traditional hobbies like fishing, hunting, shooting, dancing and singing (using their traditional equipment's or modern equipment's) and sports.

Domestic and Other Articles

The domestic articles of the tribal houses usually consist of agricultural, hunting and fishing tools and implements. The household articles of the Nishis are not numerous. They use guards of various shapes and sizes, bamboo mugs and vessels for fetching water, cane and bamboo baskets, mats and skins, earthen pots and occasionally iron frying pans and aluminium mugs. Articles of greater value are weapons and chase, like daos, spears, bows and arrows and ornaments like head bead, strings and women's waist belts of metal discs. Their wardrobes are not rich and include a few *pudu* fibre and cotton blankets. Such valuables as *majis, talus* and *kojis* are buried secretly near the house and may be

taken out only when occasions demand. Among the ceremonial objects are the horns of the sacrificed mithuns and the skulls of pigs, which are hung as exhibits on the nyodang wall. The trophies of chase found a conspicuous place, while on the koda wall may be found the horns of mithuns that have died of sickness.

Due to the availability of metal and plastic articles in the market now, people are using modern furniture such as chairs, tables, cupboards or almirah more commonly. The articles used by the Nishis are similar to articles used by the non-tribes and the traditional indigenous articles seem to be vanishing in the house of a modern educated Nishis. They are using modern gadgets like telephone, television, radio refrigerators, air conditioners, grinders etc. as a symbol of modernisation.

Infrastructure

The development of modern infrastructure is hampered with the widely scattered settlements, low population and hilly terrain. The traditional means of transport and communication in the interior part is by walking or riding horse along the narrow footpaths of the hill slopes and bamboo bridges over the streams and small rivers. During rainy season most of the places remain cut off due to land slides or damage to the roads and bridges. However, the Ganga village due to its proximity to the capital city is well connected with good road and transport facilities. Other infrastructural facilities include electricity, telephone, piped water, availability of LPG, postal service, school, community hall and fare price shop. Availability of school in the village and higher educational institutes in the capital city provides good educational facilities. Government hospitals at the capital city provide better health facilities. In addition to the existing government hospitals, the private clinics also provide health facilities. Almost all houses are electrified with the provision of street light. About 63% houses has telephone facilities. The fare price shop provides subsidised food and non-food items to the village. The means of transportation are government, public and private. About 23% households are having their own automobiles like two wheelers and four wheelers. Community hall in the village provides opportunity for enriching community life of the people particularly the youths. The traditional source of fuel has been replaced by LPG, kerosene stoves and electric heater.

Housing

The Nishis live in the valley in a clustered settlement. Their houses exhibit both traditional as well as modern. They live in traditionally long houses made up of locally available raw materials like bamboo, timber and leaves. The houses are usually made on a platform at a height of 4ft to 5ft above the ground supported either by timber or bamboo. The houses are elongated with about 20 to 30 ft long and width of about 10 to 15 ft. The long house can be extended according to the increasing needs of the family with increasing family members. The house has been divided in to a number of rooms which are quite specious with all the traditional facilities. The vacant space below the house is traditionally used for keeping livestock (Mithun, pig etc.) and protect the floor from wet and severe cold

from the ground. As per the survey nearly 70% houses are of non RCC and the remaining 30% houses are of modern RCC type. Some RCC houses are of concrete roof and others corrugated iron sheets. The traditional houses are now a days being modified with RCC pillars as basement and corrugated iron sheets as roof. The houses are lacking adequate ventilation facilities for air and light. The provision of cooking in the house occupies a special place because of the large joint family system with the provision of taking food at a time around the kiln twice in a day in the morning and afternoon. Nearly 50% houses have no separate kitchens. In the usual traditional pattern, the latrine is inside the house with an opening on the floor of the house. The human excreta is being eaten by pigs living below the floor of the house; it is a scientific use of the human waste. Now a days people prefer separate toilet or use the open space in the village near the streams in temporary enclosures. Still nearly 29% houses does not have any separate provision for latrines. Earlier the people were not habituated with taking regular baths but at present due to coming in contact with the outside people, they are taking regular baths. They usually take bath inside the house and some have separate bathrooms. However, old people are following their traditions.

Fig. 12. Nishi Tribes

Fig. 13. Village Sites of Nishi Tribes

Conclusions

This work has been taken up at the village level to study the impact of modern life on the urban fringe. The usual belief is to preserve culture, because loss of culture is loss of identity. It is observed from this study that preservation of old culture seems to be very difficult in the face of all pervasive modern life style. It is observed that modernity prevailing in the capital city Itanagar has been causing a greater change in the tribal life of the village. The old people in the village are less subjected to the cultural invasion, and they are preserving their old tradition. The young adopts the modern culture quickly keeping aside the old traditions. Polygamy has been gradually substituted by monogamy.

Trend of population growth has been slows down to negative growth in the last census from earlier fastest growth as many people prefer to limit their family size due to the impact of education and following modern family planning measures. People prefer the modern system of health to prevent the disease against the traditional treatments. The literacy rate is gradually increasing. However, marginally declining sex ratio is a major cause of concern, though girls are rated high in the Nishis. More people are getting educated especially girls and prefer tertiary occupations. Younger generations are at par with their counter parts as far as modernity is concerned. Sometimes they show excellence in various activities becoming part of the great change taking place world-wide.

References

1. Census of India (1991). District Census Hand Book of Lower Subansiri District.
2. Chib Sukdev Singh (1990). Caste, Tribe and Culture of North Eastern India, Part-8, Himalyan Publisher, New Delhi.
3. Choudhury J.N. (1988). Arunachal Panorama, Tachai Publication, Shillong.
4. Directorate of Economics and Statistics (1997). Statistical Abstract of Arunachal Pradesh, Itanagar.
5. Dutta C.S. (1981). Subansiri Gazetteer, Government of Aunachal Pradesh, Itanagar.
6. Shukla, B.K. (1986). The Daflas of the Subansiri Region, Omsons, Guwahati.
7. Takhe K. (1994). Agricultural Festival of Arunachal Pradesh, Himalayan Publication, New Delhi.
8. Thankappan N.P. (1994). Tribes of Arunachal Pradesh, Concept Publication, New Delhi.

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Archives - 1

NEWS AND NOTES

Formerly Known as The Journal of The Madras Geographical Association
(Volume IV No.3, 1929, pp.111-112)

The scheme for constituting a Department of Geography in the University of Madras, which was recommended by the Academic Council, has not been accepted by the Senate at its October meeting owing to some technical objection to the proposal. The long expected Diploma Course intended to create a set of qualified teachers in the subject, has now little chance of being started in July next.

* * * * * * * *

Since the formation of the Madras Geographical Association, some other provinces such as Bombay, Bihar, Burma and the Punjab have also started Geographical Associations. To co-ordinate their activities, a periodical conference of the Geographical Associations in India has been proposed.

* * * * * * * *

Meantime, the need for preparing the qualified teacher of Geography has become more urgent not only for work in the Intermediate classes but also for handling the subject on right lines in the High School classes. The Malabar District Board has, therefore, to be congratulated on having run a successful Refresher Course in Geography during the last Dasara holidays for the benefit of teachers in the whole district. It is hoped that other District, Boards would follow this commendable example and thus satisfy an immediate educational need.

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Archives - 2

THIS EXTRACT FROM THE SPEECH OF Dr. C.V. RAMAN, F.R.S., AT KUMBAKONAM WILL SURELY, BE READ WITH DELIGHT

(July 22, 1927. The Hindu, July 25th, p.16)

Formerly Known as The Journal of The Madras Geographical Association
(Volume II, 1927, p.74)

"What was wanted was the cultivation of live interests in the subjects they were called upon to learn. Any subject was bound to become interesting and informing if the students but approached it with the required appetite for knowledge. In his schooldays the lecturer had a step-motherly affection for Geography, but when he went to California and observed the beauties of nature there, when he wondered at the Majestic Alps and the mighty Caucasus, he thought to himself why he had not read Geography with the keenest interest so that he might enjoy and appreciate the natural scenery more thoroughly in all their aspects, harnessing personal experience to the knowledge gained in the school. They could not properly appraise and appreciate the live side of any subject if there was no knowledge about it beforehand."

The Indian Geographical Journal
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Archives - 3

REPORT OF THE SUMMER SCHOOL OF GEOGRAPHY

Formerly Known as The Journal of The Madras Geographical Association
(Volume III, 1928, pp.1-13)

The Sub-Committee appointed by the Working Council to organise and conduct the Summer School of Practical Geography has the honour to present the following Report:-

At the instance of the Secretary of the Association to whom a general desire for a special course of training in Practical Work was expressed at various centres during his lecturing tours, the Working Council of the Madras Geographical Association at its meeting on 31st January 1928 appointed a Sub-Committee, consisting of Misses Lowe, Gerrard, and Birdseye, and Messrs. M. Subramania Iyer, G.D. Watkins and N. Subrahmanyam (Secretary), to organise and conduct a Summer School of Geography in April 1928.

The Committee met accordingly in the last week of February, and issued a general prospectus, which was addressed to all headmasters of high schools in the Presidency and published in the local press. It was therein proposed to train 30 graduate teachers of Geography for a fortnight. The response was very encouraging, and applications poured in large numbers and enquiries made.

Meantime, the secretary interviewed the Director of Public Instruction on the behalf of the Sub-Committee, and applied for financial support. The Director, in his Proceedings R. O. C. No. 345 D/28 dated 9-3-'28, approved of the idea of the Madras Geographical Association running the Summer School and promised financial support, the amount of which would be decided on submission of the financial statement of Receipts and Expenses.

The Principal of the Teachers' College also consented very kindly to place the Geography Department of the College at the disposal of the Association for the fortnight, besides permitting the Lecturer in Geography to be engaged in conducting the Summer School. Further, he offered to make the Hostel accommodation of the College available for the teachers attending the course.

After a second meeting of the committee, a detailed prospectus was issued and applications registered. In a third meeting, 30 candidates were selected, of whom 26 actually turned up (Appendix A). At the same time, a definite programme of work was

settled upon (Appendix B). By special arrangement with the Principal of the Engineering College, Guindy, one of the lecturers in Surveying of that College had been engaged to give a course of training in Surveying.

On Monday the 2nd April 1928, the Summer School was inaugurated by Mr. H. Champion, M. A., and Principal of the Teachers' College with a fitting speech (Appendix C). The work went on steadily for a fortnight. Four excursions to places of geographical interest were taken on the intervening holidays. The course was felt to be a strenuous one both by the lecturers and the students.

On the last three days of the course, Messrs. Longmans, Green & Co., and Messrs. Macmillan & Co., exhibited their geographical publications, atlases, maps and other apparatus and appliances. On the evening of the last day (14-4-'28), the course came to a close with a Social and a Group Photo (at the end of Archive 3).

The Practical Work done by the students was valued at a committee meeting, and a certificate issued to each of them.

Miss J.M. Gerrard had kindly advanced Rs. 50 for the preliminary expenses, which had since been returned with thanks; and the fees collected amounted to Rs. 270. A small printing charge still remains to be paid, and is shown in suspense account. The Accounts here presented, however, does not include the remuneration to be paid to the lecturers who actually conducted the School. This is expected to be paid out of the grant kindly promised by the Director of Public Instruction in his Proceedings quoted above.

The response to the invitation has been encouraging, and has revealed what an amount of desire to learn there is on the part of the teachers of Geography. It has revealed also how much has got to be done in the way of adequate equipment, instruction and training on the practical side. The students that attended the course went through every portion of the syllabus with keenness and delight, unfamiliar as was to them the greater part of the subjects handled. It has served a useful purpose in forcibly bringing to light not only the fact of a desire to learn that is abroad, but also the necessity for a systematic and rigorous course so as to create a body of really competent teachers. A heavy responsibility, therefore, rests on those who would provide for adequate training and instruction. Nothing less than the best standard should be worked up to.

Gopalapuram,
Cathedral Post
Madras
11th August, 1928.

(Signed) I.H. Love.
(Signed) E.D. Birdseye.
(Signed) N. Subramanyam.
(Signed) M. Subramaniam.
(Signed) G. Davies Watkins.
(Signed) J.M. Gerrad.

Appendix A

List of Teachers who Attended the Summer School of Geography

in April 1928

No.	Name	Address
1.	Chakko, Miss M.	L. M. Bentinck High School, Vepery
2.	Chandrasekhara Dikshither, K. G.	Hindu High School, Kanyur
3.	Fennell, Miss W.	Church Park Training College
4.	Jacques, Miss A.	do
5.	Joseph, P. K.	St. Patrick High School, Adyar
6.	Joseph, S.	St. Peter's High School, Tanjore
7.	Kalyanasundaram, N.	Out of employment
8.	Kameswara Rao, V.	Board High School, Repalle
9.	Kohlhoff, J.	London Mission High School, Bangalore
10.	Krishnaswami, N.	Without employment
11.	Krishnaswami Ayyangar, K. S.	Banadurai High School, Kumbakonam
12.	Kunjammal, Miss K.	Lady Willingdon Trg. College, Madras
13.	Nagan, S. V.	Board High School, Uttaramerur
14.	Narasimhachari, K.	P. S. High School, Mylapore
15.	Raj, Samuel	London Mission High School, Coimbatorwe
16.	Ramakrishna Sastri, V.	Govt. Trg. School, Chittoor
17.	Ramanuja Ayyangar, S. T.	Zamindar's High School, Katuputur
18.	Sankarasubba Iyer, S.	Model School, Trg. College, Trivandrum
19.	Satyanarayana, K.	Rajah's College, Parlakimidi
20.	Sharma, K. J.	National Theosophical College, Adyar
21.	Sivasamba Iyer, V. S.	Board Secondary School, Ponneri
22.	Subramaniam, K. V.	Board High School, Sulurpet
23.	Srinivasa Raghavan, K.	National Theosophical College, Adyar
24.	Sundaresan, L. R.	Model School, Teacher's College, Saidapet
25.	Venkatarama Iyer, N. V.	P. S. High School, Mylapore
26.	Yegnaraman, N.	The High School, Tirukkattupalli

Appendix B

The Madras Geographical Association

Summer School, April, 1928

Programme of Work - Forenoon

Day	7 to 9 A. M.	10 to 11 A. M.	11 A. M. to 1 P. M.
Monday: 2-4-1928	…	Opening of the School by Mr. H. Champion	Climate and Weather: (Pressure and Winds) by G. D. Watkins
Tuesday: 3-4-1928	…	…	do
Wednesday: 4-4-1928	…	Nature and Scope of Modern Geography N. Subrahmanyam	do
Thursday: 5-4-1928	Surveying by Batch I	How to Study the Home Region by N. Subrahmanyam	Temperature and Rainfall (by N. Subrahmanyam)
Saturday : 7-4-1928	do	Value and Method of Excursions by N. Subrahmanyam	do

Monday: 9-4-1928	do	Geography Room by N. Subrahmanyam	Use of Statistics and Graphical and Diagrammatic Methods of Representation by M. Subrahmania Iyer
Tuesday: 10-4-1928	do	Geographical Equipment for a High School by N. Subrahmanyam	do
Wednesday: 11-4-1928	do	Geographical Bibliography by N. Subrahmanyam	do
Friday : 13-4-1928	do	Use of Picture and Illustrations, by N. Subrahmanyam	do
Saturday : 14-4-1928	do	Cotton as a World Commodity by M. Subrahmania Iyer	do

The Madras Geographical Association

Summer School, April, 1928

Programme of Work - Afternoon

Day	2 to 3 P. M.	3 to 4 P. M.	4 to 6 P. M.
Monday: 2-4-1928	Recent Ideas in Geomorphology by G. D. Watkins	Library	do
Tuesday: 3-4-1928	The Position of Geography Abroad by M. Subrahmania Iyer	Madras as a Natural Region by Miss E. D. Birdseye	Library
Wednesday: 4-4-1928	Climate and Weather: Temperature and Rainfall by N. Subrahmanyam		Library
Thursday: 5-4-1928	Map-reading and Map-correlations by Miss E. D. Birdseye		Surveying Batch II
Saturday: 7-4-1928	do	do	do
Monday: 9-4-1928	do	do	do
Tuesday: 10-4-1928	do	do	do
Wednesday: 11-4-1928	do	do	do
Friday: 13-4-1928	Some Advanced Surveying Instruments by Dr. K. C. Chacko		
Saturday: 14-4-1928	Irrigation and Flood Control by N. Subrahmanyam	Social	…

Programme of Excursions

7-4-1928	The Horticultural Gardens: Conduccted by Mr. M. S. Sabesan		
8-4-1928	Pallavaram Hill	do	Mr. N. Subrahmanyam
10-4-1928	The Observatory	do	do
12-4-1928	The Madras Harbour and the Light House		do

Appendix C

The Summer School organised by the Madras Geographical Association was opened at 10:30 A.M., on Monday the 2nd April 1928, in the Geography Lecture Hall of the Teachers' College, Saidapet, by Mr. H. Champion, M.A., Principal of the College. Twenty-six teachers of Geography-mostly graduates and four of them ladies-from various schools in the Presidency had gathered together for the training. A few lecturers of the College were also present.

In requesting the Principal to open the Summer School, Mr. N. Subrahmanyam, (Secretary of the Association), sketched briefly the place of Geography in this Presidency as a High School subject during the last 30 years, and pointed out the effects of allocating it under B group in the S.S.L.C. Scheme in 1911, and of the removal of it altogether from the higher classes of the High School in the revision of 1916 to make room for the History of the British Empire. He then stated how there was a dawn of a better position being accorded to it, both in the University and the High School, partly as a result of the preliminary endeavours of Messrs. Gilbert Slater and R. G. Grieve and of the activities more recently of the Madras Geographical Association. Meantime, Geography had been separated from History, and made an independent subject of training in the L.T. Course during the last four years. But the number of teachers thus specially trained in geography could not yet be counted in three digits. In view of this fact as well as of the impending reorganisation of the S.S.L.C., as a result of which Geography would be accorded an important place, the Working Council of the Association appointed a sub-committee of experts to organise and run a Summer School of Practical Geography.

Mr. H. Champion said that it gave him very great pleasure to be there at the time and to formally open the Summer School of Geography organised by the Madras Geographical Association. That was the first thing of the kind ever done by a private association in this country, and as such the Association deserved to be congratulated.

There was one particular thing in which he specially wanted the audience to do something. It was closely connected with a subject in which he was most interested at that time, viz, elementary education. Now one of the great problems relating to the elementary education was that of the supply of good text books in vernacular. As Chairman of the Geography Sub-Committee on Textbooks, he had opportunities recently of looking into the existing district and taluk geographies. He was sure that Mr. Subrahmanyam would agree with him that not one of them was prepared on right lines. Everyone of those local geography books contained not less than 80 pages, but of these nearly 60 pages referred to general geography, and the remaining 20 pages contained some meagre facts of local geography, written in a logical, stereo-typed dull manner. It was in this connection that he wanted the help of the audience. They were mostly muffasil teachers and had come from all parts of the Presidency; they knew their localities well, and now they were getting a further course of training in their subject. He would suggest to them, when they went back to their places, to try and produce good text-books of local geography for the district, the taluk and the town, on quite modern lines. By doing so, they would be helping him in the cause of elementary education with which he was just then concerned.

The Secretary, then, thanked Mr. H. Champion for having opened the school as well as for placing the whole of the Geography Section of the Teachers' College, with the equipment and the lecturer, and the hostel with its manager - at the disposal of the Summer School.

Madras Geographical Association, Summer School, April, 1928

On the evening of the last day (14-4-1928), the course came to a close with a Social and a Group Photo

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News and Notes

THE INDIAN GEOGRAPHICAL SOCIETY

Department of Geography, University of Madras, Chennai - 600 005

UG & PG Results of 1st Talent Test - 2011

THE IGS FOUNDER PROF. N. SUBRAHMANYAM AWARD

With the Cash Prize of Rs. 10,000/-

(First Prize: Rs. 5,000/-, Second Prize: Rs. 3,000/- & Third Prize: Rs. 2,000/-)

UG Results of 1st Talent Test - 2011		
Name	**Institute**	**Rank**
Mr. Dheleepan G.V.	Department of Geography, Tourism and Travel Management, Madras Christian College (Autonomous), Tambaram, Chennai - 600 059.	**1**
Miss. Malavka Vipin	Department of Geography, Tourism and Travel Management, Madras Christian College (Autonomous), Tambaram, Chennai - 600 059.	**2**
Mr. Arunlal S.	Department of Geography, Presidency College (Autonomous), Chennai - 600 005.	**3**

PROF. A. RAMESH AWARD

With the Cash Prize of Rs. 15,000/-

(First Prize: Rs. 7,000/-, Second Prize: Rs. 5,000/- & Third Prize: Rs.3,000/-)

PG Results of 1st Talent Test - 2011		
Name	**Institute**	**Rank**
Miss. Karthika. K	Department of Geography, Bharathidasan University, Tiruchirappalli - 620 024	**1**
Miss. Sreelakshmy M.	Department of Geography, Bharathidasan University, Tiruchirappalli - 620 024	**2**
Miss. Reshma C.U.	Department of Geography, Madurai Kamaraj University, Madurai - 625 021.	**3**

Please Note:

1) The Winners are requested to send their passport size photograph, postal address and contact phone number by email (kkumargeo@gmail.com / geobalas@gmail.com)
2) The Winners are requested to make arrangements to attend the award ceremony function being arranged in the *IGS Annual Conference* to be held at Bharathidasan University, Tiruchirappalli - 620 024 on Saturday, the 27th March, 2011 at 2:00 p.m.
3) For any queries, kindly contact the Coordinator Dr. K. Kumaraswamy (94421 57347) / Co-coordinators Dr. G. Bhaskaran (94444 14688) / Mr. K. Balasubramani (99440 60319) / Dr. S.R. Nagarathinam (98941 10585) / Dr. P. Ilangovan (94426 43430) / Prof. G. Jagadeesan (94432 02011).

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TOURIST SATISFACTION AT MAHABALESHWAR HILL STATION OF MAHARASHTRA, INDIA

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Abstract

Measuring tourist satisfaction for assessment of development and marketing tourism products and services is necessary. The objective of this research is to study satisfaction of the tourists at Mahabaleshwar on Western Ghat of South Maharashtra and its purpose is to examine the relationship between destination and tourist's satisfaction. The tourist satisfaction of a destination is a function of attribute importance, performance, and travel motivation. Mahabaleshwar a famous hill station on Western Ghat was used as the study area for this research. Factor analyses were employed to identify the level of satisfaction of tourists regarding destination, facilities and local people. The results revealed that nature, scenic attraction, climate and shopping facilities are significant factors in determining the overall satisfaction, whereas food and location are of significant importance in the satisfaction evaluation. Western Ghat of south Maharashtra is having variety in the attraction for ecotourism development because it is covered with the dense vegetation. On the Western Ghat of south Maharashtra, very few destinations are popular and remaining large area remains as undeveloped and remote. But as per ecotourism point of view here attention should be paid by administrative and local people. The level of development for the tourism and demand of the tourists can be assessed through satisfaction index.

Keywords: Tourist satisfaction, Development, Ecotourism, Marketing

Introduction

Kotler (2003) defines satisfaction as a feeling of pleasure or disappointment based on a comparison between the perceived performance of the product and the expectations of the customer. Satisfaction is measured through the relation between what the customer received and what he or she expected to receive. If the perception is greater than expected, the customer becomes more satisfied than expected, but if it is less, he will become disappointed and will not react positively to the experience. Tourism is service-based industry it is compiling a number of services for making tourism product, which is very difficult to make the balance between perception and expectation. For the sustainable development of the regions, it needs to assess the level of actual development and satisfy action index of tourists shows the level of development of that destination. One of the crucial elements of successful destination marketing is tourist satisfaction, which influences the choice of destination and the decision to return (Yoon and Uysal, 2005).

Therefore, here an attempt has been made to assess the satisfaction of tourists regarding natural as well as socio-economic conditions at Mahabaleshwar because Mahabaleshwar is the only established destination on Western Ghat of South Maharashtra.

Study Area

Mahabaleshwar is located in between 17°55′N to 17°92'N latitude and 73°40′E to 73°67'E longitude. It has an average height of 1,353 metres (4,439 ft). Mahabaleshwar covers an area of about 150 sq.km. Mahabaleshwar comprises three villages: Malcolm Peth, Old 'Kshetra' Mahabaleshwar, and part of the Shindola village. The climate of Mahabaleshwar is never too hot because of the heights. However, it is very cool in the winter season.

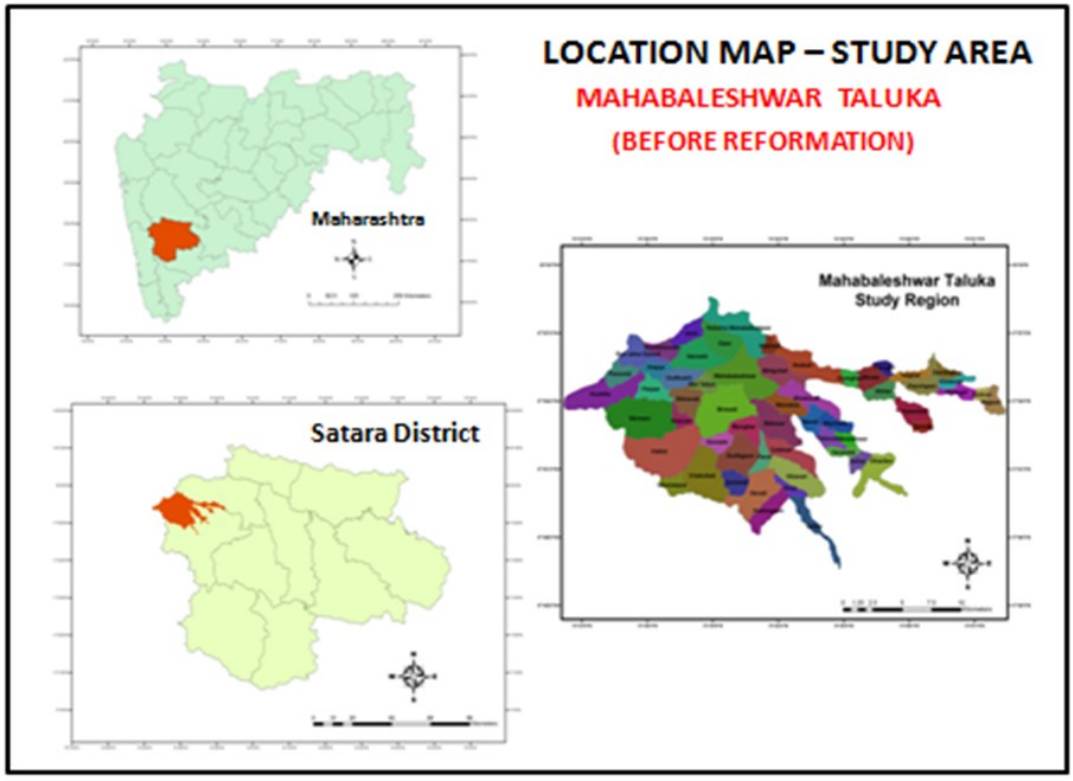

Fig. 1. Mahabaleshwar Taluka (Before Reformation)

The weather of Mahabaleshwar is healthy and contains an ideal of 20% oxygen, which is often augmented in the foggy weather of late summers and early monsoon when the plateau is covered by thick mist. The water contains a meagre percentage of iron which helps to increase haemoglobin in the blood. Mahabaleshwar is the popular hill station on Western Ghat and in Koyana backwater area. This location is having dense forest area which is thick and produces many commercial as well as medicinal trees & plants. The wildlife is limited to foxes, jackals and wild boars. Deer and bison are found in the

Brahmaaransya area whereas panthers are rare. Bulbul bird is the attraction on Mahabaleshwar. The highest peak above sea level is known as *Wilson / Sunrise Point*.

Database and Methodology

Here an attempt has been made to assess the level of satisfaction of the tourists by noting their views about various facilities provided to them at the destination. The facilities included are accommodation, transport, opinion about the place, food, behaviour of the people, shopping, and personal safety. The domestic and international tourists at Mahabaleshwar are interviewed to ask the ranks for the different facilities, destination, and local people's behaviour. These factor-wise views were collected. These views taken in marking system for that 1 to 5 marks have been given. The factor wise average values are calculated categorically summing up the values given by the tourists and dividing the total number of the tourists who noted that category.

These averages then multiplied by respective frequencies would give total satisfaction and when divided by the total frequencies for the respective factor would give the different destinations for that factor. For that, the following formula is used.

$$Sti = \frac{\sum MiNi}{N}$$

where, Sti = satisfaction index for the 'i'th factor.
Mi = Numerical values for particular level of satisfaction for the ith factor
Ni = Number of respondents deriving the particular level of satisfaction for the ith factor.
N = Total number of respondents for that factor for all level of satisfaction.

Then the ranks are given to these satisfaction indices and finally coefficient of variation of all factors is calculated to see the consistency of the tourist views.

Results and Discussion

Mahabaleshwar is the source of the Krishna River that flows across Maharashtra, Karnataka and Andhra Pradesh. Even this region is the source of other four rivers, which are Venna, Savitri, Koyana and Saraswati. In these Savitri and Saraswati are not flowing regularly and they are hidden. Therefore this place is declared as the sacred place and one temple of the goddess as idol of these rivers has been constructed here. Number of and varieties of attractions are there in Mahabaleshwar. Among many attractions, one is waterbody called Venna lake and some of the scenic point known as valley viewpoints like Arthur's Seat, Elphinston Point, Monkey Point, Castle Rock, Baghdad Point, Gaolani Point, Panchgani Point, Connaught Peak, Helen's Point, Rosamond Rock, Sidney or Lodwick, Bombay Point, Falkland and Carnac, Sassoon, Babington and Kate's point. All these points are located on the different ends of valleys surrounding Mahabaleshwar town. All these points are having unique characteristics such as few points are having captivating shapes of rocks.

Some points are generating echo of the sound. Few points gives views of the Arabian sea, Panchgani etc., but all points are covered with thick vegetation and gives an experience of the cool breeze. Even if you sit quietly for long period u can enjoy wild animals here. All points are not accessible by vehicle at few you have to go by walk. Even Mahabaleshwar is having a number of waterfalls but most of them are the seasonal they only flow in a rainy season. There are three imperative waterfalls on and near the hill, the Lingamala falls in the Yenna valley, the Dhobis' fall almost midway between Lodwick Point and the bazaar, and the Chinamen's fall near the gardens formerly cultivated by the Chinese ticket-of-leave men. These are well worth a visit, especially in the cold weather when the volume of water is considerable. Here Golavan Dam Project is also offered enjoyment to the tourists. Even on the road of Tapola and Bamnoli tourist can enjoy strawberry plantation and in the season, they can get fresh strawberry to eat on the farm. Even one religious site also established here which attract a number of tourists that is Mahabaleshwar temple at the origin of five rivers.

Table 1. Number of Tourists Coming to Mahabaleshwar

Year	Number of Tourists Coming to Mahabaleshwar	Index No.	Growth Rate
1970-1971	1,20,100	0	0
1975-1976	1,96,550	164	63.66
1980-1981	2,52,710	210	28.57
1985-1986	4,01,500	334	58.88
1986-1991	5,44,600	453	35.64
1995-1996	7,10,440	592	30.45
1996-1997	8,00,000	666	12.61
1997-1998	6,97,900	581	-12.76
1998-1999	6,63,400	552	-4.94
1999-2000	6,77,200	564	2.08
2000-2001	8,44,500	703	24.70
2001-2002	8,38,541	698	-0.71
2002-2003	9,79,800	816	16.85
2003-2004	10,16,300	846	3.73
2004-2005	9,83,800	819	-3.20
2005-2006	9,01,018	750	-8.41
2006-2007	9,23,100	769	2.45
2007-2008	10,31,000	858	11.69
2008-2009	10,40,000	866	0.87
2009-2010	11,48,500	956	10.43
2010-2011	11,94,000	994	3.96

Source: Municipal Corporation, Mahabaleshwar

Table 1 shows those numbers of tourists are increasing here in Mahabaleshwar from 1971 onwards. But growth rate is not constant in 1997-98, 2003-04 the growth rate is negative it shows that number of tourists coming to Mahabaleshwar is not constant. Reason behind this inconsistency is climate, earthquake in Koyana valley and mostly more number of tourists is coming from nearby areas and mostly on week end therefore they are not consistent. Satara is located at central point of Kolhapur, Pune and Mumbai.

Here mostly tourists are coming from these three districts and very few from remaining part of Maharashtra state, Karnataka and rest of India. But tourists from Mumbai and Pune are also having other options like Lonavala, Matheran etc. But this destination is more beautiful and having more number of attractions. Therefore, here found growth of tourists. But they are not consistent therefore here assessed therefore satisfaction index to know what actually they like and they need. Mahabaleshwar is the famous hill station in the Western Ghats with full of vegetation. This destination rich in biodiversity and even in infrastructural facilities are also well established. Therefore here tourists overall satisfied with all factors. Tourists are only dissatisfied with the rate of facilities, which are mostly high here in the Mahabaleshwar. Here highest rank in satisfaction is given to destination and natural beauty. Maximum tourists are more satisfied with the natural beauty of Mahabaleshwar. They are happy with the decision to visit Mahabaleshwar. Experience of biodiversity knowledge of biodiversity this also received the highest rank in satisfaction. The second level of satisfaction is for some of the facilities, host population behaviour, and accessibility. But, a very low level of satisfaction is the cultural and historical attribute.

Table 2. Distribution of Respondents Satisfaction Level of Tourist on Mahabaleshwar

No.	Indicators	1	2	3	4	5	Total
1	A positive view of destination	27	62	80	98	33	300
2	Friendly homely environment	3	65	75	99	58	300
3	This destination is very famous and having importance in peoples mind	3	27	81	93	96	300
4	Having abundant natural beauty	7	10	78	109	96	300
5	Secured location	5	48	77	105	65	300
6	Easily accessible	14	49	119	68	50	300
7	Very good cleanliness	12	54	118	65	51	300
8	Nature conserved very well	13	45	101	99	42	300
9	Cultural and historical diversity	19	89	99	74	19	300
10	Accommodation facilities are good	12	81	118	59	30	300
11	Internal transportation	7	44	144	73	32	300
12	Local food available	10	89	144	40	17	300
13	Shopping facilities	11	21	31	44	193	300
14	Enjoyment of night life	13	29	48	89	121	300
15	Getting rest	33	29	39	55	144	300
16	Entertainment and site sizing is available	3	20	39	89	149	300
17	Cultural programs are organizing	98	121	51	21	9	300
18	Spas and massage centers are good	10	55	139	81	15	300
19	Booking of facilities are easy	19	123	89	29	40	300
20	Rate of food and accommodation are affordable	153	103	35	7	2	300
22	Destination gives amazing experience	1	13	28	159	99	300
23	It increases knowledge about destination	4	16	47	81	152	300
24	Decision about destination	1	1	8	97	193	300
25	Host population are very good	8	41	149	81	21	300
26	Tourists are also helpful	1	6	30	121	142	300
27	Wants to visit this destination frequently	7	10	44	117	122	300
28	Insist to the friends and relatives to visit this destination	10	5	35	149	103	300
29	Rare biodiversity experienced	3	20	41	147	89	300
30	Natural beauty is most attractive	1	2	22	86	189	300

Source: Fieldwork

Table 3. Indicator-wise Satisfaction Index on Mahabaleshwar

Sl. No	Indicator	
1	A positive view of destination	3.16
2	Friendly homely environment	3.48
3	This destination is very famous and having importance in peoples mind	3.84
4	Having abundant natural beauty	3.92
5	Secured location	3.59
6	Easily accessible	3.30
7	Very good cleanliness	3.30
8	Nature conserved very well	3.37
9	Cultural and historical diversity	2.95
10	Accommodation facilities are good	3.05
11	Internal transportation	3.26
12	Local food available	2.88
13	Shopping facilities	4.29
14	Enjoyment of night life	3.92
15	Getting rest	3.83
16	Entertainment and site sizing is available	4.20
17	Cultural programs are organizing	2.07
18	Spas and massage centers are good	3.12
19	Booking of facilities are easy	2.83
20	Rate of food and accommodation are affordable	1.67
21	Destination gives amazing experience	4.14
22	Increases knowledge about destination	4.20
23	Decision about destination	4.60
24	Host population are very good	3.22
25	Tourists are also helpful	4.32
26	Wants to visit this destination frequently	4.12
27	Insist to the friends and relatives to visit this destination	4.13
28	Rare biodiversity experienced	4.00
29	Natural beauty is most attractive	4.53

Source: Compiled by the Author

This is natural place then also its place of origin of a river where they constructed temple but not well maintained and no facilities, which show culture, therefore, receives the low rate of satisfaction. Even facilities like accommodation and food are getting in high rate, which receives the low satisfaction of the tourists. The overall destination is developed therefore about all factors are receiving the high level of satisfaction. But the destination is fully developed and therefore it creates some problem like exploitation from local people, a high cost of accommodation food and transportation facilities, crowdie therefore at this destination tourists gave the low level of satisfaction to the facilities.

Conclusions

The study came a conclusion that the nature, scenic attraction, climate and shopping facilities are important parameters that determines the overall satisfaction of a traveller or tourist coming into an area, whereas food and location plays prominent among them which helps in the evaluation. The Western Ghat regions of south Maharashtra possess several attractions for developing ecotourism since it is an area of dense

vegetation cover which is the required peculiarity for its development. But very few destinations of the Western Ghats region of south Maharashtra are developed while others are still to be in the remote regions. As per ecotourist viewpoint the attention should be paid by both administrative and local people in the area.

References

1. Meena Potdar, P. T. (2011). Satisfaction of Tourists at Religious Tourists Places in Kolhapur District. Maharashtra Bhugol Shastra Sanshodhan Patrika, 28, pp.100-104.
2. Agarwal,P.K. (2003). Marketing Management: An Indian Perspective, Pragati Prakashan: Meerut.
3. Potdar, M. (2013). Economic Impact of Tourism on Kolhapur District of Maharashtra, Review of Research , 2 (2), pp.1-5.
4. Yoon, U. (2005). An Examination of the Effects of Motivation and Satisfaction on Destination Loyalty: A Structural Model. Tourism Management, pp.45-56.

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SPATIO-TEMPORAL VARIABILITY OF RAINFALL OVER NORTH COASTAL ANDHRA PRADESH

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Abstract

The study of rainfall variability is very important for a country like India whose food security and economy are dependent on the timely availability of water. Seasonal and annual variability of rainfall have been studied using monthly rainfall data of 60 years from 1951-2010 for 20 stations in North Coastal Andhra Pradesh. Southwest monsoon is the main rainy season during which the study area receives greater amount of rainfall. During the northeast monsoon season, the coastal regions receive good amount of rainfall due to cyclonic activity. Long term changes in rainfall were computed by linear trend. The annual rainfall over a period of 60 years showed an insignificant trend. Departures of annual rainfall from normal were computed to identify wet and dry years. The analysis revealed that about forty years out of sixty years of study period recorded normal rainfall and remaining period noticed extreme rainfall either excess or deficit from normal.

Keywords: Rainfall distribution, Spatial variability, Temporal variability, Wet and dry years

Introduction

Precipitation is an important climate element, which determines agricultural production of a region. The success or failure of crops in any year is closely linked with the performance of monsoon. Rainfall is the major parameter influencing agriculture activity, location of farming system and the choice of enterprise. Rainfall variability has significant effects on socio-economic and ecological conditions of any region. The present study is an attempt to analyse spatio-temporal variability of rainfall over North Coastal Andhra Pradesh (NCA). Rainfall variability is high in North Coastal Andhra and droughts are frequent in many parts of the region. Agriculture is the main occupation of the people in North Coastal Andhra Pradesh (NCA) and accounts for about 50 percent of the region's income. It has diversified farming base with variety of cash crops and agricultural production, largely depend on the monsoon rains. Also, about 25 percent of the irrigated area is accounted by tanks which in turn depend upon rainfall.

Several researchers have studied the distribution, variability and trends of rainfall at regional levels in India (Mohapatra et.al. 2003; Mohapatra and Mohanty, 2006; Kulkarni and Kanth, 2004; Devappa et. al., 2009; Sahu and Nandankar 2006). The Inter-Governmental Panel on Climate Change (IGPCC) predicted that billions of people in developing countries will face challenges due to changes in rainfall patterns that will contribute

to severe water shortage or flooding (FAO, 2007). Measures of variability of distribution about the mean value are given as standard deviation and coefficient of variation (Kim and Ahemed, 2008). Variability of precipitation can be expressed in terms of its probabilistic occurrence (Kim and Ahmed, 2008). Daily rainfall data and monthly rainfall data were analysed by Rajeevan et al., (2008). Long-term changes in rainfall were determined by Mann-Kendall rank method and linear trend was used (Krishnakumari et al., 2009; Kumar et.al. 2010). Extreme rainfall analysis of Andhra Pradesh using a probability distribution model was carried out by Guhathakurta et.al. 2005. Gore and Potdar (2006) analysed variability of extreme rainfall in Maharastra. Stephenson and Kumar (1999) studied impact of extreme daily rainfall events on ensemble forecast of the Indian monsoon. Analysis of variability and trends of extreme rainfall events over India using 104 years of gridded daily rainfall data was carried out by Bhate and Jaswal, 2008.

Statistical methods were utilised to justify change in the average monthly and annual rainfall trend using probability density function and non–parametric tests such as the Pettit test, Wilkinson signed- rank test and paired sample test. Agriculturally, this is the area where crop production often is dependent on rainfall and is low as it lacks adequate irrigation facilities (Das and Kore, 2003). Especially important is the spatial variation of the probabilistic occurrence of extreme low and extreme high amounts – because these extreme amounts have tremendous effects on various sectors of the economy in a given region.

Study Area

North Coastal Andhra Pradesh (NCA) comprises three districts namely Srikakulam, Vizianagaram and Visakhapatnam extends over an area of about 23, 48,620 hectares which constitute 8.5 percent of the geographical area of Andhra Pradesh. It is situated within the geographical coordinates of $17^{o}10'$ to $19^{o}10'$ N latitudes and $81^{o}53'$ to $84^{o}50'$ E longitudes. It is bounded on the north by Orissa state, on the south by East Godavari District and on the east by Bay of Bengal. Physiographically the region is divided into three natural divisions, such as coastal, plains and hilly regions. Hilly regions run parallel to the coast from northeast to southwest.

Agriculturally the study area is less developed when compared to other coastal districts of Andhra Pradesh due to lack of assured irrigation facilities. Both annual and seasonal rainfall is highly variable over time and space. Most of the cultivated area is used for single crop cultivation only due to insufficient rainfall. The major crops grown in the study area are paddy, groundnut, sugarcane and pulses and their average crop yields are low due to erratic rainfall rainfed farming is the characteristic of agriculture as 80 percent of cultivation depends on rainfall. For rainfed crops, the distribution of rainfall, both seasonal and annual is important because the length of water availability periods helps to assess the farming needs from time to time. Hence the present study is an attempt to study the distribution of rainfall and its variability and trends. About 80 percent of annual rainfall

occurs during southwest and northeast monsoon seasons. Rainfall variability affects agriculture through its direct and indirect effects on crop production.

Database and Methodology

The present study is based on secondary data sources. Monthly rainfall data have been collected from the publications of the India Meteorological Department for twenty climatological stations in North Coastal Andhra Pradesh (NCA) (Figure 1) for a period of 60 years, from 1951 to 2010. From monthly rainfall data, seasonal rainfall totals were obtained for each year and for each station under study. From seasonal totals for 60 years period, mean seasonal rainfall has been computed to study the spatial variability of rainfall over the study area. Rainfall intensity and variability have also been studied. Temporal changes in annual rainfall were also analysed by linear trend. Analysis of annual rainfall over a period of 60 years was carried out to identify wet and dry years.

Results and Discussion

Spatial Distribution of Rainfall

The area receives rainfall mainly from the southwest monsoon and retreating southwest monsoon seasons. The range of Eastern Ghats lying to the west exerts significant influence on rainfall distribution. The average annual rainfall in the study area is 1088 mm and it increases from the coastal region towards west and northwest hilly region (Figure 1). September is the rainiest month. The Isohyetal map was constructed by plotting the precipitation amounts for each station on a suitable map and then drawing line of equal precipitation (isohyets) at proper intervals. The mean annual rainfall distribution over North Coastal Andhra Pradesh is shown in Figure 1. The annual rainfall increases from the coast towards interior and it varies from 914 mm at Visakhapatnam near the coast in the east to 1286 mm at Parvathipuram (RS-7) in the north. The isohyets run almost parallel to the coast line. The general trend of isohyets is an increase from the coast towards interior due to orographic effect. Indian monsoon rainfall largely depends on the westward moving Low Pressure Systems (LPS) developing over Bay of Bengal.

Rainy Days

A rainy day is defined by the India Meteorological Department (IMD) as a period of 24 hours during which a total rainfall equal to or more than 2.5 mm is received. Mean annual rainy days vary from 60 along the coast to 80 days towards interior. On comparing the average number of rainy days per year in the study area, coastal stations are found to experience less number of rainy days with 50 days per year (Table 1 and Figure 1) whereas hill stations in the west have 80 rainy days. The trend resembles the yearly rainfall distribution pattern, which shows an increase from the coastal stations to the interior stations.

Variability of Rainfall

An important aspect of rainfall is its variability. Variability of rainfall refers to the possible deviation from the average rainfall. The actual annual total for the station may be far above or below the statistical annual average. If the area is dry, the greater will be its statistical variability in its precipitation. The commonly used parameter for these studies is the coefficient of variability of rainfall. These coefficients have been computed for the stations in the study area and the rainfall variability is shown in Figure 1. It is observed that it varies between 20 to 30 percent. The stations in the south eastern part have variability of 20 percent, whereas interior regions of show high degree of variability of 30 percent.

Seasonal Distribution of Rainfall

The study area receives the major portion of its rainfall from the southwest monsoon. Hence, the higher amount of precipitation is recorded over the entire region during this season when compared with other seasons (Table 1 and Figure 2). The rainfall during the southwest monsoon varies from 600 mm along the coast to 800 mm in the northwest. The stations, Parvathipuram (RS-7), Palakonda (RS-6) in the northwest and Paderu (RS-20) in west received more than 800 mm of rainfall. The coastal stations received less than 600 mm of rainfall. According to Naidu et al., (2012) there is an enhancement in the northeast monsoon rainfall over the major area of southern India which is associated with the intensification of easterly wind belt in the lower troposphere. The trend of isohyets is different during the retreating southwest monsoon season compared to earlier season. The rainfall decreases from the coast towards interior. All the coastal stations show high amount of rainfall, around 300 mm due to cyclonic activity and interior stations show less rainfall of 200 mm (Figure 2).

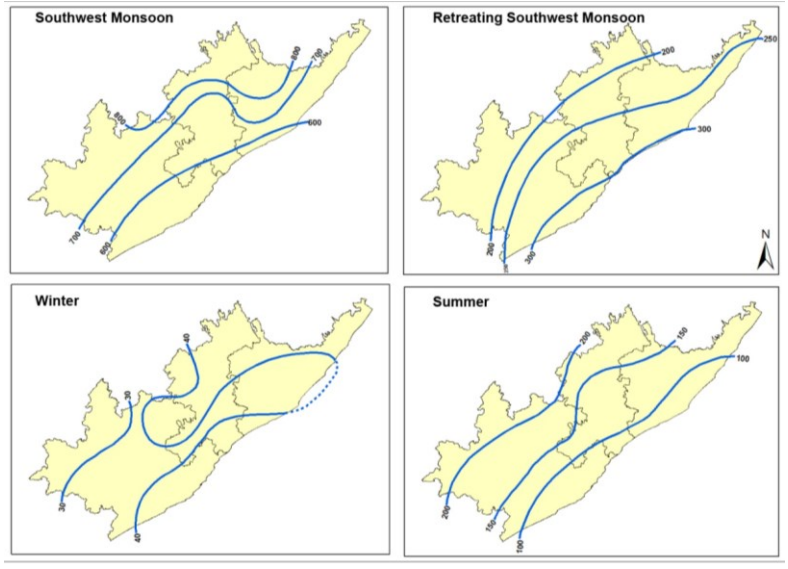

Fig. 1. Spatial Variability of Rainfall

During winter season, the region exhibits very meager amount of rainfall (Table 1 and Figure 2) as it is dry season with fair weather. The rainfall varies from 30 mm to 40 mm (Figure 2). During the summer season, the region receives rainfall on account of convective activity. The rainfall pattern during this season resembles that of the southwest monsoon with lower rainfall i.e., 100 mm along the coast (Figure 2) and increases towards interior to 200 mm of rainfall.

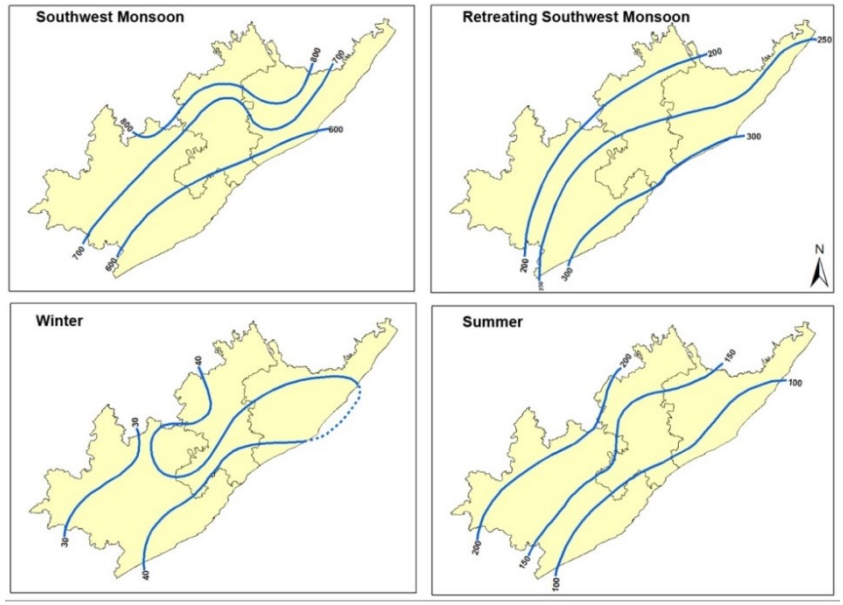

Fig. 2. Seasonal Distribution of Rainfall (mm)

Temporal Distribution of Rainfall

The annual rainfall has large temporal variations. Over a given region, there are spells of good rainfall alternate with periods of little rain. Since rainfall plays a vital role in the economy of the North Coastal Andhra (NCA) as it influences agriculture, an attempt has been made to study the interannual variability of rainfall and to identify wet and dry years over a period of 60 years (1951-2010).Twenty stations have been selected from the study area to examine the rainfall variability. Analysis of annual rainfall data was carried out to identify wet and dry years and results are presented in Figure 3 to 5 and Table 2. Annual rainfall of each year is expressed as percentage deviation from normal. The bars above the mean value shows the positive departures from the normal rainfall i.e., excess rainfall years. The bars below the mean value indicate negative deviations i.e., deficit of rainfall from normal. If the annual rainfall is less than 75 per cent of the normal, it is treated as dry year. Rainfall exceeding 125 per cent of the normal considered as wet year. Annual rainfall of an individual year is classified as wet or dry when the percentage departure is above or below by 25 per cent from normal rainfall.

A few stations from Srikakulam District such as Sompeta, Tekkali, Ichapuram, Kalingapatnam, Srikakulam and Palakonda have been selected and temporal distribution of rainfall was carried out and results are presented in Figure 3. It is evident from the graph, the station Sompeta (RS-1) experienced 9 wet years and 13 dry years. There were two extreme rainfall years 1958 and 2003 with more than 50 per cent of positive departure from mean rainfall of 1140mm (Figure 3 and Table 2). The year, 2008 was the driest year with 50 per cent of negative departure.

Table 1. Mean seasonal and annual rainfall (mm) over North Coastal Andhra (1950-2010)

No.of Raingauge Stations	Stations	Southwest Monsoon	Retreating Southwest Monsoon	Winter	Summer	Annual	Rainy Days
RS1	Sompeta	671.9	288.6	45.8	117.8	1124.1	54.6
RS2	Tekkali	699.3	274.8	35.9	94.4	1104.4	55.1
RS3	Ichapuram	652	310	46	119	1127	58.6
RS4	Kalingapatnam	598.2	285.3	34.5	86.4	1004.4	50.4
RS5	Srikakulam	647.1	244.3	25.6	101.2	1096	52.4
RS6	Palakonda	849.1	203.1	34.3	148.4	1234.8	64.6
RS7	Parvathipuram	866.4	203.5	45.2	169.6	1286.2	71.3
RS8	Bobbili	699.7	218.7	41.4	146.3	1106.1	63.9
RS9	Saluru	685.1	254.6	35.8	144.8	1120.3	63.6
RS10	S.Kota	671.4	289.3	51.1	155.1	1166.8	64.7
RS11	Vizianagaram	636.2	265.4	40.4	112.5	1054.5	54.4
RS12	Cheepurupalli	675.4	242.8	32.5	112.7	1063.4	56.9
RS13	Visakhapatnam	502.1	324.9	49.3	78.1	954.3	50.3
RS14	Bheemunipatnam	581.5	372.4	31.7	127.8	1113.4	58.3
RS15	Anakapalli	560.3	281.7	41.6	97.3	980.9	53.1
RS16	Elamanchili	525.7	291.3	47.3	99.5	963.8	52.9
RS17	Chodavaram	598.2	268.7	38.4	123.4	1028.7	54.1
RS18	Narsipatnam	656.3	265.1	37.9	168.9	1128.2	67.8
RS19	Chintapalli	715.4	198.9	30.2	183.1	1127.6	73.1
RS20	Paderu	800.8	242.3	46.3	230.5	1319.9	81.1

The interannual variability of rainfall at Tekkali (RS-2) is shown in Figure 3. There were about 20 wet years with 25 to 40 per cent of positive departure of rainfall and 1966 was the wettest year with more than 60 per cent of positive departure from mean value. About 12 years were identified as dry years. 1959 to 1968 was the driest decade and 1985 to 1995 was the wettest decade. Ichapuram (RS-3) shows 12 wet years including 2 extreme rainfall years with 50 per cent of positive departure from mean and 8 dry years with 25 to 40 per cent of negative departure from mean rainfall. Kalingapatnam (RS-4), being coastal station experienced 5 extreme rainfall years and 1956 was the wettest year with more than 75 per cent of excess rainfall as the station is prone to cyclones. It was observed that 1964 to 1974 was dry period followed by wet period from 1980 to 1990 (Figure 3). Srikakulam (RS-5) experienced 19 wet years, 1956 and 1962 were identified as excess rainfall years with 50 per cent of positive departure from normal. There were 11 dry years over a period

of 60 years. Palakonda (RS-6) experienced heavy precipitation during 1950 to 1960 and it was the wettest decade followed by dry period from 1960 to 2010. The inter-annual variability of rainfall was very less during 1961-2010 and 1 wet year and one dry year were identified.

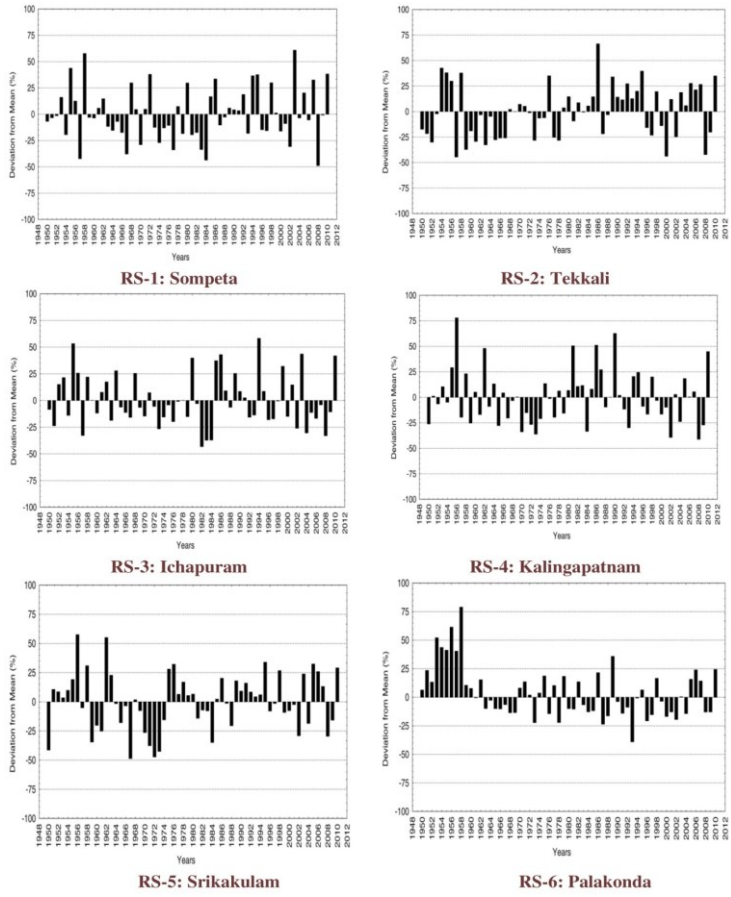

Fig. 3. Srikakulam District - Annual Rainfall Departures

About six stations, Parvathipuram, Bobbili, Saluru, S.Kota, Vizianagaram and Cheepurupalli are selected fom Vizianagaram district and interannual variability of rainfall was carriedout and results are shown in Figure 4. Parvathipuram (RS-7) being hilly station experienced 5 wet years and 1958 and 1992 were the wettest years during the period 1950-2010 with 50 percent of positive departure of rainfall from mean value. There were about 5 wet years with 25 percent positive departure of rainfall and 5 years identified as dry years with 25 percent of negative departure from normal rainfall. The temporal distribution of rainfall at Bobbili (RS-8) is shown in Figure 4. 1958 was the wettest year with nearly 70 percent of positive departure of rainfall from normal followed by the year 1991 with the positive deviation of 50 percent of rainfall. Among the dry years, 1966 was the driest year with more than 40 percent negative departure from normal.

There were five wet years with 25 percent and above positive departure from normal and 4 dry years with 25 percent negative departure of rainfall. Among the dry years, none of the years exceeded 50 percent of negative departure from normal rainfall. Saluru (RS-9), another hill station of the district exhibits more number of wet years. It is evident from the Figure 4 that there were many years with negative departures from mean rainfall especially during the period 1951 to 2010.

There were two wet years, 1957 and 1987 with 50 percent of excess rainfall from mean value of 1106 mm (Figure 4). About 10 wet years were identified with 25 percent and above positive departure from normal and about 4 years with 25 percent negative departure from the mean rainfall. S.Kota (RS-10), which is located in the western part of the study area, shows 6 wet years and 7 dry years. The year 1990 was the wettest year with 50 percent of excess of rainfall from normal rainfall of 1,178 mm. It is observed that S.Kota (RS-12) recorded wet and dry years are same during the period from 1951 - 2010, which indicates that an increasing trend of rainfall. The year 2002 was identified as the driest year with 50 percent of negative departure from mean. Vizianagaram (RS-11) shows more number of wet years. The year 1958 was the wettest year with more than 70 percent of positive departure of rainfall followed by 1956 and 1976 with 75 percent of positive departure.

There were no dry years with 50 percent of negative departure of rainfall. There were about 10 wet years with 25 to 50 percent of positive departure and 8 dry years with 25 to 50 percent of negative departure from mean rainfall of 1088 mm. About 42 years had normal rainfall with slight positive or negative deviations. Cheepurupalli (RS-12) shows more number of dry years when compared to other stations in the study region. Similar trend was observed with negative deviation of rainfall from 1962 - 1980. Again from 1994 to 2006 there were many years with 25 to 50 percent negative departure of rainfall from mean value of 1,048 mm. About 8 stations such as Visakhapatnam, Bheemunipatnam, Anakapalli, Elamanchili, Chodavaram, Narsipatnam, Chintapalli and Paderu are selected from Visakhapatnam district and inter annual variability of rainfall is shown in Figure 5. It is evident from the figure Visakhapatnam (RS-13) experienced 2 wet years with 50 percent of positive departure of rainfall from the mean rainfall and 10 wet years with 25 percent of positive departure from the average value.

There were about 11 dry years with 25 percent negative departure from the mean value. From the figure it is clear that the station experienced a prolonged dry period from 1965 to 1985 followed by a wet period and the station experienced a climate shift from dry period to wet period. Though it is a coastal station, there was no record of extreme wet years. Bheemunipatnam (RS-14), another coastal station of the study area experienced extreme wet years in 1955 and 1986 with 75 percent of positive departure of rainfall from the normal rainfall, three wet years with 50 percent of positive departure and 5 wet years with 25 percent positive deviation from the mean rainfall. There were three dry years with 50 percent of negative departure and 9 dry years with 25 percent of negative deviation from the normal rainfall.

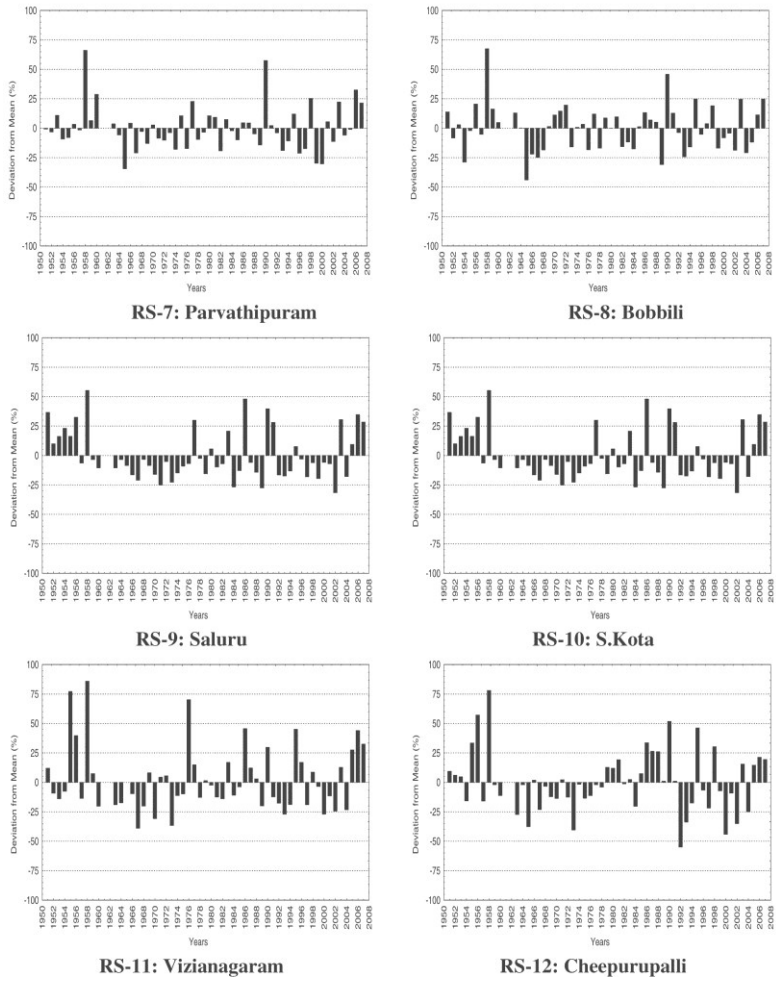

Fig. 4. Vizianagaram District - Annual Rainfall Departures

The temporal distribution of rainfall at Anakapalli (RS-15) and Yelamanchili (RS-16) is shown in Figure 5 and Table 2. The year, 1955 was the wettest with more than 75 percent of positive deviation from the normal rainfall followed by the year 1988 with 65 percent above normal rainfall at Anakapalli (RS-15). There were 8 wet years with 25 percent of positive departure from the normal rainfall. Among the dry years, 1960 and 1967 have recorded more than 50 percent negative departure from the normal, and 8 years with 25 percent negative deviation. Similar to Visakhapatnam (RS-13), Anakapalli (RS-15) also experienced a prolonged dry period from 1960 to 1982 followed by a wet period. A clear climatic shift is observed at Anakapalli (RS-15) also. Another continental station from the study region, Yelamanchili (RS-16) also exhibits similar distribution of annual rainfall. There were 10 wet years and 8 dry years over a period of 60 years. The year, 1998 was the wettest year with extreme annual rainfall and more than 75 percent of positive departure from the mean value.

There were three dry years with more than 50 percent of negative departure from the normal rainfall. Chodavaram (RS-17), a foothill station, experienced 11 wet years and 1989 was the wettest year with more than 75 percent of positive departure from the mean rainfall. It is evident from the figure that there were many years with negative departure from the mean rainfall especially during the period of 1960 to 1968. There were 13 dry years with more than 25 percent of negative departure from the normal and 1966 was the driest year with 50 percent negative deviation. Narsipatnam (RS-18) recorded 12 wet years and, 1989 was the wettest year with nearly 90 percent of positive deviation from the normal rainfall. There were 11 dry years with negative deviation of 25 percent from the average rainfall. There was no record of severe droughts at Narsipatnam (RS-18). Most of the years are normal with slight deviation either positive or negative. Chinthapalli (RS-19), hilly station of the study region experienced 9 wet years and 6 dry years and 2003 was the wettest year with excessive rainfall of more than 75 percent from the normal. The years 1989 and 2005 were also wet years with more than 50 percent positive deviation and the remaining 6 years with 25 percent above the normal rainfall. The driest year was 1968 with more than 50 percent negative deviation from normal and another 5 years were also dry with 25 percent less than normal. Paderu (RS-20), another hill station of the district exhibits less number of deviations from the normal rainfall. Annual rainfall data was available for a period of 46 years only. There was only one wet year, 1983 with more than 25 percent positive deviation and 3 dry years with more than 25 percent negative departure from the normal rainfall. It is observed that the decade 1964-1974 was the dry period, with more negative departures from normal. Paderu (RS-20) experiences less rainfall variability when compared to other stations of the study area. Over a climatic period of 46 years, Paderu (RS-20) exhibits three wet years and three dry years and remaining 40 years are normal with slight deviation (Table 2).

Table 2. North Coastal Andhra Pradesh - Wet and Dry Years (1950-2010)

RS.No.	Name of the Station	Number of Wet Years	Number of Dry Years	Number of Normal Years
RS1	Sompeta	09	13	38
RS2	Tekkali	20	12	28
RS3	Ichapuram	12	08	40
RS4	Kalingapatnam	10	13	37
RS5	Srikakulam	19	11	30
RS6	Palakonda	08	05	47
RS7	Parvathipuram	05	05	50
RS8	Bobbili	05	04	51
RS9	Saluru	10	04	46
RS10	S.Kota	06	07	47
RS11	Vizianagaram	10	08	42
RS12	Cheepurupalli	09	10	41
RS13	Visakhapatnam	12	11	37
RS14	Bheemunipatnam	10	11	39
RS15	Anakapalli	10	10	40
RS16	Elamanchili	10	08	42
RS17	Chodavaram	11	13	36
RS18	Narsipatnam	12	10	38
RS19	Chintapalli	09	06	45
RS20	Paderu	01	03	46

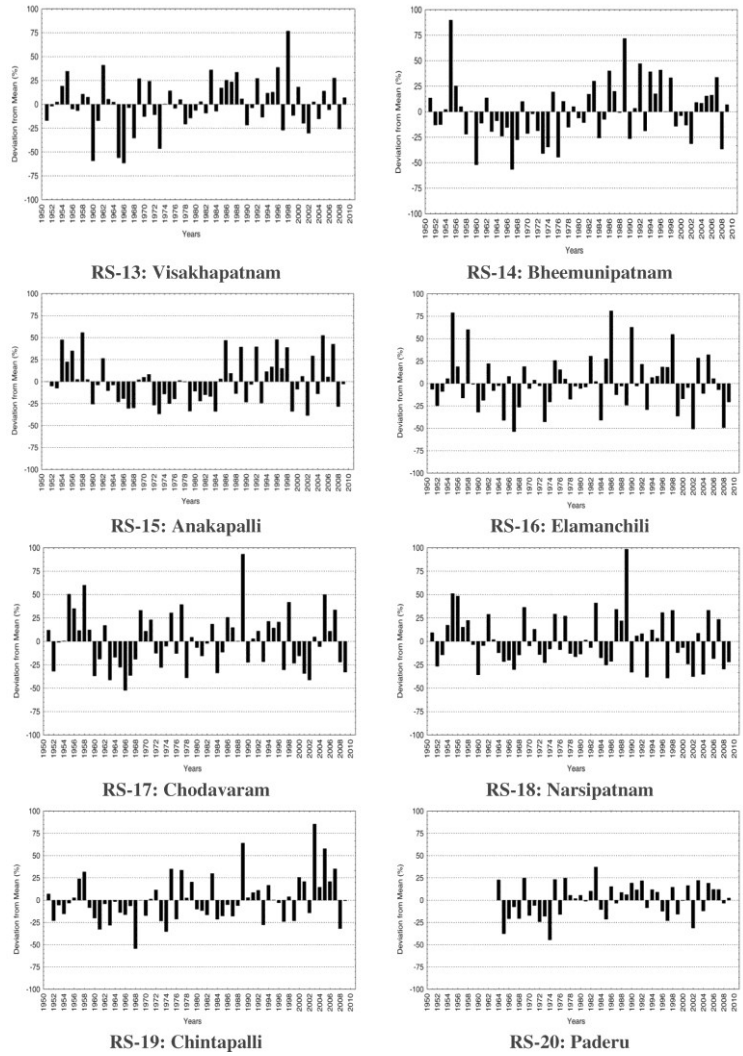

Fig. 5. Visakhapatnam District - Annual Rainfall Departures

Rainfall Trends

Trend analysis of rainfall over India is reported by several researchers (Nandargi and Mulye, 2014; Sahu and Khare, 2015; Subbaramayya and Naidu, 1992). Mooley (1997) made detailed examination of rainfall series of India as a whole. According to the report of Intergovernmental Panel on Climate Change (IPCC, 2007) the trends in seasonal and annual precipitation were observed during past decades all over Asia.

Trend analysis has been carried out for a period of 60 years for 20 stations of North Coastal Andhra Pradesh. Annual rainfall data have been analysed and presented in figures 6 to 8. A few stations from Srikakulam include Sompeta, Tekkali , Ichapuram,

Kalingapatnam, Srikakulam and Palakonda are selected and rainfall trends are computed. The temporal distribution of rainfall at Sompeta (RS-1) and Tekkali (RS-2) is shown in Figure 6. It was observed that there is slight positive trend i.e., an increasing trend of rainfall at both the stations. But the trend is insignificant. Ichapuram (RS-3) and Kalingapatnam (RS-4) showed slight decreasing trend which is also insignificant. Srikakulam (RS-5) shows increasing trend and Palakonda (RS-6) shows decreasing trend. Decreasing trend of rainfall was observed at most of the stations in Vizianagaram District. The temporal distribution of rainfall at Parvathipuram (RS-7) is shown in Figure 7. It is observed that there is slight increase in annual rainfall during the period 1950-2010.

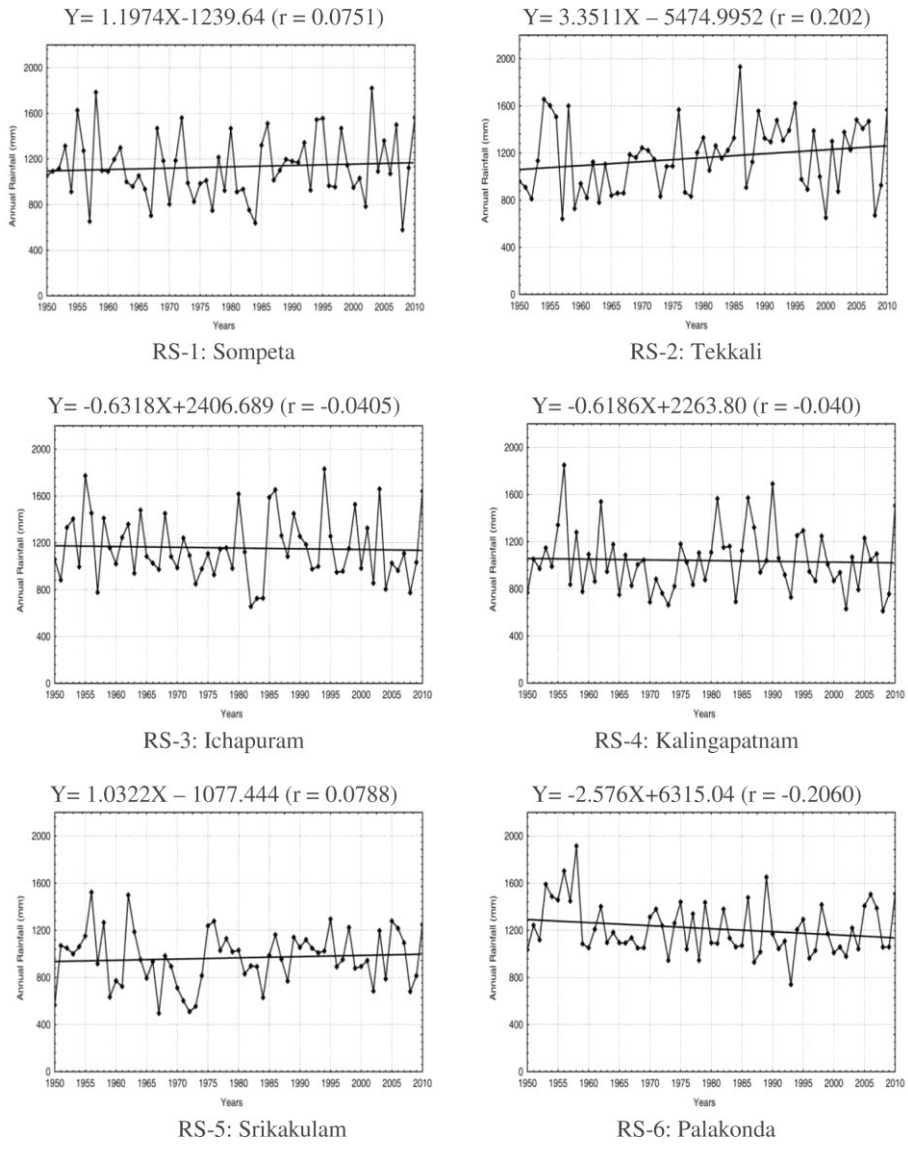

Fig. 6. Srikakulam District - Rainfall Trends

Bobbili (RS-8) station exhibits slight decreasing trend during the climatic period 1951-2010 (Figure 7). Saluru (RS-9) shows slight decreasing trend of rainfall during 1951-2010. An increasing trend of rainfall is observed at S.Kota (RS-10) and the trend is statistically insignificant. Vizianagaram (RS-11) shows declining trend of rainfall during 1951-2010 and Cheepurupalli (RS-12) also shows similar trend.

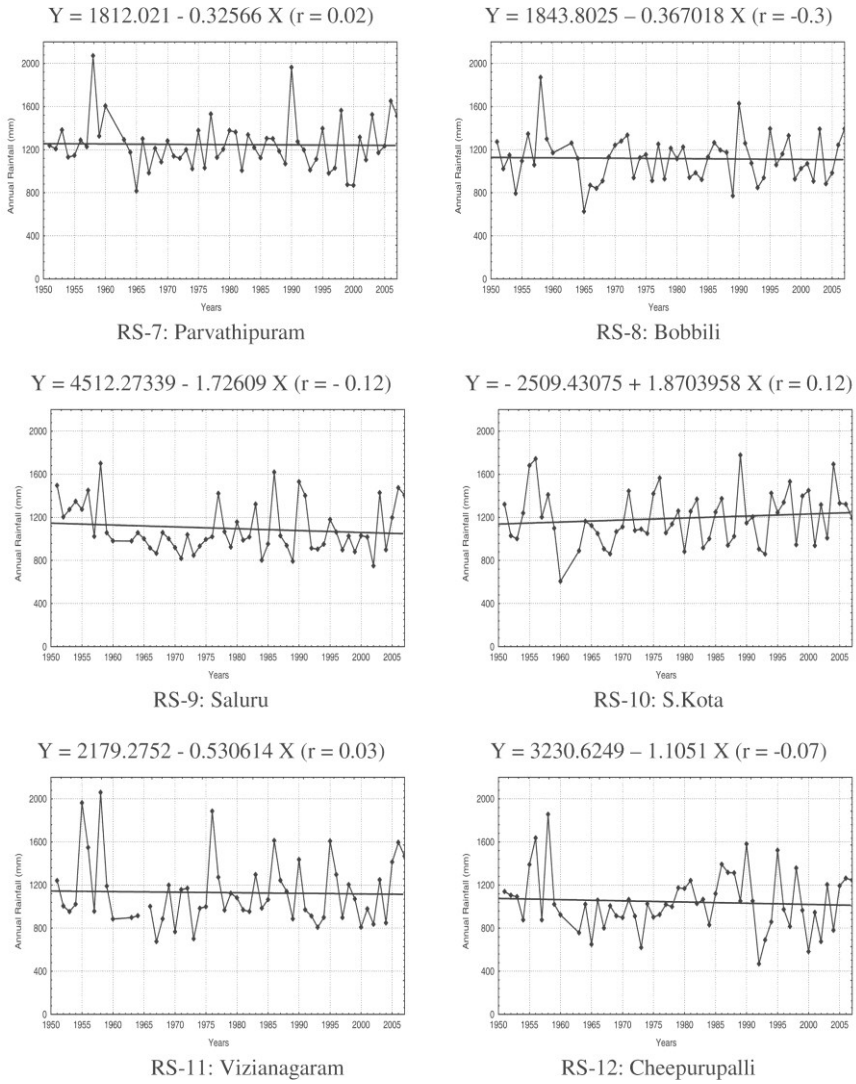

Fig. 7. Vizianagaram District - Rainfall Trends

Trend analysis of annual rainfall at Visakhapatnam district is shown in Figure 8. It is observed that there is no clear trend in the distribution of rainfall at Visakhapatnam and Bheemunipatnam. But it is evident from the figure that there is a slight increase of rainfall, from 1985 onwards and it was wet period for both the stations from 1985 to 1998 followed

by dry period up to 2003. Anakapalli (RS-15) station exhibits an increasing trend of rainfall. The same trend is observed at Yelamanchili (RS-16) also. It is observed that it was dry period from 1960 to 1984 followed by wet period from 1985 to 1998. Both Anakapalli (RS-15) and Yelamanchili (RS-16) stations are known for sugarcane cultivation, which needs irrigation facilities. There is no trend in the distribution of annual rainfall at Chodavaram (RS-17). Narisipatnam (RS-18) also showed negative trend of rainfall and it is also insignificant. Both the stations Chodavaram and Narisipatnam are located at foothill zone and exhibit decreasing trend of rainfall. Hilly stations, Chinthapalli (RS-19) and Paderu (RS-20) showed an increasing trend of rainfall (Figure 8). Chinthapalli, being located at higher altitude experiences heavy rainfall throughout the year. It is one of the wet stations in the study area. Both the stations are known for paddy cultivation and also coffee plantation. It can be concluded that hilly stations show increasing trend of rainfall whereas the stations along the foothill zone experienced decreasing trend of rainfall. Interior stations like Anakapalli and Yelamanchili exhibit slight positive trend of rainfall and there is no trend among coastal stations. It can be concluded that the trend analysis of rainfall of all the stations under study show insignificant trend, whether it is positive or negative.

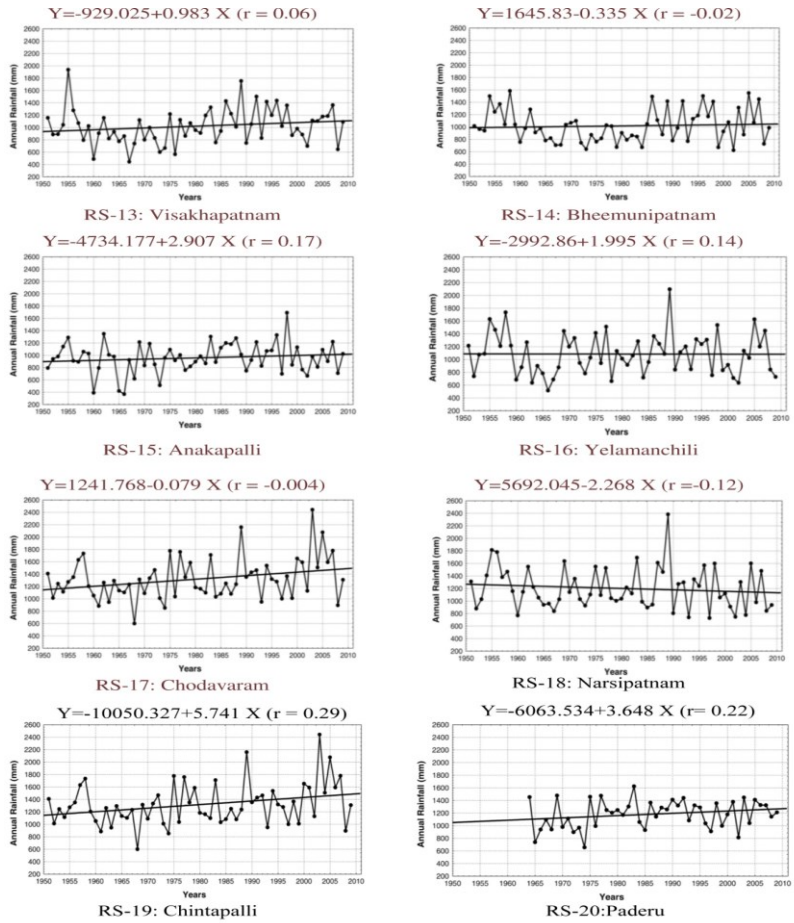

Fig. 8. Visakhapatnam District - Rainfall Trends

Conclusions

Rainfed farming is the characteristic of agriculture in North Coastal Andhra Pradesh. For rainfed crops the distribution of rainfall both annual and seasonal is very important. The distribution of rainfall during southwest and northeast monsoon seasons and also on annual basis shows spatial variability. It is observed that both annual rainfall and southwest monsoon rainfall increase from coastal areas towards interior, whereas rainfall decreases from coast towards interior during retreating southwest monsoon and winter season. With regard to temporal distribution the study reveals that about 70 percent of years of study period recorded normal rainfall and remaining period noticed that extreme rainfall either excess or deficit from normal. Trend analysis of annual rainfall reveals that there is insignificant trend over a period of 60 years. About 11 stations out of 20 showed insignificant increasing trend and remaining 9 stations exhibited insignificant decling trend.

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References

1. Bhadram, C.V.V., (2003). A Synoptic study of active and weak southwest monsoon over Andhra Pradesh. Mausam. 54 (2), pp.385 – 392.
2. Das.H.P., & Kore.P.A., (2003). Pattern of rainfall variability over dry farming zone of India and its agricultural implications. Mausam. 54 (2), pp.471-476.
3. Devappa.V.M., Khageshan., & Mise.S.R., (2009). Study of various Meteorological Parameters in drought prone areas of Gulbharga District in Karnataka, India. Mausam. 60 (2), pp.225-229.
4. Ghadekar S.R., & Miskin R.B., (1998). A study on the characterization of monsoon rainfall for sorghum (Sorghum Vulgare Pers) and its response to typical rainfall patterns. Mausam. 49 (1), pp.115-120.
5. Gore. P.G., & Potdar. B.V., (2007). Variability of extreme heavy rainfall in Maharastra, Mausam. 58 (4), pp.556-563.
6. Guhathakurta,P., Menon, P.A., Dikshit S.K., & Sable S.T., (2005). Extreme rainfall analysis of Andhra Pradesh using a probability distribution model: A regional estimate. Mausam. 56 (4), pp.785-794.
7. IPCC, (2007). The physical science basis. Contribution of working Group I to the fourth Assessment Report of the Intergovernmental Panel on Climate Change (Cambridge University Press) Cambridge, United Kingdom and New York, NY, USA 996.
8. Jat M.L., Rajveer Singh., & Balyan J.K., (2004). Spread of drought in Rajasthan during the 1987 south –west monsoon. Mausam 55 (2), pp.345-350.
9. Jayanthi.N., & Govindachari.S., (1999). El-Nino and NE Monsoon Rainfall over Tamil Nadu. Mausam. 50 (2), pp.217-218.
10. Krishanakumar.K.N., Prasad Rao. G.S.L.V., & Gopakumar.C.S., (2009). Rainfall trends in twentieth century over Kerala, India. Atmospheric Environment. 43, 1940-1944.
11. Mohapatra. M., (2004). Some characteristics of monsoon rainfall variability over Orissa. Mausam, 55 (2), pp.351-372.

12. Mooley, D.A., (1997). Variation of summer monsoon rainfall over India in El-Niño. Mausam. 48 (3), pp.413 – 420.
13. Naidu,C.V., Satyanarayana, G.Ch., Durgalakshimi, K., Mallesear Rao,L., & Nagaratna,K., (2010). Is winter monsoon rainfall over south peninsular India increasing in global warming era. Global and Planetary Change. 72, pp.69-72.
14. Parthasarathy, B., & Mooley, D.A., (1978). Some features of long Homogeneous Series of summer monsoon rainfall. Weather Review. 106, pp.771-781.
15. Patnaik., (2006). Analysis of rainfall variability over Andhra Pradesh in relation to cyclonic disturbances. Mausam. 57, pp.329-337.
16. Rajeevan.M., Jyoti Bhate., & Jaswal.A.K., (2008). Analysis of variability and trends of extreme rainfall events over India using 104 years of gridded daily rainfall data. Geophysical Research Letters. 35, pp.1-6.
17. Sadhuram, Y., (2006). Long-range forecast of monthly rainfall over India during summer monsoon season using SST in the north Indian Ocean. Current Science, 91 (4), pp.425-428.
18. Sikka, D.R., (1980). Some aspects of the large-scale fluctuations of summer monsoon rainfall over India in relation to fluctuations in the planetary and regional scale circulation parameters. Proc. Indian Acad.Sci. 89, pp.179-195.
19. Vinodkumar., (2003). Maximum and Minimum temperatures as predictor elements of southwest monsoon rainfall over Gaya: A statistical approach. Mausam, 54 (4), pp.935-937.

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IMPACT OF CLIMATE CHANGE ACROSS THE NORTHEASTERN AND WESTERN PART OF AFRICA IN GENERAL AND AGRO-ECONOMY OF ZOBA MAEKEL (ERITREA) IN PARTICULAR

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Abstract

This paper analyses the impact of Climate change across the Northeastern and Western part of Africa in general Zoba (Province) Maekel`s agro-economy of Eritrea in particular. Based on past observations and projections some important findings have been provided. Presently, ongoing and future trends of occupational heat stress have shown by coloured maps based on globally gridded climate data and model of Africa. The increasing intensity of global warming and the nature of climate change followed by land degradation have adversely affected the economies of many Sub Saharan African countries including Eritrea. Eritrea`s 80 per cent population is depend upon agriculture. The erratic behavior of dominant determinants of agriculture temperature and rainfall has been examined that adversely affected the crop production of Zoba Maekel.

Keywords: Climate change, Rain fed agriculture, Eritrea, Zoba Maekel, Agro-economy,

Introduction

Climate change is a change of statistical distribution of weather over a period of time that ranges from decades to millions of years. Warming of the climate system is unequivocal, as is now evident from observations that the global average air and ocean temperatures increasing, widespread melting of snow and ice and rising global average sea level. Extreme drought is increasing. Higher temperature causes a higher rate of evaporation and more droughts in some areas of the world. Ecosystems are changing. As temperature warm, species may either move to a cooler habitat or die. Species that are particularly vulnerable include endangered species, coral reefs, and polar animals. Warming has also caused changes in the timing of spring events and the length of growing season.

Data base and Methodology

This paper is an original outcome of secondary and empirical data. The empirical encompasses practical observation of field and responses by the farmers and labourers based on questionnaires. The secondary data have been collected from different magazines, journals, books, different ministries and internet.

The gridded spatial data (0.5 x 0.5 degrees grid cells; 55,000 grid cells above land surfaces) available free of charge from the Climate Research Unit (CUR) at the University of East Angila, United Kingdom, and calculated the WBGT (Wet Bulb Global Temperature) maximum (indoor) levels for the month of June across the Northeastern and Western part of Africa. Rainfall and crop production data have been gathered. The mean maximum and mean minimum temperature graphs have also been collected by the Ministry of Land Water and Environment. Methodologically, data calculation, computation, graphs, bar diagrams and cartographic methods have been carried out for the completion of this paper.

Trends of Climate Change in Africa

New studies confirm that Africa is particularly vulnerable to climate variability and change due to its multiple stresses and low adaptive capacity. In Africa, between 75 to 250 million people are projected to be exposed to increased water stress due to climate change by 2020. Also, by the same year in some countries of Africa yields from rain fed agriculture could be reduced by 50 per cent. Agriculture production, including access to food in many African countries is projected to be severely compromised. This would further adversely affect food security and exacerbate malnutrition. Most of the global warming, caused by human activities that increase concentrations of green house gases (GHGs) in the atmosphere, will lead to severe impacts on natural ecosystem, human health and water resources especially in developing countries, where reduced agriculture yields, the rise in sea level, extreme weather events and the greater prevalence of some infectious diseases are likely to be particularly disruptive (Pachauri *et al.,* 2007). Warming of 2^0 C could result in a 4 to 5 per cent permanent reduction of annual per capita in Africa, as opposed to animal losses in high income countries and global average GDP loss of about 1 per cent. According to International Labour Organization (ILO, 2008), 1.8 billion people are expected to suffer from fresh water scarcity by 2025, mostly in Africa and Asia, and 2 million people globally are expected to die permanently each year due to indoor and outdoor air pollution (World Development Report, 2010).

Hotter and drier conditions will increase water shortages, with a consequent increase in food insecurity, hunger and malnutrition (www.who.int/heli/risks/climate/climatechange/en). In addition, increasing number of every hot day each year will adversely affect the ability of people to carry out daily tasks, including their capacity for income generating work. This will mean a disproportionate economic burden on already marginal populations (Patz *et al.,* 2005). With regard to malaria, already one of the main causes of infant and maternal mortality, climate change will alter the breeding the environments of the anopheles vector, resulting in drying of some areas with reduced transmission, but simultaneously rendering previously unaffected areas more suitable environments for these organisms. As a result, malaria control programmes will be more difficult to plan, posing particular challenges to countries in Sub–Saharan Africa (Kjellstrom, 2009). The continent of Africa has heavily been influenced by climate change.

Land degradation is often a cause and a consequence of rural poverty. Desertification can cause poverty, and poverty can cause further desertification. About two million people are potential victims of the effects of desertification remains unchecked, 50 million people will be displaced over the next 10 years from the continent of Africa (Hanssen, 2009). No continent except Antarctica is immune from desertification. The problem is particularly acute in Africa, which has 37 per cent of the world`s arid zones. About 66 per cent of its land is either desert or dry lands.

Recent climate changes and variations are beginning to have effects on many natural and human systems, including earlier spring crop planting at the higher latitudes in the Northern Hemisphere. In the Sahelian region of Africa, warmer and drier conditions have led to a reduced growing season with detrimental effects on crops. Yields from rain-fed agriculture depend on rainfall. One way to present ongoing and future trends in occupational heat stress is to create coloured maps based on globally gridded climate data and modelled data on climate futures. The increase estimated heat stress levels from 1975 to 2050 are clear from the colour trends and extreme levels (WBGT max 32º C) occur in parts of Ethiopia, Somalia, Eritrea, and the near–Saharan countries across east to west coast (Figure 1).

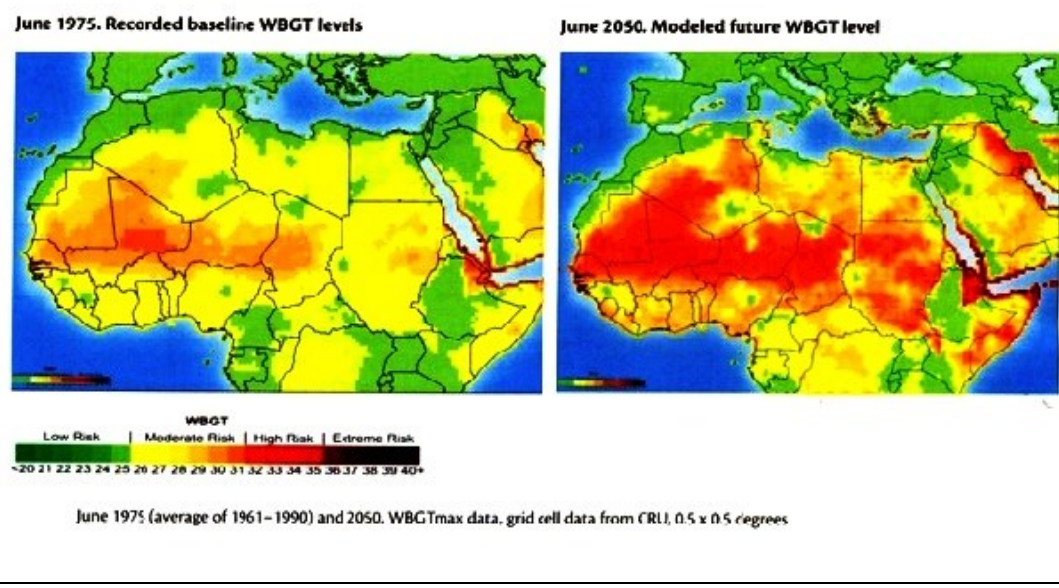

Fig. 1. Impact of Climate Change Trend on Africa
Source: Kjellstrom et al., (2011). Figure 2, p.46.

Developing countries in general, poorest countries in particular depend heavily on agriculture, the most climate-sensitive of all economic sectors, and suffer from inadequate health care and low-quality public services (Lehtinen, 2011). Africa`s nutrition situation is deteriorating, and this is a serious concern. Much of the population is more vulnerable to malnutrition and starvation than ever before. (Ruskin, 1996). As the temperature increases

across the Eastern and Western part of Africa high risk is likely to be observed in the countries like Eastern part of Mauritania and Mali, Northern part of Niger, Chad, South Western part of Algeria, in the whole part of Sudan, and Somalia, while extreme risk may be observed in the whole part of Djibouti Northeastern part of Ethiopia, Northeastern tip of Somalia and Southern part of Eritrea.

Study Area

Eritrea is situated in the Horn of Africa and lies north of equator between latitudes 12^0 22′ N to 18^0 02′ N and longitudes 36^0 26″ 21′ E to 43^0 13′ E. It has an area of 122,000 square kilometres. To the east, the country is bordered by the Red Sea, extending about 1,212 kilometres from Ras Kasar in the north to Dar Elwa in the southeast. Djibouti borders Eritrea in the southeast, Ethiopia in the South, and the Sudan in the north and west. Administratively, the country is divided in to six *Zobas* (Provinces): Anseba, Debub, Debubawi KeihBahri, Gas Barka, Semenawi Keih Bahri and Maekel (Figure 2).

Fig. 2. Location of Eritrea and Zoba Maekel

Most of the Western Low Lands and Coastal Plains are associated with hot and dry climatic conditions, while the Highlands are relatively cool. The presence of flat land, relatively fertile soil, and a milder climate makes the Central Highlands a centre of rain-fed agricultural activity in Zoba Maekel. Several major urban centres of Eritrea, including the capital city, Asmara, are located in the Central Highlands Zone. During good rains the Western Lowlands have a potential for cultivation and agro-pastoralism. The Coastal Plains are the location of the densely populated part of the country, while the Lowlands are sparsely populated.

Agriculture and pastoralism are the main source of livelihood for about 80 per cent of Eritrea`s population. The agriculture sector depends mainly on rain, with less than 10 per cent of the arable land currently irrigated. Consequently, productivity is low and the agriculture sector, including livestock and fisheries, accounts for only one fifth of the gross domestic product (GGP). Eritrea is one the poorest countries in the world, with GDP per capita of about US$ 200, well below the average US$ 270 for less developed countries (UNDP, 2001).

Impact of Climate Change on Agro-economy of Zoba Maekel

Zoba Maekel is one of the sixth Zoba of Eritrea which is certainly located in the centre where the capital of the country is in it and it is bordered with Anseba, Semenawi Keihbahri, Gash-barka and Debob Zone. It has a total area of 1,079,078 hectare of which 54,448 hectare is total potential area for agriculture, from this 33,000 hectare is cultivated through rain fed cropping, 3,000 hectare is cultivated using irrigation system and the rest is for grazing, forest plantation etc.

Zoba Maekel`s altitude ranges from 1,600 metre above sea level, which is Dirfo up to 2,610 m above sea level that is Zagger. The rainy season is from June to August, but also too little rain showers during spring season. Moreover, frost occurs between October and February. Mean annual rainfall is 415.4 mm; maximum rainfall is 715 mm (recorded in 1994) and the minimum annual rainfall is 194 mm recorded in 1996. The mean annual temperature of this zone is 15^0; with 25.5^0 C maximum temperature and 4.3^0 C mean annual temperature. Zoba Maekel`s 27 per cent population engaged in agriculture, 23 per cent in trade and service, 18 per cent in manufacturing and hand craft, 7.5 per cent in civil service and 24 per cent causal labour. So it has its own importance in relation to agriculture. The farmers here practice mixed farming in which growing of crops and herding of animals is the major occupation. The crops grown are cereals which go into sustaining the farmer`s family and its proximity to the urban centre have promoted both vegetable and dairy farming.

Eritrea being in Sahelian region of Africa, it is frequently affected by drought and erratic pattern of rainfall. The climate is becoming more and more unpredictable and hence negatively affecting agricultural production. The Zoba Maekel is not free from such effect. The central highlands of Eritrea in which Zoba Maekel is located have an altitude of over 1600 m, receiving an average rainfall of 500 mm to 750 mm and a growing period of crops ranging from 90 days to 130 days. The effect of climate in Zoba Maekel is reflected by the temporal and spatial variation of temperature and rainfall. These climatic variations have a significant influence on the people`s activities including, livestock raising, forestry, horticulture and crop production.

Dominant Determinants of Agriculture

It is generally accepted that the elements of climate are the most important variables which play a vital role in crop production, even though technological advances

and improvements in forecasting have made some possible adjustments in planting and harvesting schedule. The two most influential elements of climate on crop production are rainfall and temperature.

Rainfall

In general, speaking rainfall has an upper hand in determining the success or failure of agricultural crop. Especially this is evident in countries like Eritrea, where agriculture is mostly dependent on rainfall. Although the total amount of rainfall received each year seem to be sufficient for crop production (400 to 600 mm), most parts of Eritrea indeed suffer from chronic droughts over the years. The table No 1 reveals that the rains are erratic and unpredictable. Moreover, there are also moments when the rain fails to come in time and sometimes are late, resulting in the destruction of maturing crops. This was witnessed in 1997, which was the *El Nino* year and the rain failed to occur in time, which in turn caused a lot of destruction. Historic metrological record reveals that the frequency of droughts have increased during the past 100 years. Eritrea has faced serious droughts from 1905-1915; from 1939-1945; from 1965-1978 and 1984, 1985, 1989, 1991, 2002, 2008 and 2009. Thus the availability of rainfall is a necessary condition for the success of agricultural productivity. But excess abundance of moisture in the soil can have an adverse effect on agriculture as free movement of oxygen is blocked and compounds which are toxic to the plant roots can formed. The scarcity of moisture can also lead to plant wilting and dying. Zoba Maekel is a province located in the central highlands of Eritrea which have enough rainfall to support plant growth between June and September (summer season) and little rain showers in spring season (March and April). In this Zoba, out of 36,000 hectares cultivated 33,000 hectares is rain fed cropping and remaining 3,000 hectare through irrigation. As the rain fed crops and summer rainfall is important for the success of these crops. The table gives a glimpse of spring and summer rainfall and their relation with crop production with selected years.

Table. 1. Spring and Summer Rainfall versus Total Production of Agricultural Crop

Year	Spring rainfall in mm	Summer rainfall in mm	Total rainfall in mm	Total production in ton
1992	10.6	286.5	297.1	21,000
1994	20	239	259	24,429
1996	42	147	189	9,559
1998	109.3	396.9	506.2	39,244
2000	100.9	366	466.9	23,090
2002	11.8	267.6	279.4	2,817
2004	61.4	184.2	245.6	6,089
2006	110	366.4	476.4	35,544
2008	86.4	154.7	241.1	3,170
Source: Department of Metrology and Ministry of Agriculture				

From the above table a strong positive correlation can be seen between the amount of spring and summer rainfall as well as crop production. For instance, the year 1998 and 2006 shows high crop production where there is high spring and summer rainfall. Whereas the year 2002 and 2008 recorded the lowest as both and spring and summer rainfall was not sufficient to support crop production.

Furthermore, the above table shows that the occurrence of spring without summer rainfall and vice versa has negative influence on the productivity of crops. For example, in the year 2008 there was abundant spring rainfall but failure of summer rainfall is the decline of crop production. In addition, the distribution of rainy days and area coverage in the region has its own effect in crop production. As on crop, the rainfall has a similar effect on livestock, wildlife and forestry.

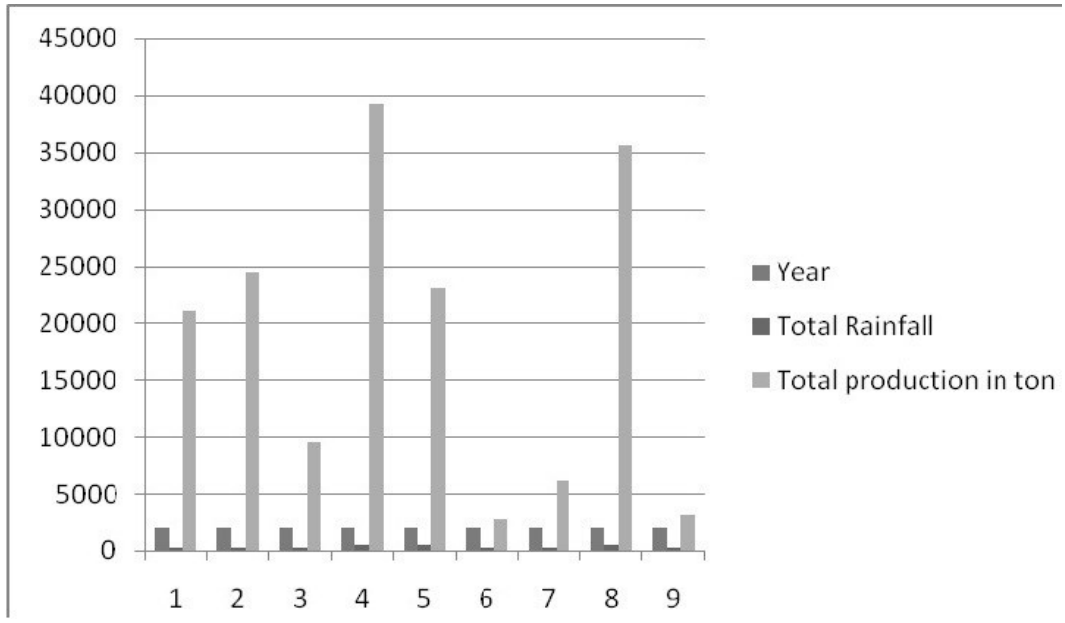

Fig. 3. Total Rainfall and Total Production of Crops in tons

Temperature

Not only rainfall, temperature too plays a significant role in the productivity of agriculture. Temperature could be defined as the hotness of a body. All crops have minimal, optimum and maximum temperature limited for each of their stage of growth. Generally speaking, a high temperature is not as destructive as a low temperature, if moisture supply is sufficient to prevent wilting.

High temperature can cause *sun scaled,* an injury caused by high radiation which leads to high evapotranspiration that can lead to plant drought. The mean minimum and mean maximum temperature of Asmara has been analysed because most of the areas in Zoba Maekel have similar altitude. The month of January and July has been used to

analyse the temperature trend of past 18 years from 1992 to 2009. These months are selected because they show extreme temperature conditions of the year. The maximum temperature record of these two months for interval of two years difference is assessed in the graph below.

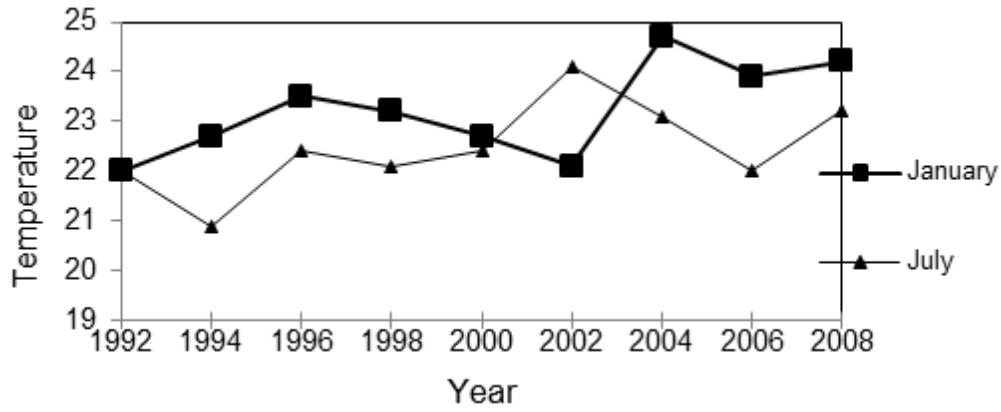

Fig. 4. Mean Maximum Temperature of Asmara for the Months of January and July

The Figure 4 shows a general increase of mean maximum temperature in the month of January 22^0 C in 1992 to 24.3^0 C in 2008. Similarly, the mean maximum temperature of July escalates from 22^0 C in 1992 to 23.3^0 C in 2008. The mean maximum temperature of January and July shows similar trend of increasing. This is to be pointed out that January`s mean maximum temperature is more than July. Because in the month of July clouds cover the sky and prohibiting solar radiation to come on the earth`s surface. This constant cloud cover reduces its mean maximum temperature by reflecting back most of the incoming solar radiation. Thus from the above graph a general increase of temperature can be seen over the past 17 years.

The occurrence of low temperature has also far reaching impact on plant growth because plant growth stops when temperature falls below 6^0 C. As for mean maximum temperature, the mean minimum temperature of Asmara for the month July and January are also assessed in the Figure 5.

The mean minimum temperature of Asmara in January has risen from 4.2^0 C in 1992 to 5.6^0 C in 2008. Similarly, the mean minimum temperature of July month shows an increase from 12.7^0 C in 2008. From the above figure it is evident that the mean minimum temperature of July and January show great variation because the cloud cover in the month of July prevent heat loss through re-radiation. Thus, a change in either rainfall or temperature can adversely affect the agricultural production.

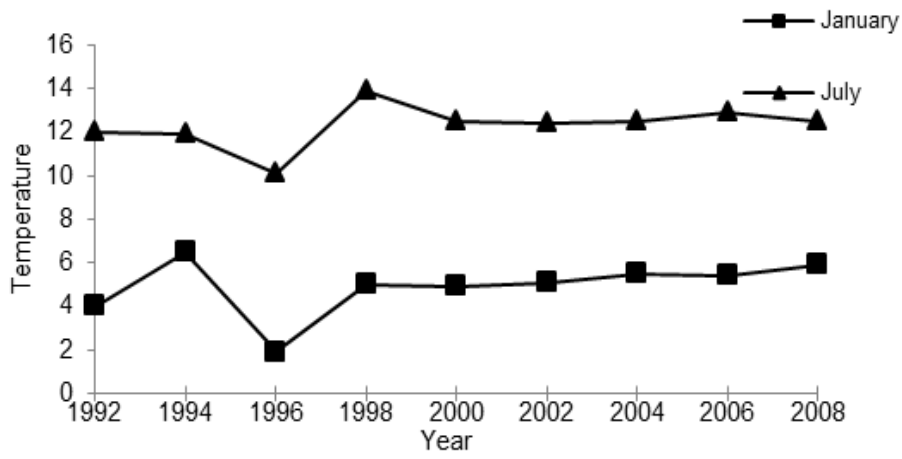

Fig. 5. Mean Minimum temperature of Asmara for the Months of January and July

Impact of Climate Change on Agriculture

In Eritrea, climate change is related to shortage of rainfall, extended rainy seasons, or late rains those results in decreased biomass production, yield loss, livestock death and therefore famine. In Zoba Maekel, as farmers are heavily depending on rain fed agriculture; they are adversely affected by climate change. Over 27 per cent of the total population in Zoba Maekel makes their livelihood from mixed farming. These economic activities had been influenced by variations in elements of climate especially temperature and rainfall. As we have seen the two important elements of climate that are rainfall and temperature, have been changing over the past 17 years. So their changing impact on agriculture is illustrated as follows:

Types of crops grown in an area are largely influenced by type of climate in that particular area. Change in climatic condition of an area affect cultivation of crops. As already cited above, Zoba Maekel has been experiencing change in climate. The change in climate in return affects the region`s crop cultivation pattern. Although both temperature and rainfall are important, the influence of rainfall in Zoba Maekel`s crop production is most imminent. This is because large amount of Zoba Maekel`s farm land is rain fed. Climatic variations have direct effect on rain-fed crops. In the direct effect, rain fed yield changes are driven by both precipitation and temperature change. The irrigated yield effects are from temperature change alone because it has constant supply of ground water.

Climate change will also have indirect effect on irrigation crops as climate variation has direct effect on internal renewable water. Internal renewable water is available from precipitation. It is the internal renewable water affected by climate change; in return this will affect the irrigated crop production.

Since global warming is a great threat in the twenty first century, this also affects the crop production by increasing water requirement by a specific crop. The common crops grown in Zoba Maekel in order of their proportion are barely, wheat, maize, sorghum, millet, tiff and lentils. Most of crops depend on rainfall since the climate change cause decline of rainfall from year to year, the production of crops also decreased. The bar graph of the production of crops has given below from 1992 to 2008 in tons.

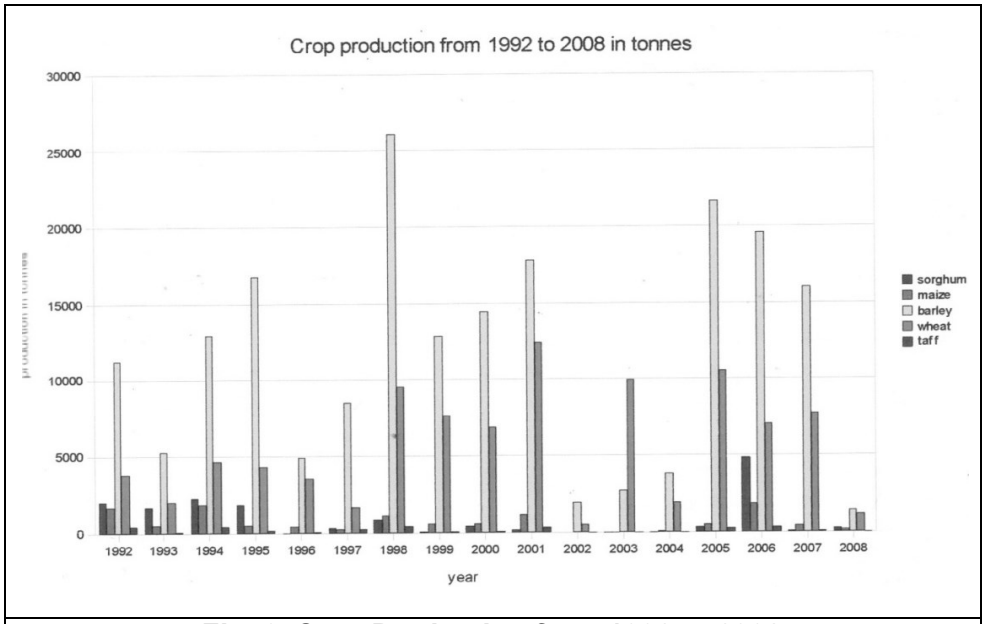

Fig. 6. Crop Production from 1992 to 2008

According to Figure 6, production of sorghum shows a decline from 2,000 tons in 1992 to 235 tons in 2008. Likewise, maize production decreased from 1,700 tons in 1992 to 120 tons in 2008. On the other hand, the production of barley and wheat shows a slight increase because the land which was previously used to cultivate sorghum and maize were shifted to produce barley and wheat. This shift in land use has taken place due to the unreliability of spring rainfall, which has become very scare in some years (Table 1) and is not enough to support either sorghum or maize in the dry periods. The other years show alternative rise and fall of crop production. This means there are alternative 2 to 3 successive rises of production and 2 to 3 successive fall production. This is because Eritrea is located in the region where drought occurs every 2 to 4 years.

Climate change have diversified impact, however, its destructive impact is on agriculture in which farmers are affected first. In spite of their low level of education most of Eritrean farmers felt and noticed the existence of the climate change without knowing the factors that causes it. Even though farmers suffer from climate change, they do not have ample knowledge in adopting this problem. This is agreed that farmer`s comprehensive understanding of the ongoing climate change is crucial in tackling the problem through different mechanisms.

Eritrea like other parts of the world is under the grip of climate change. Successive drought and unreliable rainfall is prevailing in the country. This has led to decreasing agricultural production in different parts of the country evidenced by chronic food shortage. The rainy season in Eritrea in general and in highlands in particular is shrinking and farmers are continuously losing their long term crops, which take a maturity period of around six months.

Conclusions

Change in climate significantly affects a wide range of physical systems including water resources, agriculture, forestry and human settlement. Climate change has a greater impact on agriculture production of the world by in general and Eritrea in particular shifting the rainfall pattern of a given environment. Zoba Maekel`s agro-economy has been affected by climate change. A strong positive correlation has been seen between the amount of spring and summer rainfall as well as crop production. The occurrence of spring without summer rainfall and vice versa has negative influence on the productivity of crops. The crops like Barely, Wheat, Maize, Sorghum, Millet, Tiff and Lentils depend on rainfall since the climate change cause decline or erratic nature of rainfall from year to year, the production of crops has also been decreased. On the other hand, temperature of mean maximum and mean minimum altered the productivity.

Overall, the impacts of climate change in the developing countries of the world need careful consideration, because resilience and capacity of societies in several developing countries to cope with projected impacts of climate change are limited. This is a subject which needs to be addressed both at global, as well as the local level, and creating knowledge and awareness on this issue would be of great value not only for sensitizing policy makers but also the public at large, particularly the younger generations whose future would be impacted by various dimensions of climate change.

References

1. Kejellstrom, T, Lemke, B., and Otto, M. (2011). Climate Change, Occupational Heat Stress, and Impacts on Health and Productivity in Africa. African Newsletter on Occupational Health and Safety. 21 (3), pp.44-47
2. Lehtinen, S., (2011). Safty Culture Needs to be Created On Occupational Health and Safety. African NEWS Letter on Occupational Health and Safety 21(3), p.62.
3. Pachauri, R.K., and Resisinger, A. (eds). (2007). Forth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) Climate Change 2007. Synthesis Report Contribution of Working Groups I, II and III to the Forth Assesmeent Report of the Intergovernmbetal Panel on the Climate Change. IPCC ,Geneva, Switzerland, p.104.
4. International Labour Organization (ILO). (2008). Unite to combat Climate Change, Green Jobs Fact and Figures, Geneva.
5. James. H., (2009). Global Warming in 21st Century, An Alternative Scenario, NASA.

6. Kjellstrom, T., Holmer, I., and Lemake, B., (2009). Workplace heat stress, health and productivity an increasing challenge for low and middle - income countries during climate change. Global Health Action, 2, p.10.
7. Ministry of Land Water and Environment, Eritrea. (1997). Environmental Information Systems Project. Asmara, Eritrea. Asmara: Ministry of Land Water and Environment
8. Patz, J.A., Campbell, Lendrum, D., Hollowway T., and Foley, J, A,. (2005). Impact of Regional Climate Change on Human Health. Nature, 438(17), pp.310 -7.
9. The World Bank. (2010). Development and Climate Change. World Development Report. Washington DC.
10. Ruskin, F, R., (1996). Lost Crops of Africa. Washington, D.C: National Academy Press.
11. World Health Organization. (2011). The Health and Environment Linkages Initiative (HELI). See http:// www.who.int/heli/risks/climate/climatechange/en/ (Accessed on 15 - 09 - 2011).
12. United Nations Development Program (UNDP) (2001). Human Development Index. Oxford University Press, New York.

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PATTERNS OF RESOURCE FLOWS AND RURAL DEVELOPMENT IN AN AGRICULTURALLY PROSPEROUS REGION

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Abstract

With growth and development, changes in the structure and function of the economies are unavoidable. The changes may bring good or bad results. As far as the study villages are concerned, the changes happened in the 20 years period from 1980 to 2000 appeared to have improved the living conditions of the villagers. Of the two, Palamputhur has significantly improved, while the other village, namely Vengidengal is not so. The reasons for the differences in the development patterns appear to be the differences in the basic socio, economic and agrarian structures of the villages. Palamputhur with more equitable resources has developed faster, while Vengidengal with inequitable resource ownership has missed the path. That is why the equitable asset ownership is advised for achieving sustainable economic development. The economic and political history of the major countries in the world shows more and more skewed distribution of asset and income, which may create more stress for larger section of people.

Keywords: Mechanisation in agriculture, Consumption pattern, Employment pattern, Cropping pattern, Irrigation pattern, Resource use pattern, Landholding pattern

Introduction

Despite fast urbanisation and industrialisation, Indian villages still continue to be the living place for larger proportion of Indians. They share greater percentage of workforce, supply essential food requirement for the whole Indian population and also act as market for the goods and services produced by the other sectors as well. These villages gradually expand in terms of size and functions, affect and get affected by the exogenous development and functionally integrate with the rest of the economy, thanks to the extension of social and economic infrastructure. The policy changes of the last two decades relating to rural / agricultural sector as well as urban / non-agricultural sector have also influenced the pace and pattern of the structural changes in the village economy. In India, the policy makers earlier tried to understand the village activities mainly because, the villages were the major direct source of income to the government. When food production was inadequate in India (about 50 million tonnes only in the First Five Year Plan period), the food had to be imported. The sufferers were the non-land owning poor ones with lower purchasing power. The new rulers of India then started giving importance to rural and

agricultural development so that the misery could be mitigated. Efforts were made to raise the agricultural production through both extensive and intensive cultivation. New technologies and new irrigation sources were generated. As a result, farm sector could produce marketable surplus. India's food production growth rate was more than the population growth rate, which was just opposite to the popular Malthusian theory. In this process, the degree of dependence on market for purchasing agricultural inputs and selling agricultural outputs rose. Terms of trade were also unfavourable to agricultural sector.

The agricultural sector in certain pockets of Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Punjab and Haryana was relatively more prosperous. These prosperities were reflected in increasing value of land. The relative role played by labour in cultivation was ultimately diminishing due to increased mechanisation. Labour use per rupee worth of crop came down. As a result, the agricultural prosperity could not bring prosperity to a large majorityof the landless people (Sen, 1981). The income and social status of those who depended mainly on agricultural sector for employment and survival were not encouraging. The developments in the 1950s and 1960s, notwithstanding their favourable effects, had also widened economic and social inequalities. Trickle-down theory or spill-over effect was not seen operating in majority of the Indian villages. Attempts were made to mitigate the bad side-effects of the growth.

Late 1960s witnessed major changes in the direction of government policies. Land reform measures for redistribution of land were on cards. In the late 1960s and in early 1970s, poverty eradication and village oriented development programmes were launched. Banks were nationalised to ease the availability of credit for the poor and also help development of farming, rural transport, electrification and other infrastructural sectors. This second phase of development along with the first phase (introduction of irrigation and technology) produced the following effects:

a) Productivity levels rose. Some amount of surplus of produces with the rich farmers was realised; and, dependence on market for input / output rose. The significance of government policy increased.
b) The pace and degree of monetisation and marketisation went up hand in hand.
c) The rural people, who were earlier mostly producing for self-consumption, were thrown to look up to the tyrant markets. For majority of their production and consumption needs, the rural masses began to depend on markets. Thus, gradually the concept of self-reliance was redefined as not having every requirement sufficient, but having sufficient purchasing power to purchase all or most of their requirements. But, after 1980s, gradually the State decreased its support for rural economy by reducing public investment and fertilizer subsidy (Narayanamoorthy, 1995). Like many other development programs, the market also lured the rural mass. Of course, the richer among them could get more benefit, which they otherwise could not have got. The surplus production and transportation system certainly helped many sections of the Indian society.

d) The rich land owners were able to get higher prices for their produces, cultivate new crops, get higher income, buy lands and new technology, buy labourers in groups, turn to be the local money lenders, and eventually exercise more control on irrigation water also.
e) The poor landless labourers also got an opportunity to operate machines in agricultural and non-agricultural sectors, both within and outside the villages. They could get access to new facilities and products and
f) The urban counterparts could exploit the rural workers by paying relatively lower prices for agricultural produces for longer duration. The rural resources, which had not earlier entered into the market, started flowing to the urban markets. Some examples are: i) flow of food-grains ii) flow of surplus money to urban investments (there was a net surplus money outflow from rural areas) iii) flow of forest resources in the form of fuel wood. iv) flows of animal meat, milk etc. v) flow of commercial water both for drinking and irrigation purposes. Thus, the rural community based resources which were almost freely available (or at lower prices) to the rural masses were marketed and the people who can afford (through their better economic and political power) to pay a price were able to enjoy the consumption of those goods and services.

In the above context, the following trends became discernible:

a) Changes in the volume and direction of resource flows within village economy and
b) A net outflow of resources (human, animal and other natural) from rural areas to urban areas. The differential impact of these flows on the socio-economic development of caste and class groups was immense. These flows of resources, their direction and size are certainly conditioned by various macro-economic policies and rural socio-economic structures as well.

Various studies have attempted to trace the resource flows; estimate the size of flows, and, to understand and analyse their impact and implications on rural economy. These studies have followed different concepts, reference points of analysis, framework, and also methodologies.

Some (Sau, 1974) have analysed the patterns of flows of paddy to markets and found out that the farmers were not price maximisers. That is, the volume of outflow of paddy to urban market was greater when the prices were lower (particularly during post-harvest seasons) and vice-versa. This kind of apparently irrational behaviour was explained by such factors as absence of storage facilities with the farmers, urgency to repay accumulated debt and interest burden and attractive government procurement policies.

Mundle (1975), Mody (1981) and others have analysed the flows of a few agricultural and non-agricultural resources, using secondary data. Almost similar attempt was made by Thamarajakshi (1972), Venkataramanan and Prahladhachar (1979) and others, again using secondary data, but of course with longer period. These studies, with their main emphasis on terms of trade between agricultural and non-agricultural sectors,

identified different patterns in different periods. The results were also affected by the base year that was used to calculate the price indices. Mitra's work (1979) was on terms of trade and class relations. Sidhu (1994) and Pravin (1995) did similar exercise mainly to identify which sector (agriculture or non-agriculture) is facing favorable terms of trade and how this trend had been explained by agricultural marketing and pricing policies.

These studies, however, had not dwelled upon other basic and more important grass-root level details, which are required to thoroughly understand the dynamics of changing production and exchange relationships, and the actual resource flows between rural and urban sectors. These details are important to better understand the impact of macro-economic policies on the whole economy in general and the rural economy in particular. The macroeconomic policies and the socio-economic structure of the villages jointly determine the type and amount of benefit one could receive from the economic development. When the two sectors namely rural and urban sectors with different backgrounds, compete with each other for sharing all kinds of resources, the fact as to which sector would get more could be understood only by empirically studying the actual resource flows in detail.

It was in this context, an in-depth survey was first decided to go for accounting total resource flows between different groups of households within the village and between village and outside the village. Hence Census method was adopted and number of villages to be studied was limited to two. It is true that two villages can meaningfully represent only two agro-climatic regions. Villages in Tamil Nadu vary to a greater extent in terms of agro-climatic conditions as well as socio-economic conditions. However, it would be difficult for a single researcher to capture all the variations at a particular point of time. Therefore, first an agriculturally prosperous region was chosen. Agricultural prosperity can be decided by using different norms like yield per acre (for different crops), cropping intensity, irrigation intensity etc.. On these bases, Thanjavur District, also called 'rice bowl' of Tamil Nadu, appeared to be the agriculturally most prosperous district in Tamil Nadu. Many researchers including Beteille (1971) have also studied this district. This district was also observed to be unique in many aspects. Now this district has been trifurcated and named as Thanjavur, Tiruvarur and Nagapattinam districts. The study villages are found in Orathanadu and Thiruvarur taluks in the 1991 census. However, the undivided Thanjavur district is referred here as the study area.

Thanjavur District has received to a large extent the government interventions in the form of supply of irrigation water (for not less than 4-5 centuries), price polices and land reform measures. More than one third of surplus land (under land ceiling legislation) identified in the Tamil Nadu state are found in Thanjavur district. More than one third of the tenants (and the lands under tenancy) in the State are found in this district. And also, more than one third of the cases filed in the court of law on the tenants' eviction are also found in this district. A greater concentration of landless labourers and scheduled caste population and lands under absentee landlords and religious institutions are also found here.

In his study, Beteille (1971) has divided this district into two zones, namely, Old Delta Zone (ODZ) (east Thanjavur, now found in Tiruvarur and Nagapattinam Districts) and New Delta Zone (NDZ). The ODZ is irrigated for centuries, while the NDZ received irrigation facility since 1970 only. These two zones present very wide and interesting variations in the socio-economic aspects, in terms of land ownership pattern, caste composition, cropping pattern and so on. Hence, it was decided to select one village from each zone purposively. The pilot survey was done in a group of selected ten villages in each zone to know the major characteristics of the villages. The information collected confirmed the inter-zonal differences. Finally, two villages, one village in each zone with most representative characteristics of the zones were selected. They are Palamputhur from NDZ and Vengidengal from ODZ. Palamputhur is located on the road connecting Orathanad and Pattukkottai. Vengidengal is located on the road from Thiruvarur to Nagoor via Kangalancheri.

In the first survey (1982-1983), besides the background information on the study villages, information on the following major terms were collected from 265 households in Vengidengal and 290 households in Palamputhur village. They are: a) household identification b) demographic structure c) landholding pattern d) credit structure e) assets ownership pattern f) agriculture and animal husbandry production g) kind and cash receipts and h) kind and cash expenses.

These statistics were first used to group the households into three different sectors (on the basis of per capita net income and land area operated) and to assess the inequality in land and asset ownership. Secondly, the degree of dependence was worked out for each sector (groups of households on the basis of class and caste) on other sectors in the villages, and on outside the village for four activities namely production, consumption, asset formation and financial transaction and in two forms namely monetized and non-monetized flows. The results in the two villages are discussed below:

Vengidengal

a) The dependence of majority of the households on absentee landlords for their survival was very crucial as the absentee landlords (who belong to higher castes) owned about 90 per cent of the village land and cultivated through the paid managers (*Kariyadhars* - mostly the landlord's relatives or belonging to higher caste). A very large proportion of the agricultural produces was transported to urban areas where the absentee landlords lived.
b) The degree of dependence on the village economy was not very significant.
c) Of the total flow of resources, the share of asset formation and financial transaction was very little and
d) The greater degree of absentee landlordism, tenancy and landlessness among the native households had resulted in greater incidence of poverty and very little scope for future development.

The above situation in Vengidengal led to suggest that unless some drastic (reform) measures are adopted to redistribute the landholdings (the major productive asset) in Vengidengal, there would be hardly any scope for perceptible improvement in the village economy, and the native households would either continue to reel under rampant poverty or desert the village in search of livelihood. The reform measures could be among others, (a) a large amount of public sector investment, so that sufficient off-farm employment could be generated and (b) the village lands must be redistributed among the tillers in the village.

Of the above two suggestions, the effects of redistribution of land on rural economy is relatively easier to assess. In Vengidengal, it was found out in the first survey itself that about 50 acres of land had been redistributed by a Non-Governmental Voluntary Agency (NGO) called Land for Tiller Freedom (LAFTI) to the then landless households. Owing to these reasons, the possible improvements were hypothetically assessed, assuming that the lands owned by absentee landlords were redistributed to the native households. It is interesting to note here that in resurvey of 1999-2000, it was found out that six landlords had sold away a larger portion of their lands to the LAFTI and the LAFTI has been able to sell those lands to native landless households. With the above reforms, it was found out that a substantial improvement could be achieved in the Vengidengal economy, through which the economic status of the households could also be improved. In the other study village namely Palamputhur, this measure was not required because of the absence of absente landlordism here.

Palamputhur

This village, dominated by small and native backward caste and landowners, presents entirely a different look as compared to Vengidengal. The findings in Palamputhur are presented here:

a) The degrees of dependence on the native village and on other sectors within the village for all the four activities are greater.
b) The asset and financial formation have shared substantial amount of resources and
c) The resource flow analysis indicated the existence of a greater potential for development in the future.

Re-survey

With these background details about the villages in the early 1980, the present resurvey was planned. In the last 15 years, with liberalization, privatization and globalization policies, many changes in policies and programmes have been observed. To put it briefly, Indian government has, with deliberate policy package, started to reduce public investment in villages, input subsidy etc. and expected the village economies to depend more on the market. These macro-economic policy changes are bound to have their impact on the village economy. The following are some of the changes observed at the national level, which however may vary from region to region or even village to village:

a) Enhancement of non-farm employment
b) Enhancement of water market both for drinking and irrigation purposes and
c) Increased dependence on urban markets for both the purchase of the requirements and sale of the agricultural outputs

These macro and micro level changes are expected to influence the characteristics of the villages, relative position of different groups of households, their production and exchange relationships and also their relationship outside their native village economy.

These expectations prompted the researchers to make a resurvey of those two villages. On the whole, there was no much change made in the questionnaire. The re-survey was done in Palamputhur first in 1998-1999, followed by Vengidengal 1999-2000 (Agriculturally these two years were in no way different from other years in the study villages).

An Overview of the Changes

The aim of the resurvey was tracing the changes during the period between 1982 (first survey) and 1998 (second survey). The following are the major village-wise changes observed during the survey.

Aspects	Palamputhur	Vengidengal
Infrastructure	Yes	Yes
Mechanisation	Yes	Yes
Dependence on PDS	Yes	Yes
Employment Pattern	Yes	No
Cropping Pattern	Yes	No
Irrigation Sources	Yes	No
Village Resource Use Pattern	Yes	No
Landholding Pattern	No	Yes

Infrastructure

Now, Palamputhur looks very much developed in terms of road and other facilities. Unlike those days, now even the long-route buses stop nearby this village. Mini buses ply to this village from its taluk headquarters viz. Orathanadu. Metal road has been laid. Telephone connections are available. Television is a recent addition. Many motorised two wheelers now ply. People frequently go to the town. Students, relegating the low-cost government run Tamil medium school, get urban and English medium education. Poultry meat is often purchased in the town for meal. Workers have developed urban contacts. Their mobility has become easy and frequent. Due to the presence of bore wells, water for domestic purposes is available in plenty, if electric power is available. All these changes appear to have made people happier. Many new house buildings are found. Residents appear to welcome these changed situations. Some of the above changes are also, though not in similar proportion, observed in Vengidengal. The quality of road has improved and bus frequency has gone up. This however does not seem to have very much influenced the village economy or the people's mobility.

Not many students or workers go out of this village. It is felt that the improvement in the transport facility whatsoever observed is not due to the pressure emerged from this village, but other villages on the route between Tiruvarur and Nagoor (via Kangalancheri). Absolutely no individual has constructed new house in the last eighteen years from 1982. Water scarcity is very acute, both for drinking and bathing purposes.

Mechanisation in Agricultural Operation

Increased use of capital equipment is observed in both the villages. Machines are largely used for most kinds of agricultural activities. Due to the absence of good quality water, there is no bore well in Vengidengal and hence no pump-sets. Canal water is the only source of irrigation. However, in Palamputhur, the bore-wells have attracted the energised pump-sets. Government has installed four deep bore wells for irrigation. They irrigate large areas and the villager's manage them. These increased use of pump-set and under-ground water seem to have very well raised the income generating capacity of the farmers. New crops like soya-beans are raised now using the bore-water. These bore wells have helped the farmers to go for long term, annual and perennial crops. Coconut trees have occupied large part of lands, which was used to cultivate paddy earlier. Machines are found everywhere in the village for cleaning the field channels and levelling the grounds.

Dependence on Public Distribution System (PDS)

In both the villages, the degree of dependence on PDS particularly for rice, kerosene and sugar has substantially increased. Kerosene is largely used for lighting purpose in Vengidengal; while in Palamputhur, this is for cooking purpose. Many households in Vengidengal do not have electricity connection; it is not so in Palamputhur. Sugar has replaced *jaggery*. Fuel wood has become relatively costly and hence the demand for kerosene (due to its other advantages including less carbon in the vessels) has increased in Palamputhur. PDS rice is perceived to be very cheap (despite its poor quality and time involved in collecting the rice from PDS) by the villagers. They sell most of their paddy after their harvest to the Direct Procurement Centres (DPCs) and buy rice from PDS. Strangely enough, even big landlords buy rice in the PDS. One landlord is reported to use PDS rice for feeding his cattle. Non-availability of storing-space inside the house could also have caused immediate sale of paddy.

Consumption Pattern

Rao (2000) has reported changes in the consumption pattern of village households. Rise in the consumption of processed food is observed. Purchase of vegetables and meat from the town is frequent. Consumption of fish caught in the local water sources and poultry appears to have increased. Observing this trend, a local postgraduate student established a poultry farm. He felt that there was substantial demand for poultry meat to stabilise the business. But he had to close-down the business as he was unable to collect the money from the buyers, most of who happened to be his own relatives and friends in his village. The consumption patterns in Vengidengal have not undergone major changes. In

Palamputhur so far there are many households with television-sets but there is no cable connection, while in Vengidengal a person from Nagoor has established a cable network.

Employment Pattern

Non-availability of sufficient jobs in the rural areas, increased demand for money for buying the marketed goods and services and relatively better wage conditions existing in non-farm sector have made the rural labour force to seek employment in the non-farm sector. These changes in the last two decades have been observed by many (Pravin and Basant, 1994, Iyyampillai and Jayakumar 1997). This has had impact on other aspects like land price, land transactions, investment and consumption pattern and so on. More than fifty persons in Palamputhur have spent (at least Rs. 50,000 each, mobilised by selling their assets) on going abroad, particularly to gulf countries and they have earned a substantial amount. The earnings from other countries have been used for purchasing lands (perhaps compensating the lands lost earlier) building terraced houses, purchasing modern consumer durables (particularly TV) and motorised vehicles and for investing in chit funds. In Vengidengal these changes do not seem to be very significant. Generally, the shift in employment has saved and enriched some.

Cropping Pattern

The cropping pattern has changed mostly in favour of long term, annual and perennial crops. A new crop namely Soya-beans has replaced partly the paddy crop both in the tank irrigated area as well as well irrigated area. *Kavalai* (a lift irrigation method using animal power) has completely disappeared. Soya-bean is cultivated in the *kavalai* irrigated areas.

The following factors seem to have in general caused the present changes in cropping pattern:

1. Shift of labour supply from agriculture to non-agriculture.
2. Influence of new irrigation technologies which can supply water for the whole year, unlike the earlier (tank and open shallow wells) sources.
3. The arrival of new and more remunerative crops suitable to their lands and
4. Free and adequate availability of rice in PDS at lower prices (this has enabled the farmers to avoid the paddy crop that was earlier raised for their consumption).

Excepting the last one, the other three are not found very much in Vengidengal. It is generally felt that all the lands in Vengidengal are suitable only for raising paddy crop and nothing else. A dynamic brahman farmer reports to have tried different crops, but in vain. Therefore, though the paddy cultivation is very much felt by many to be an uneconomic proposition, they have no other alternative. Barring a few landlords, who keep a small quantity of paddy for their self-consumption, many sell out paddy in Direct Procurement Centres (DPCs) and ultimately they depend on PDS for their rice consumption. Absence of storage facility with them, pressing burden of loans, the possibility of selling the paddy at DPCs and purchase of rice at subsidised prices at PDS are stated to be some of the

reasons for the sale of paddy immediately after the harvest, when the prices are relatively lower. They are called 'non-profit maximising farmers' by Sau (1974).

Irrigation Sources

Palamputhur has got low-lying and upper-level lands almost in equal proportion. The system tanks found there can irrigate the first category. While the second category was unfit for tank irrigation, hence earlier depended on lift irrigation with a little water and for a very short span of time (due to the absence of power, energized pump-sets and deep bore digging technologies). Now the system tank water is felt to be undependable and inadequate, hence low-lying areas are cultivated with coconut trees. The upper-level lands are irrigated by energised pump-sets that draw ground water from deep bore wells. In Vengidengal no change is found; only the canals continue to be the single major source of irrigation.

Village Resource Use Pattern

Palamputhur appears to have made a better account of resource management, thanks to the villagers' co-operation and the initiative shown by the village *panchayat* president (actually the president being a young unmarried woman, her father is looking after the activities unofficially). The village has tried to tap all the possible sources to mobilise money which is used for many developmental works and sometimes cultural festivals (on 30th April 1999 for a temple festival, the famous Tamil play-back singer Ms. L.R. Eswary was brought and about Rs. One lakh was spent on that day from the fund which was supposed to go to the village fund. In the year 2000, Ms. P. Suseela was invited for their function. This money was stated to be the donation from a tailor who is now running his business very successfully in Mumbai). Money is mobilised by collecting penalties from the illicit arrack sellers, selling the community village resources like trees, fish etc. and also selling the water of the community bore wells. They say now they have surplus fund. *Kallar* caste, the single major cultivating caste in Palamputhur, evinces much interest in building up the village fund. Vengidengal presents a very poor picture in this respect too. In Vengidengal, the fish caught in their ponds are consumed by themselves. These pond have not been desilted for many years.

Landholding Pattern

Though substantial land transactions have taken place (as they were earlier, but in terms of value of money involved, it is now disproportionally higher) in Palamputhur, there does not seem to be a clear direction from one category to another, either in farm-sizes or in the castes. In Vengidengal a clear-cut direction is observable. As already noted the households of rich land owning communities [particularly *brahmins* and *mudhaliyars*] started losing their interest in cultivation, as they could easily manage to make more money from profitable non-farm activities outside the village. Hence, they were cultivating their lands either by the tenants or through the paid supervisors (mostly their close relatives or upper caste friends). Sub-renting practice has also existed.

In the last two decades, there does not seem to have happened any great improvement in the productivity of paddy crop, (the dominant crop) or in land quality. Hence, actually there has been a down-fall in the importance attached to the land by the absentee landlords (who own more than 90 per cent of village lands) and by the native landlords. However, the non-land owning tenants and agricultural labour households have been land hungry for a long time. During the first survey, many of them hoped that the land reform measures would be sooner effectively implemented and they would get some land for their own cultivation. However, so far (excepting what had happened before the earlier survey) nothing of that sort seems to have happened.

Recently in the year of 1991, LAFTI has entered into this scene. The LAFTI has purchased land from six absentee landlords [mostly *mudhaliyar and brahman*] and sold one acre per family at the rate of Rs. 12,000 per acre on long instalments with a subsidy of Rs. 5,000 (subsidy for SC people only). If any of them want more lands, land will be made available to them without any subsidy. In this way, more than hundred households have become landowners. Though their hunger has been to some extent satisfied, they are reported to find it very difficult to mobilise funds for agricultural operation expenses.

Thus, unable to repay the borrowed money to the lenders of Nagoor for agricultural operations, some of them have mortgaged even all pieces of land obtained through LAFTI. With all limitations, certainly some households, which otherwise would not have owned even a small piece of land at all in life time, could own land, and in their view could go up in the social and economic status. Now these new owners report (and also personally witnessed by the researchers) that it is below their dignity to work in others' lands for wage, rather they prefer to be idle. It is a surprise that in this delta region there is no much demand for land even at low price of Rs.12,000 per acre.

Conclusions

With growth and development, changes in the structure and functions of the economies are unavoidable. The changes may bring good or bad results. As far as the study villages are concerned, the changes happened in the 20 years period from 1980 to 2000 appeared to have improved the living conditions of the villagers. Of the two, Palamputhur has significantly improved, while the other village, namely Vengidengal is not so. The reasons for the differences in the development patterns appear to be the differences in the basic socio, economic and agrarian structures of the villages. Palamputhur with more equitable resources has developed faster, while Vengidengal with inequitable resource ownership has missed the path. That is why the equitable asset ownership is advised as a prerequisite for achieving sustainable economic development. The economic and political history of the major countries in the world shows more and more skewed distribution of asset and income, which may create more stress for larger section of people. And, achieving peace and harmony would remain a dream.

References

1. Beteille Andre, (1971). Caste, Class and Power, Berkley, Los Angels, London.
2. Iyyampillai S & N Jayakumar, (1997). Non-farm Employment and Income in Rural Tamil Nadu: An Analysis of Macro and Micro Level Data, Political Economy Journal of India, 6(3 & 4), pp.136-143.
3. Mitra Ashok, (1979). Terms of Trade and Class Relations, Rupa & Co., Calcutta.
4. Mody Ashoka, (1981). Resource Flow Between Agricultural and Non-agricultural Sectors In India, Economic and Political Weekly, 16(10,11,12), p.424.
5. Mundle Sudipto, (1975). Intersectoral Flow of Consumer Goods: Some Preliminary Results, Economic and Political Weekly, pp.165-174.
6. Narayanamoorthy A., (1995). Is Urea Decontrol Needed?, Manistream, March 18, pp.22-24
7. Pravin Visaria, (1995). Rural Non-farm Employment in India: Trends and Issues for Research, Indian Journal of Agricultural Economics, 50 (3) pp.398-409.
8. Pravin Visaria and Rakesh Basant et al., (1994). Non-agricultural Employment in India: Trends and Prospects, Sage Publication, New Delhi.
9. Ranjit Sau, (1974). Some Aspects of Inter-sectoral Resource Flows, Economic and Political Weekly, 9(32, 33,34) pp.1277-1285.
10. Rao C H H., (2000). Declining Demand for Foodgrains in Rural India: Causes and Implications, Economic and Political Weekly, 35(4) pp.201-206.
11. Sen A K., (1981). Poverty and Famine: An Essay on Entitlement and Deprivation, Oxford University Press, New Delhi.
12. Sidhu D S., (1994). Some Aspects of Agricultural Marketing and Pricing Policies in India, Presidential Address, 50th Annual Conference of Indian Society of Agricultural Economics, Haryana Agricultural University, Hissar.
13. Thamarajakshi R., (1972). Intersectoral Terms of Trade and Marketed Surplus of Agricultural Produce, 1951-52 to 1965-66, in Pramit Chaudhuri, Indian Agricultural Development George, Allen and Unwin, London.
14. Venkataraman L.S. and M. Prahladachar, (1979). Inter-sectoral Terms Trade and Marketed Surplus of Agriculture 1964-65 to 1973-74, Paper presented at the Indo-Hungarian Economists Seminar, February 26-28, Lonavia.

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News and Notes

THE INDIAN GEOGRAPHICAL SOCIETY

Department of Geography, University of Madras, Chennai – 600 005

Conduct of 2nd Talent Test - 2012 for Geography Students on 22nd February, 2012

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The Indian Geographical Society is organising the state wide **Second Talent Test - 2012** for final year UG and PG students of the Geography Departments in Tamil Nadu on **22nd February, 2012**. The Executive Committee of the Society has identified the following coordinators to organise this event successfully with the support of Principals of the respective colleges and Heads of Geography Departments.

Regional Coordinators

1**. Dr. G. Bhaskaran (Chennai Region),**
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5. **Prof. G. Jagadeesan (Salem Region)**
Professor and Head, Department of Geography, Government Arts College (Autonomous), Salem- 636 007, ***Mobile:*** *94432 02011*

Prizes will be awarded to the winners of Talent Tests during ***87th IGS Annual Conference*** to be held at Department of Geography, University of Madras, Chennai on Saturday, the 24th March, 2012 (Saturday). All other participants will be given Certificate of Participation. Please visit IGS website for registration forms and further information: http://www.igschennai.org

Details of Awards and Prizes

Prize	Award and Prize Amount	
	UG The IGS Founder Prof. N. Subrahmanyam Award	PG Prof. A. Ramesh Award
I	Rs. 5,000/-	Rs. 7,000/-
II	Rs. 3,000/-	Rs. 5,000/-
III	Rs. 2,000/-	Rs. 3,000/-

The ***International Workshop on Environment and Waste Management: Problems and Issues*** and ***the Annual IGS Meeting*** were held on 23-24 March, 2012 (Saturday) at Department of Geography, University of Madras, Chennai. The Chief Guest of the event was **Prof. Er. S. Panchanathan**, the Former Chief Engineer, Public Works Department, Government of Tamil Nadu and Former President of the Indian Geographical Society. Along with him are **Prof. N. Sivagnanam**, Former Professor and Head, Department of Geography, University of Madras, Chennai and **Dr. K. Devarajan**, Director of School Education (Examinations), Government of Tamil Nadu, Chennai. Other dignitaries include **Dr. R. Jaganathan**, Professor and Head, Department of Geography, University of Madras, Chennai and Secretary of the IGS, **Dr. K. Kumaraswamy**, Professor and Head, Department of Geography, Bharathidasan University, Tiruchirappalli and Editor of the IGJ, **Prof. V. Madha Suresh**, **Dr. R. Bhaskaran** and **Dr. M. Sakhtivel** of Department of Geography, University of Madras, Chennai. The winners of the Talent Test are also standing on the last row of the Top Right Photo.

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I, K. Kumaraswamy, hereby declare that the particulars given above are true to the best of my knowledge and belief.

Dr. K. Kumaraswamy
Editor, The Indian Geographical Journal