ASSESSMENT OF BAMBOO GROWING AREAS IN UMSNING BLOCK, RIBHOI DISTRICT, MEGHALAYA, USING GEOSPATIAL TECHNOLOGY

A major project

Submitted in fulfillment of the requirements for the award of the degree of M.Sc. in Remote Sensing & GIS

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M.Sc. REMOTE SENSING AND GIS

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CERTIFICATE

This is certifying that the JOONMANI DEKA, 4th Semester student of the department of Remote Sensing & GIS has successfully carried out his dissertation work entitled **"ASSESSMENT OF BAMBOO GROWING AREAS IN UMSNING BLOCK, RI-BHOI DISTRICT MEGHALAYA, USING GEOSPATIAL TECHNOLOGY''** under my internal supervision. This work to the best of my knowledge, is originated and has been carried out at Dept. of Space North Eastern Space Application center, Umiam- 793103

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[Internal Project Guide]

DECLARATION

I, JOONMANI DEKA a bona fide student of M.Sc. in Remote Sensing & GIS in North Orissa University, Baripada, Odisha would like to declare that the dissertation entitled "ASSESSMENT OF BAMBOO GROWING AREAS IN UMSNING BOCK, RI-BHOI DISTRICT UMSNING BLOCK, RIBHOI DISTRICT, MRGHALAYA USING GEOSPATIAL TECHNOLOGY" Submitted by me in partial fulfillment of the requirements for the award of the Degree of Master of Science in Remote Sensing & GIS in my original work. I declare that this written submission represents my ideas in my own words and where others Ideas or words have been included, I have adequately cited and referenced the original sources.

Date: JOONMANI DEKA

Place: R.S. & G.I.S.

ACKNOWLEGEMRNT

First and foremost, I respect and thank **Dr. P.L.N. Raju,** Director of North Eastern Space Application Centre, Umiam, Meghalaya, for providing me an opportunity to do the project work and giving me all support and guidance which made me to complete the project. I am also thankful to him for providing such support and guidance.

I would also like to extend my deepest gratitude to internal guide **Mr. Debabrata Nandi** Head of the dept. department of Remote sensing and GIS. North Orissa university, Baripada (Odisha).

I would also like to extend my project guide **Dr. K.K. Sharma**(scientist/Engineer SG) of North Eastern Space Application Centre.Umiam, Meghalaya.

I owe my deep gratitude to my project mentor **Miss. Haobam suchitra Devi,**(scientist/ Engineer SE) of North Eastern Space Application Centre. Umiam, Meghalaya. who took keep interest on my project work and guided me all along, till the completion of my project work by providing all the necessary information for developing a good project work. I am also thankful to her for providing such support and guidance.

I would like to thank to **Mr. Bhrigu kumar kalita**(project asst. NESAC) helped me to complete directly /indirectly in my project work.

Finally, I would like to take this opportunity to thanks my family, friends, and all the people who have contributed towards the completion of this project.

Above all, I thank Almighty God for his blessings.

Joonmani Deka.
(M.S.C.R.S. & G.I.S)

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LIST OF ABBREVIATION

LISS-:Liner Imaging self – (Scanning Sensor)

NIR: Near Infrared

SWIR: Short –Wave Infrared

TM: Thematic Mapper

USGS :United State Geological Survey.

ETM: Enhanced Thematic Mapper.

ASSESSMENT OF BAMBOO GROWING AREAS UMSNING BLOCK, RI-BHOI DISTRICT, MEGHALAYA, USING GEOSPATIAL TECHNOLOGY

ABSTRACT

India has the second largest reserve of Bamboo population in the world. Distribution, growth and productivity of commercial edible bamboo species of northeast India. Bamboo is an important natural fastest growing plant with wide scale application in paper industries, Medicines, constructions industries. Forest of Meghalaya are richly endowed with bamboo species which are put to varied uses by local tribal communities. Umsning is block where forest is abundant and its Multiple purposes play a vital role in the social and economic development of the local folks. The livelihood of a significant amount of population Handicrafts made from Bamboo. Geospatial technology refers to all of the technology used to acquire, manipulate, and store geographic information. GIS is one form of geospatial technology. GPS, Remote sensing & Georefrencing are other example of geospatial technology. Bamboo is the fastest growing canopy for the re-greening of degraded land and its stands release 35% more oxygen then equivalent stands of trees. Some bamboo even sequesters up to 12 tons of carbon dioxide from the air per hectare. bamboo is one of the strongest building materials. Bamboo shoots provide nutrition for millions of people worldwide. Bamboo is a mystical plant a symbol of strength, flexibility, tenacity, and endurance. The umsning is a block of Ribhoi district, in Meghalaya. there people are basically depending upon agriculture, they can destroyed bamboo plant forest for using jhum cultivation. The study was carried out using multi temporal satellite data of 2009,2014, and 2018(sentinal2, Landsat TM and Landsat ETM imagery) for mapping the distribution pattern of Different bamboo cover changes over a period of years (2009 to 2019). the study area also observed bamboo cover decreased 2009 to 2018. there are various regions of decreased bamboo cover changes over a period. Bamboo is a high –yield renewable resource. Therefore, analyzing and monitoring the distribution pattern of bamboo is required developed conservation and management of the natural forest resource. Various uses, advantage, disadvantage of bamboos in a study area and overall India.

Keywords: Bamboo species, Bamboo density, Bamboo shoots, Traditionally craft, Income source, Marketing. Bamboo pattern, Remote sensing.

CHAPTER -1

INTRODUCTION

Bamboo is one of the fastest growing tress on earth. bamboo is generating carbon credits and its helps in climate change mitigation. Carbon credits can become the source of additional income to farmers. Bamboo is an important natural resource for the north eastern region of India. Bamboo As a beautiful plant, bamboo has developed a survival strategy in nature with its efficient structure through million years of evolution. It has been used by man as a useful material worldwide since the beginning of human civilizations. In many countries bamboo has played an important role not only in everyday life culture but also in art, literature and philosophy due to its elegant shape, practical utilizations and symbolic meanings.. Bamboo has been used traditionally since ancient period for the construction of houses in rural area. Recent advancement in method of construction of bamboo houses available in the literature, reflects the efforts towards better utilization of mechanical properties of bamboo. Bamboos are multipurpose plats, widely harvested from natural forest and also cultivated. bamboo is an important natural resource which plays a vital role for maintaining socio- economic activities. bamboo as materials for building came from the same time that human being tried to use wood for their building. Bamboo with its multifarious utility plays an important role in food and nutritional security of the tribal population in north-east India besides Industrial value. Bamboos are multipurpose plants, widely harvested from natural forest and also cultivated. Their uses are dependent upon the characterticts of individual species such as culm strength, flexibility and size. bamboo is ability to protect against soil erosion & the high nutritive value of their leaves of their leaves

and shoots. bamboo is a economically and ecologically important plan and they merit serious attempts to Meghalaya is richly endowed with the bamboo forest. People harvest bamboo from the areas belonging to their respective communities. The harvested bamboo is used for the following purposes:

a) Household use of the village.
b) Making handicrafts.
c) Selling bamboo of poles in the villages and city markets
d) Selling bamboo as raw material to the paper mills located in the adjoining state of Assam.

Bamboos are one of the most difficult groups of plants to identify. Bamboo as a material for building came the same time that that human being tried to use wood for their buildings. There is various architecture use human being in daily life. They are –

a) Bamboo bridge.
b) Furniture.
c) Bamboo chain.
d) Bamboo bed.
e) Household tools.
f) Baskets.
g) Fishing tools.
h) Bamboo brush
i) Music and Dancing Instrument.
j) Artwork.
k) Bamboo wall.

l) Bamboo house.

m) Bamboo bag.

Bamboo is one of the most important resources, it is mainly distributed in tropical and subtropical regions, with a few species found in temperate and frigid regions. The bamboo plant use for watershed protection and soil remediation .it retains water in the watershed, reduce runoff, sustains riverbank and helps mitigate water pollution due to its high nitrogen consumption. Bamboo is pioneering plant and can be grown in soil damaged by overgrazing and poor agriculture technique. Using bamboo to replace timber saved the rainforest. Remote sensing, with its synoptic coverage and finer spatial, spectral, temporal and radiometric resolution, is found to be an effective tool for collecting information on forest resource (Sarma et. al. 2015) Remote sensing provide a systematic, synoptic view of earth cover at regular time interval useful for changes in land cover and to revels aspect biological diversity directly (Hall, et., 1998; Roughargarden et.al; 1991; turner et al; 2003 and Goward, et. al. 2004; Kumar et al 2010). Satellite imagery helps to detect changes in land cover and in the monitoring of the forest. Now a day many airborne and satellite sensors with high spatial and spectral resolution are available for studying land cover changes over a period of time. Ribhoi district is one of district of Meghalaya which came into existence and assumed the hierarchical status of the district on 4th June 1992 by upgrading the former civil Sub-division. Bamboo is an important plant of rural people. Rural people using business and income source. Although most bamboo resource grow naturally, greeter attention has been paid the recent years to the established of planet bamboo. Bamboo is an integral part of forestry and a major non wood forest product. Meghalaya is richly endowed with the bamboo forests. Umsning is also abundance and multiple uses have led bamboo to

play a vital role in the socio-economic and cultural life of the tribal people of the block.

- There are various advantage of bamboo-
    - Light in weight and environmental friendly material.
    - Very cheap and easily available in ample quantity.
    - One can grow/cultivate and procedure in the farm.
    - Fast growing.
    - Highly productive.
    - Earthquake resistance.
- There are various Disadvantage of bamboo plant-
    - Bamboo requires to preserve otherwise over time it may perish and loose its strength.
    - Bamboo has its natural shape which is not uniform.
    - Bamboo gets attacked by fungi, insects so coating needs to apply.
    - Always joints are week in bamboo.
    - Need advanced guidance, details study and codes.
    - They are not fire resistance but helps fire so dangerous to use in fire prone zone.

Forest paly a dual role by providing forestry and wood based natural resources for food. Bamboo is highly versatile. It is capable of growing in a variety of soils derived from different parent rocks, within its climatic habitats. Bamboo has also been planted on a large scale along roadsides and canals. It is also planted in degraded forest areas particularly near habitations. This can also be planted on

agricultural fields and homestead plantations. However, no reports available so far, about the performance of bamboo in social forestry. The present work was undertaken to assess the performance of bamboo in various programmes of social forestry in India.In social forestry programmes bamboo is grown mainly in the following systems.

1) Strip plantation.

2) Community forestry programme.

3) Agroforestry plantation.

4) Rehabilitation of degraded forest.

5) Reclamation of wastelands.

Bamboo is a strong, fast growing and very sustainable material, having been used structurally for thousands of years in many parts of the world.Bamboo is a form of grass and can grow up to 25m in six months2. Each culm emerges from the ground at its final diameter (i.e. its girth does not expand during its life), tapering as it increases in height, and growing vertically through cell-division "telescopically" between the nodes (i.e., the distance between nodes increases as it grows). Once fully grown, culms typically take three to five years to mature to full strength, during which they experience silification and lignification. After a period of five to six years, the culm's strength begins to deteriorate

1.1 Research objectives

The main aims and objectives of the research are as follow-

- **AIMS.**
  a) How many Bamboo cover area in study area⁉
  b) Why increase and decrease Bamboo forest cover changes of study area.
  c) Uses of bamboo species in study area.
- **OBJECTIVES.**
  a) To map the bamboo growing areas of Umsning block.
  b) To Detect the Bamboo, cover change of study area over a period of time.

CHAPTER-2

LITERATURE REVIEW

Remote sensing provides real time data, with the help of real time information improves the prospectus of vegetation changes (Roy and Das,1991).in the recent years, remote sensing coupled with geographical information system(GIS) serves as a potential tool for monitoring the forest and also the changes in forest cover at global scale.it helps in identifying the conservation priorities in global hotspots rate of deforestation and quantification of overall forest cover loss at finer scale (Kumar,2011). Forest resource evaluation using remote sensing provides us with three tire of information, namely (1) the spatial extent and spatial Dynamics of forest cover, which is helpful in assessing forest cover (2) forest types and (3) various other biophysical and biochemical properties(Boyedet.al.2005). Deforestation and fragmentation are important concerns in managing and conserving tropical forest and have global significance. In the Indian context, in the last one century, the forest has undergone significant changes due to several policies undertaken by government as well as increased population pressure (Reddy et.al. ,2012). The expansion of city often takes place with the conversion of available forested areas, resulting in loss of ecological services that the forests provide (Rachna y and Anamika B, February 24,2016).

Digital image processing gives wider possibilities for improving the visual quality of images. The main objectives of image enhancement is to manipulate pixel values and generate appropriate original image for specific applications (Maini and Aggarwal,2010).

Remote sensing data is very useful for classification of forest. Visual images interpretation plays a major role to map the objects due to a prior knowledge and control over the class values for polygons of the project (Chakraborty, et.al.,2009). Finding object is easier after correlating with ground experiences and multitemporal satellite imagery.

Forest degradation is mainly due to anthropogenic disturbances. Degradation of forest cover is a complex process, with possibility of ecological reversibility and a strong interaction with climate fluctuation (Lambin,1999). Forest degradation is a process of 'temporary'or permanent worsening in the density or structure of vegetation cover or its species composition (Grainger,1993).

Satellite remote sensing provides a wider range of temporal images allow detection of land cover changes over a period of time. The ability of this technology to give synoptic and repetitive coverage gives important benefit over traditional methods of mapping (Chauhan,et.al., 2003). Land use land cover changes have also undesired or useful effects on the environment deserve special attention (Chakraborty, et.al.2009).

Forests play a due role by providing forestry and wood based natural resource for food, energy and development thus acting as source and at the same time regulate the environment by sequestering carbon dioxide gas emissions, herby acting as sink. Forest is natural resources which is not only a source of biomass-based materials but also has cultural, spiritual and religious values associated with it (Sharma,2009). It also plays a vital role in maintaining the ecological balance and environment setup.

An International policy workshop on "Bamboo in Fisheries" was organized by Centre for Indian Bamboo Resources and technology (CIBART)India at National

Institute of oceanography, Goa on 30th Sept -1st Oct; 2004. The present author presented a technical paper related to innovative bamboo products for fisheries sector and coastal areas. In this workshop recommendations related to fisheries gear, packging water transportation and local bamboo resource utilizations and fisheries sector have been done. The need of demonstration and improvement in the application of bamboo for raft and packaging as suggested in the paper is recommended in the workshop.

Ali Awaludina, Viki Andriania,"Bolted Bamboo Joints Reinforced with Fibers,2nd International Conference on Sustainable Civil Engineering Structures and Construction Materials 2014 (scescm
2014), Procedia Engineering 95 (2014) 15–21.

In this study, connections in bamboo constructions are regarded as the weakest parts and have hindered the optimal utilization of excellent bamboo engineering properties were studied in this work. This paper discussed development of various methods of bamboo jointing, including the authors' proposal where Fiber Reinforced Plastic (FRP) in the form of sheets is used to improve the structural performance of bolted bamboo joints.

The test results showed a significant increase of join slip modulus and lateral load capacity of the bolted bamboo connections due to wrapping effects when they are reinforced with FRP sheets,especially the overlap joint, Atul Agarwal, Bhardwaj Nanda, Damodar Maity, "Experimental Investigation on Chemically Treated Bamboo Reinforced Concrete Beams and Columns", Construction and Building materials 71 (2014) 610–617, 26th September 2014.

In this study, the feasibility of usage of bamboo of usage of bamboo as reinforcement in concrete has been evaluated through a series of experiment

investigation on of various beams and column. The bamboos were chemically treated. The tests performed on specimens were tensile test on bamboo specimen, pull out test of bamboo slats embedded in concrete, axial load tests an d transverse load test on BRC columns and 2-point load test on BRC beams. It is observed from pull out test that the bonding strength of the treated bamboo concrete composite is highest for Sikadur 32 Gel among the other adhesives composed. From the axial load test it is observed that, the plain concrete and untreated bamboo reinforced concrete show brittle behaviour and shows little warning before axial failure whereas treated bamboo reinforced concrete column with Sikadur 32 gel shows ductile behaviour and gives warning before failure. It is found that treated BRC column with 8.0% bamboo reinforcement provides same strength and behavior as per with reinforcement concrete column with 0.89% steel. From all these test we got to know that bamboo has the potential to substitute steel as reinforcement for beam and column members. Bhavna Sharma, Ana Gatóo, Maximilian Bock, Michael Ramage, "Engineered Bamboo for Structural Applications", Construction and Building materials 81 (2015) 66–73, 23rd February 2015.

The experimental work characterizes the mechanical properties of two types of commercial products: bamboo scrimber and laminated bamboo. The study utilised timber standards for characterization, which allows for comparison to timber and engineered timber products. The results of the study indicate that both products have properties that compare with or surpass that of timber. Bamboo scrimber and laminated bamboo are heavily processed before testing. Future work includes investigating the influence of processing on the material properties. In particular, the impact of heat treatment performed on the material to achieve a caramel color. A

comparison study on natural colored bamboo will provide better understanding of the effects of heat treatment on the strength of the material. The beam section can be optimized to take advantage of the high flexural strength to density ratio. Research on the influence of the orientation of the original board on the stiffness will also allow for further optimization. Further investigation of the influence of moisture and the density on the mechanical properties is needed to provide a foundation from which to develop design characterization factors for engineered bamboo. Additional testing of full- scale specimens would also elucidate any effects in comparison to small clear specimens, as well as allow further comparison to timber and provide an additional step forward towards construction.

Humberto C. Lima. Jr, Fabio L. Will rich, Normando P. Barbosa, Maxer A. Rosa, Bruna S. Cunha, "Durability Analysis of Bamboo as Concrete Reinforcement", Materialsand Structures (2008),
published online on 12th September 2007.The experimental work on the bamboo species Dendrocalamus giganteus showed that the bamboo tensile strength is comparable with the best woods used in constructions and even with steel. The tensile stress Vs strain curve of the bamboo is linear up to failure. Bamboo average tensile strength is approximately 280 MPa in the specimens with node. Finally, 60 cycles of wetting and drying in solution of calcium hydroxide and tap water
did not decrease the bamboo tensile strength neither the Young's Modolus.
Leena khare, "Performance Evaluation of Bamboo Reinforced Concrete Beams", the University of Texas at Arlington December 2005.

This study evaluated the feasibility of the use of bamboo as a potential reinforcement in concrete structural members. To achieve this objective a series of

tensile tests were conducted on three types of bamboo followed by four-point bending tests of concrete beams reinforced with bamboo. The test results were compared with plain and steel reinforced concrete beams behaviour. Three types of bamboo used were: Moso (China); Solid (South America; and Tonkin (China). Based upon the tests conducted, the following conclusions are at the forefront.

In 1990 s, two large FAO/UNDP regional projects supported bamboo related work in Asia. The forestry research support programme for Asia and the pacific (FORSPA) and the improved productivity of Man-made forest through Application of Technology advances in tree breeding and propagation (FORTIP) project.

In Latin America ,in 2004, FAO supported a technical cooperation project in Colombia on industrial processing of bamboo (Guadua angustifollia). The objectives of the project were to support intensive harvesting of Guadua and to improve the production chain through feasibility studies and establishment of an industrial processing plant for bamboo, with the participation of small scale farmers.

Ghavami (1995) [7] discussed the mechanical properties of Bamboo, specifically pertaining to Bamboo in concrete. This study showed that the ultimate load of a concrete beam reinforced with Bamboo increased 400% as compared to un-reinforced concrete. It was found that, compared to steel, there was lower bonding between the Bamboo and concrete, and the Bamboo had a Modulus of elasticity 1/15 of steel. Bamboo's compressive strength was much lower than its tensile strength, and there was high strength along the fibers, but a low strength transverse to the fibers. Stated is the need for the development of a simple design code for the application of Bamboo as a construction material

The United States Naval Civil Engineering Laboratory (1966, 2000) reported a study providing a set of instructions on how to properly construct a variety of structures and structural elements using Bamboo. This study suggested not to use green, unseasoned Bamboo for general construction, nor to use un-waterproofed Bamboo in concrete. Concerning Bamboo reinforced concrete, it was found that the concrete mix designs may be the same as that used with steel, with a slump as low as workability will allow. It was Bamboo reinforced concrete is a potential alternative light construction method at a low cost.

Amada s., Y. Ichikawa, T. Munekata, Y. Nagase, and H. Shimizu. (1997) investigated the mechanical and physical properties of Bamboo. They conducted a thorough investigation into the structure and purposes of the nodes, which they found to strengthen the Bamboo Culm. They also commented on the advantage Bamboo has over other natural building materials with its fast growth rate.

Amada and Untao (2000) [3] studied the fracture properties of Bamboo. In contradiction to other studies, this study states that the tensile strength of Bamboo fibers almost corresponds to that of steel. The main discovery is that the fracture properties of Bamboo depend upon the origin of fracture. In the nodes, it is found that the average fracture toughness is lower than the minimum value of the entire Culm, suggesting that the fibers in the nodes do not contribute any fracture resistance.

A study reported in International Network for Bamboo and Rattan (INBAR) (2005) [8]compared Bamboo to other plants such as trees by looking at how fast it grows the basics of the plant, its habitat, its history and its modern uses. For instance, we see that the same height tree takes just as many years to replace as Bamboo takes

days. A single Bamboo clump can spread 15 km in its lifetime. Bamboo is the most diverse group of plant in the grass family and has tropical and subtropical distribution spreading from 46N to 47S latitude, giving many cultural uses for Bamboo.

A study reported in International Network for Bamboo and Rattan (INBAR) (2002) coordinated research and a project located in Costa Rica with the Technical University of Eindhoven as the supervisor, with the aim as Bamboo to be used as a building and engineering material. They found that their project in Costa Rica has become a success story due to the fact that it was "a local initiative and the staff was fully national." In 1999, 3 drafts were submitted to National Standard Institutes of 20 growing nations seeking support, which lead to having the drafts accepted as draft International Standard Organization texts in 2001.

CHAPTER-3
STUDY AREA

3.1 Location

Umsning is a village panchayat located in the Ri-bhoi district of Meghalaya state India. umsning blocks essentially consists of hilly area. The native language of study area is English and also most people speak khasi and English language. Ri-bhoi district headquarters are located at Nongpoh and Umsning is located 28 kilometers towards south from Ribhoi districts headquarters of Nongpoh. Umsnings block headquarters is Umsning C& RD block. Ribhoi district was carved out from the erstwhile east khasi hill district and lies between North Latitude 25 15’ and 26 15’ and between east longitudes 91 45’ and 92 15’. Distance between capital shillong to Umsning block 244 km towards east. Umsning consist of 62 villages and 62 panchayats. Total geographical area of block 1,189km2, including1,176.99km2rural area and 11.98 km2urban area. There are about 302 villages in study area. the geographical extent of umsning block is between latitude is 25º 45’10.4364’’N and longitude is 91º 53’40.0380’’E. Umsning Meghalaya, India 761 meters, height that is equal to 2,497 feet.

3.2 Topography

Umsning block is bounded by Mawryngkneng block towards South, Shillong block towards south, Ribhoi block towards North, Thadlaskein block towards east, Shillong, Jowai, Dispur, Guwahati are the nearest cities of Umsning. Shillong, Nongpoh, jowai, Dispur, Guwahati, are the near by important tourist destinations to see.Umsning block is a hilly area. The native language of Umsning is English and

most of the village people speak English. Umsning people use English language for communication.

3.3 Physiography

Umsning is a small block of Ribhoi district in Meghalaya, India. Ribhoi district is divided into three block. There are -

Name	Headquarters
Jirang	Wahsynon
Umling	Nongpoh
umsning	Umsning

Umsning block is a hilly area. Transportation connectivity is very low. In 1981 Ribhoi district became home to the Nongkhyllem wildlife Sanctuary, which has an area of 29km2(11.2Sq mi). the physiography of the micro-watershed is moderately undulating. The altitude ranges from a minimum of 560 m to a high of 860 m above mean sea level. In the lower reaches (valley land) the slope range from 0% to 60%,

Table: 3.3.1 physiographic details.

Elevation(m)	Slope range(%)	Order of watershed	Major Stream	topography
560 m to 860m	0% to 60%	Micro Watershed	Umpih %Umran	Moderately sloping

3.4Climate& Rainfall

The climate of umsning block is per humid subtropical. The whole year can be divided into four seasons- Summer, monsoon, (Rainy), Autumn and winter. The summer season extend from the last last part of march to Mid-May, and Rainy season is started in April/May and last up to October /November, through it rain intermittently for the whole year but this is the wettest period of the year. Autumn season start in Mid-October to November, the winter season which is extend to the start to March. Umsning block are average annual temperature is 20.7 ⁰ C. The average rainfall here 1000 mm to 2500 mm. Umsning block are in winter there is much less rainfall in study area than in summer. The Umsning block climate classified as Cwa by the Koppen-Geiger system.

3.5 Population

The study area is the Sub-group of the main khasi tribe people. Although they use the khasi dialect as a major subject in their schools. Umsning block of Ribhoi district has total population of 140,900 peoples as per census 2011.Out of total males 72,603 and female are 68,297. there were total 25,162 families residing in umsning block. There are 25,162 houses in the sub-district. The average sex ratio of umsning block is 941.umsning blocks are total density of population 93per Sq.km. the average Sex ratio of the study area is 941.The total literacy rate of umsning block is 74.21%. The male literacy rate is 57.95% and the female literacy rate rate is 58.2%in umsning block. The population of children of age 0-6 years in umsning block is 30641 which is 22% of the total population. There are 15605 male children and 15036 female children between the age of 0-6 years. Thus as per the census 2011 the child sex ratio

of umsning block is 964 which is greater than average sex Ratio (941) of Umsning block.

3.6 Soil &Agriculture

The soil of study area is various types of soil and each types of soils and each and type of soil has its own physical and chemical properties. Soil in the study area may broadly classified into hill and plain soils. There are soil is useful for jhum cultivation. There are main crop productions of study area –

Table: 3.3.2 Crop production of umsning block.

Crop	Area	Production
paddy	A-4378 ha.(winter) A-28 ha.(Jhum)	P-11820MT.(Winter) P-41 MT (Jhum)
Ginger	A-830 Ha	P-6638MT
Tea	A-440 Ha	P-2210 MT
Maize	A-1278 Ha	P-2888MT
Turmeric	A-72 Ha	P-317MT
Pine apple	A-633 Ha	P-7272MT

Umsning is a famous for with its agricultural businesses & a large iron processing plant. The soils are in general deep to very deep with loamy to clay in the surface texture. Soils are acidic in nature. Soils are generally well drained except in low land where water table fluctuate. There soils are more good vegetation cover, the area is

exposed to erosion hazards. Umsning people is basically depends upon the agriculture, they are income source is a basically agriculture.

3.7 Geology

The Shillong plateau of NE India may be considered as a natural museum wheredifferent rock sequences from Archean Proterozoic to Plestocene-Recent sediments are observed. The plateau is clearly confined by surrounding tectonic discontinuities / lineaments such as Garo Rajmahal tectonic graben to the west, Brahmaputra lineament to the north, Dauki fault to the south and towards east belt of Schuppen. The E-W trending Dauki fault (tear fault of Evans, 1964) separates Surma valley / Bangladesh from the Precambrian plateau and sets the southern International boundary. The Daukitear fault with 250 km movement is a dextral strike-slip fault. Umsning block is a hilly area.Umsning block rocks were intruded by epidiorite rocks known as Khasi green stone.Umsning block are also hilly area so road and transportation is not good ,one place to another place connectivity is very low.this problem is effect the development of economy of the study area.

3.8 Drainage

The Drainage system is controlled by topography. the drainage pattern shows annular, trellis, Sub-dendritic types which also indicate the structural control. The important river includes the Umtrew, Umsiang, and Umiam rivers.

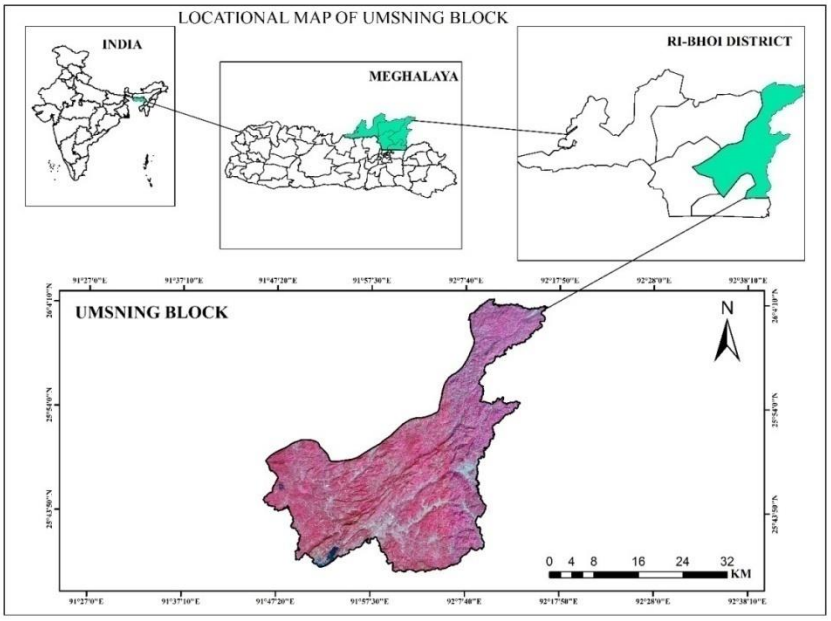


Fig3.1 Locational map of study area

Umsning block is a hilly area of Ri-bhoi district in Meghalaya. various types of in the umsning block. All people are using bamboo plant as an income source, making a house, making home wall in they are life style. Bamboo is a using eating purpose, bamboo shoots, wood also use making food . The bamboo species that have traditionally been used for construction tend to have the following characteristics-

- grow locally in abundance
- stronger than other local species
- large diameter (50mm–200mm)
- Grow relatively straight.
- mature quickly (three to five years)
- slightly more resistant to insects and fungi (lower starch content) less susceptible to splitting

CHAPTER- 4

METERIALS AND METHODOLOGY

4.1 METERIALS

4.1.1 Satellite Imagery.

To carry out the study total area 4 images have been used which include the following data set:

- Landsat 4-5 TM satellite image
- Landsat 8 ETM satellite image
- Sentinel 2 satellite image

There all satellite image have been used for analysis of bamboo cover area and bamboo cover changes area in the study area.

Satellite	Path & Raw	Bands	Resolution (m)	Date of Acquisition
Landsat TM	136042-20091104	Blue	30	28/Nov/2009
		Green	30	
		Red	30	
		NIR	30	
		SWIR-1	30	
		THERMAL Infrared	120	
		SWIR-2	30	
Landsat ETM	136042-20141118	Blue	30	28/Nov/2014
		Green	30	
		Red	30	
		NIR	30	
		SWIR-1	30	
		Thermal	60-(30)	
		SWIR-2	30	
		Panchromatic.	15	
Sentinal-2	TR6RCP-A009025 TR6RDPA009025	Coastal Aerosol	60	1/Nov/2018 1/Nov/2018
		Blue	10	
		Green	10	
		Red	10	
		Vegetation Red Edge	20	
		Vegetation Red Edge	20	
		Vegetation Red Edge	20	
		NIR	10	
		Narrow Nir	20	
		Water vapor	60	
		SWIR-Circus	60	
		SWIR	20	
		SWIR	20	

Table-4.1 Data Acquisition in details.

4.1.2 Software and instruments.

Following software are used in the study:

- ArcGIS 10.2 used for GIS analysis.
- Erdas Imagine 2014 used for pre-processing and classification of images.
- MS office 2016 used for graph and report preparations.
- GPS also used for ground truth verification.
- Digital camera used taking fields photographs.

4.2 Methods

4.2.1- preprocessing

Preprocessing means to noise and eliminate irrelevant, visual unnecessary information. The Landsat TM and Sentinel 2 satellite imagery were downloaded from United States Geological Survey (USGS). The downloaded images Landsat TM, Sentinel 2 and Landsat ETM are already georeferenced and all the necessary information was stored as in the form of metadata. using Erdas 2014 software layer staked and Thereafter, image enhancement is applied in every field where images are ought to be understood and analyzed (Maini and Aggarwal ,2010). Image enhancement basically is the enhancement of information of images for better visualization. Image enhancement is tha application of frequency domain methods to modify the image brightness, contrast or the distribution of grey levels. Various image enhancement techniques were performed in the imagery before interpretation in Erdas imagine software.

4.2.2- Wavebands Selection.

Band 1, Band 2, Band 3, Band 4 from Landsat TM data and Band 2, Band 3, Band 4, Band 5 Landsat OLY were selected for generating false color composite images(FCC). Similarly, Band 2, Band 3, Band 4, Band 8,Band 11, Band 12,Sentinel 2 were used for generating FCC.

4.2.3 Visual image interpretation for forest density mapping.

Visual image interpretation is a process of taking out of both qualitative and quantitative information of any objects from temporal satellite data. Image interpretation is processes to classifying the features seen on the images by the analyst. visual image interpretation technique is based on the size, shape, tone, texture, pattern, association of satellite imagery. The bamboo cover area has been classified using this technique.

4.2.4 Ground Truthing

Ground Truthing plays an important role to verify the accuracy of result.it was carried out with the help of Global positioning system (GPS)and classified hardcopy maps to check the accuracy. GPS locations of different forest types were taken and correlated on the ground for checking the accuracy of the map.

4.2.5 Image Enhancement

Image Enhancement belongs to image pre-processing method. Image enhancement methods are based subjective image quality criteria.

4.2.6 bamboo cover.

Bamboo cover area in study area year wise…

2009	2014	2018
98966.75555(ha)	98966.76(ha)	98966.76(ha)

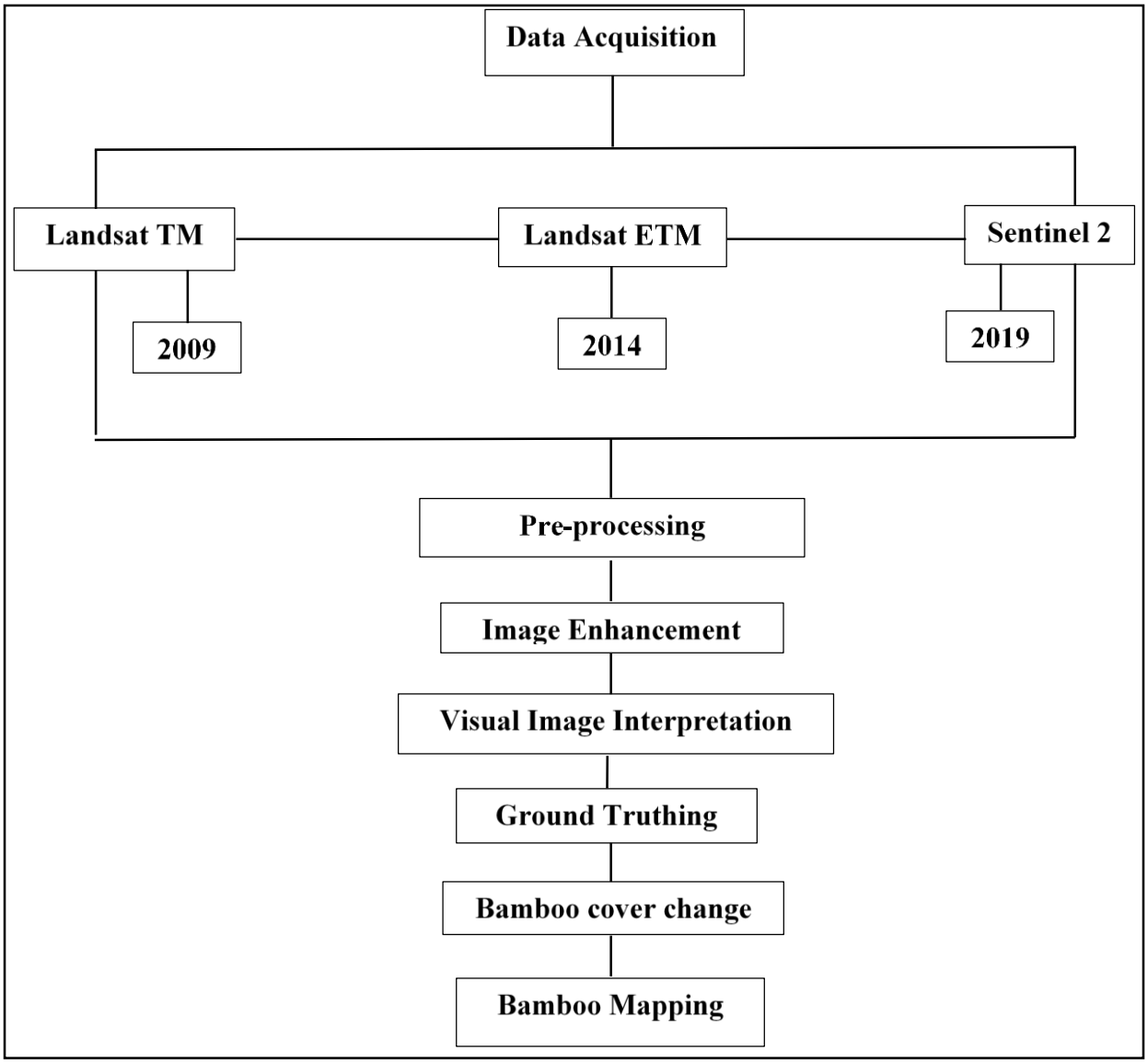


Fig 4.2 Flow chart of methodology.

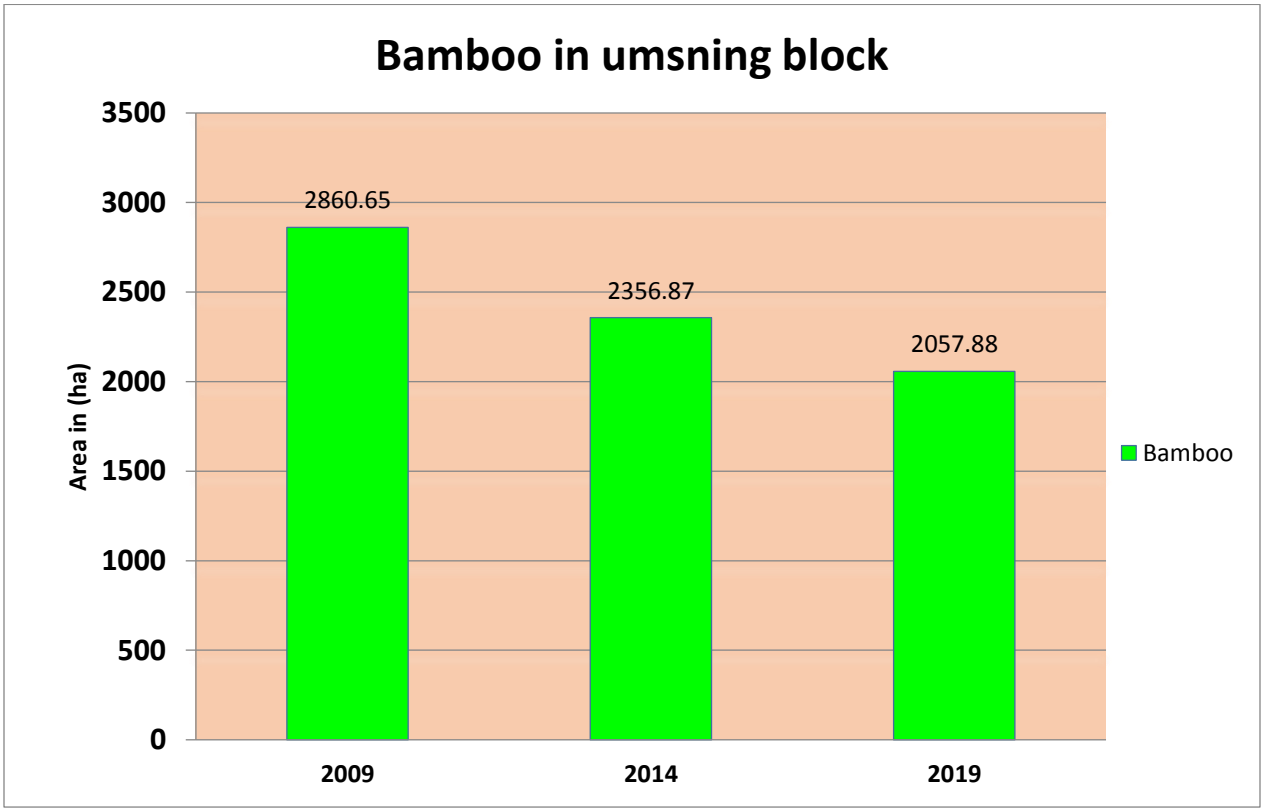
CHAPTER-5

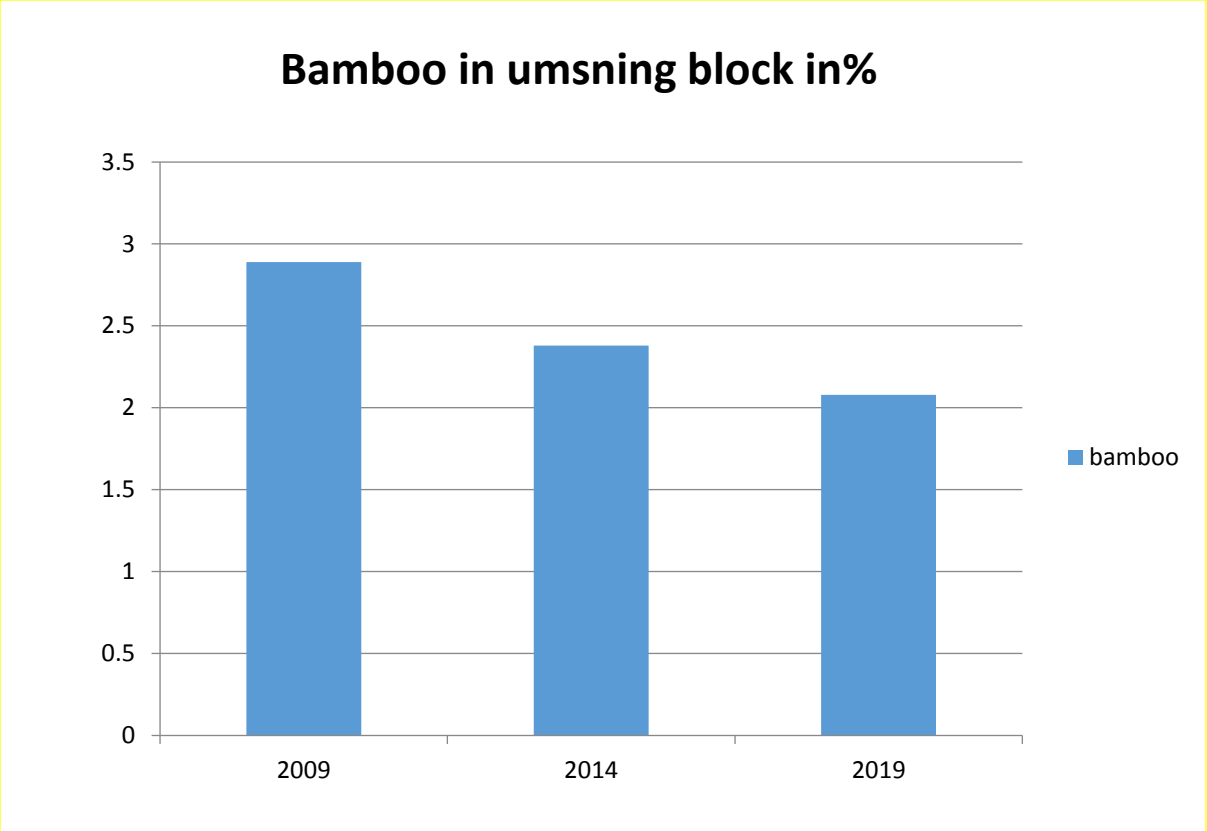
RESULTS AND DISCUSSION

5.1 INTRODUCTION.

The details analysis of the bamboo cover area and bamboo cover changes pattern over a period of time using sentinal2, Landsat TM, Landsat ETM satellite imagery.

Year	Area in (ha)		
	2009	2014	2019
Bamboo	2860.65	2356.87	2057.88
other area	96106.11	96609.90	96908.88
Grand Total	**98966.75555**	**98966.76**	**98966.76**





Year	Area in (%)		
	2009	2014	2019
Bamboo	2.89	2.38	2.08
other area	97.11	97.62	97.92
Grand Total	**100**	**100.00**	**100.00**

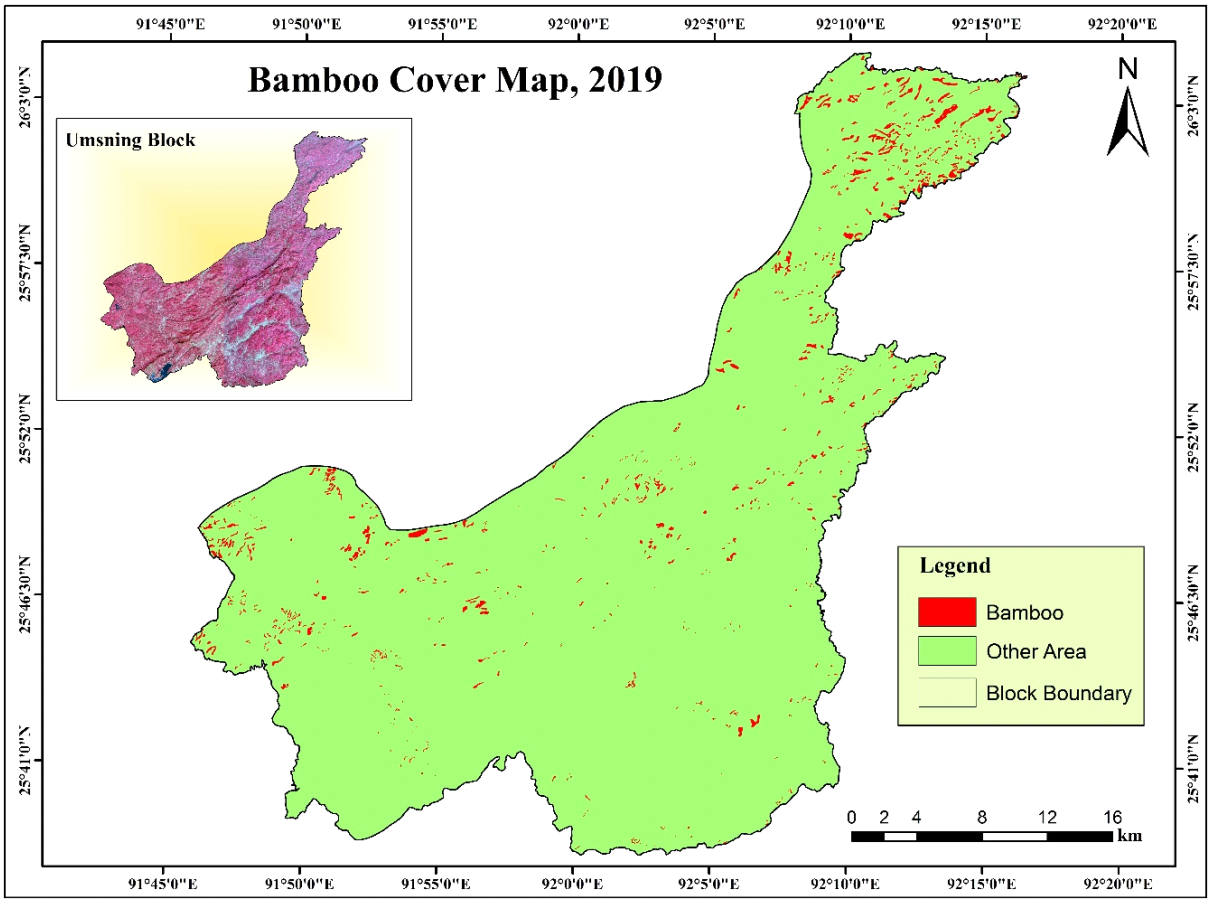


Fig.5.1.1 Map of the Bamboo covers area (2019)

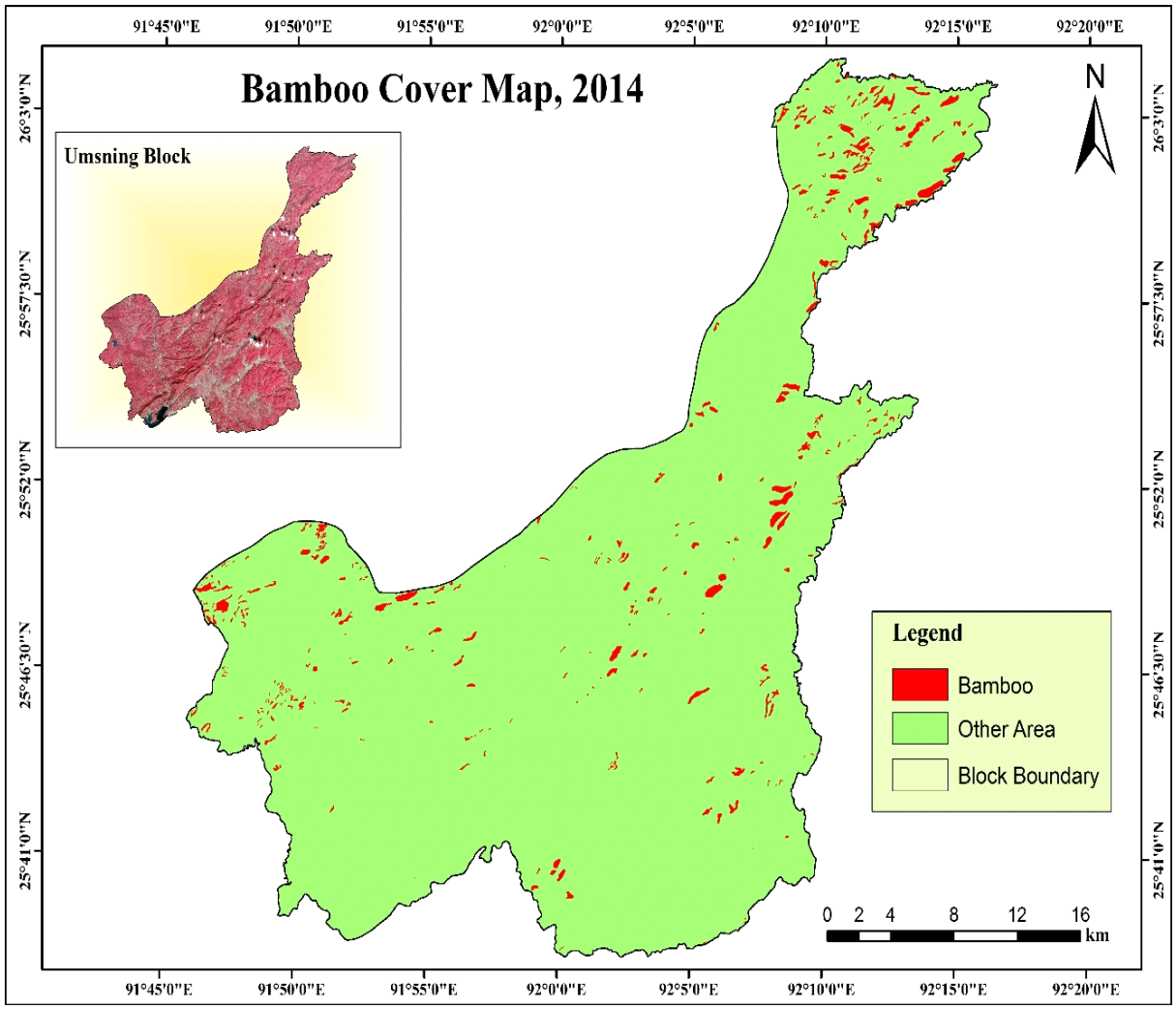


Fig. 5.2.2 Map of the bamboo cover area (2014)

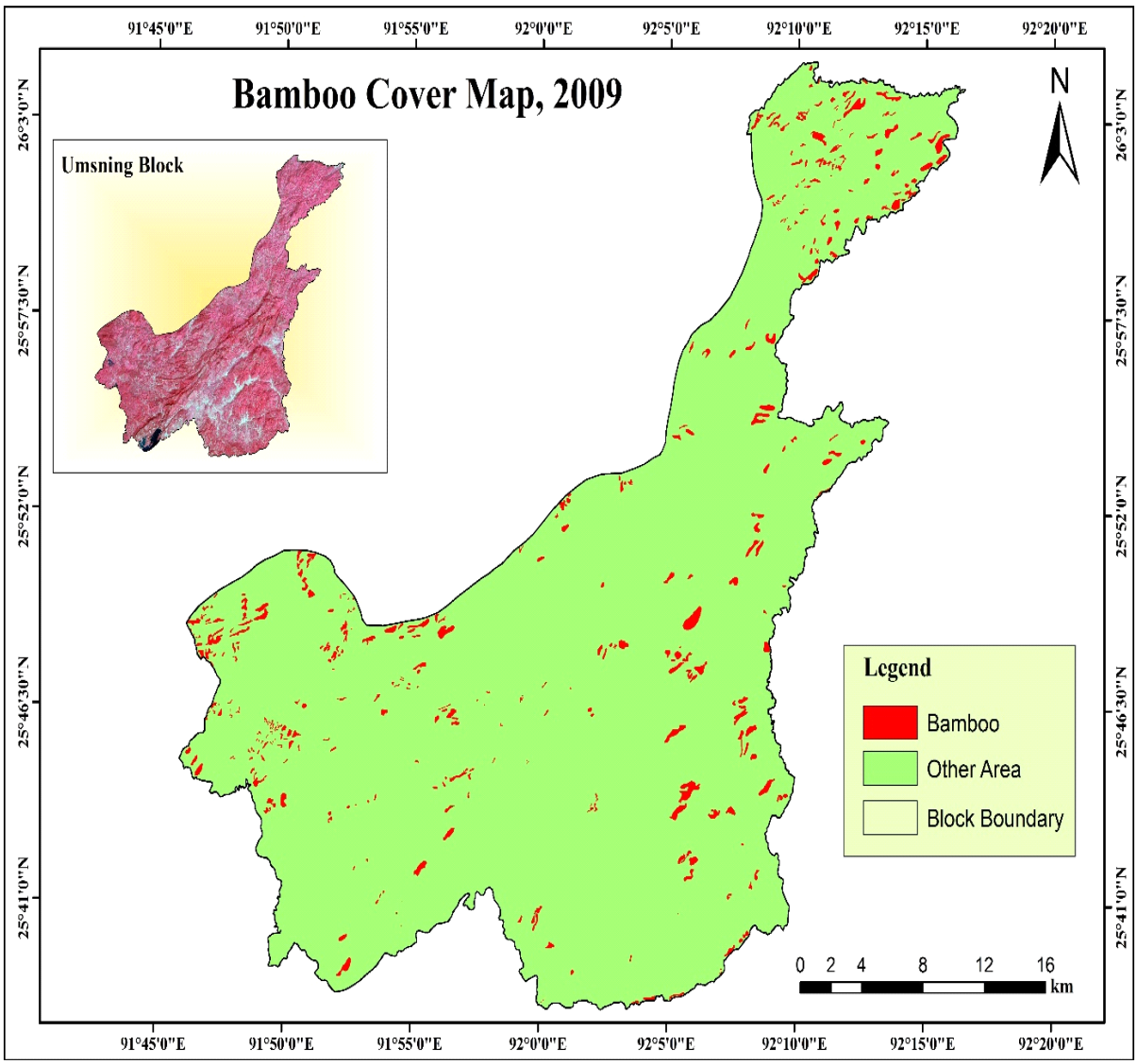

Bamboo Cover Map, 2009
Umsning Block
N
Legend
Bamboo
Other Area
Block Boundary
0 2 4 8 12 16
km
91°45'0"E
91°50'0"E
91°55'0"E
92°0'0"E
92°5'0"E
92°10'0"E
92°15'0"E
92°20'0"E
26°3'0"N
25°57'30"N
25°52'0"N
25°46'30"N
25°41'0"N

Fig. 5.2.3 Map of Bamboo cover area (2009)

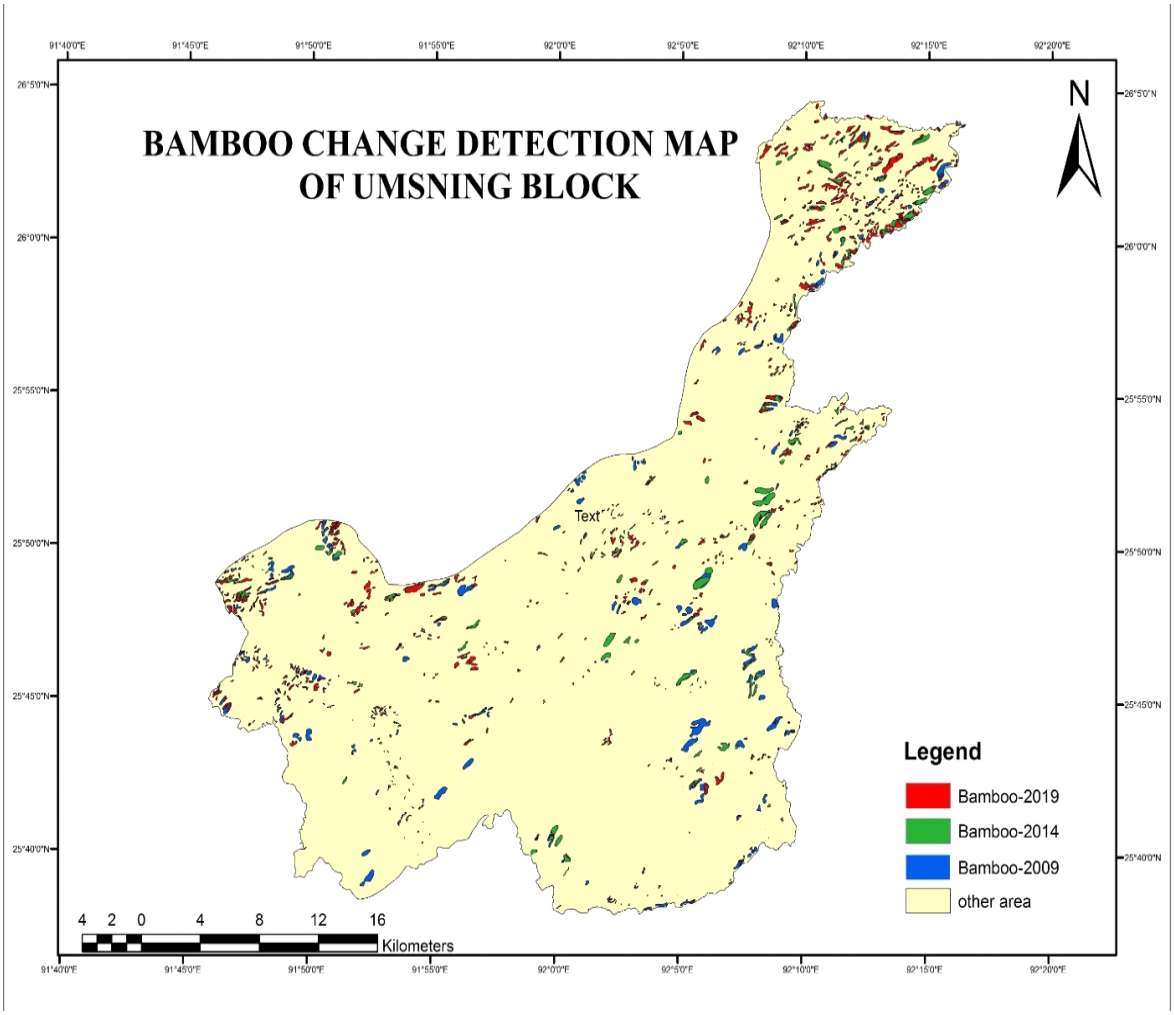


Fig.5.2.4 Map of the bamboo change area of (2019,2014,2009)

Table 5.2.5Consumption pattern of Bamboos in North eastern region &India.

Uses.	%Consumption.
Pulp.	35%
Housing.	20%
Non-Residential.	5%
Rural uses.	20%
Fuel(Non Residential)	8.5%
Packing industrial Basket.	5%
Wood based industrial and transport.	2.5%
Furniture	1%
Other	3%
total	100%

Source- Tiwari, D.N. (1992).

5.2.5 Fig. Bamboo root. Bamboo shoot.

5.2.6 Table: – Traditional dishes prepared from bamboo shoots.

Sl. No	state	Tribal communities accessing the resource	English name	Local dialect communities	Preparation procedure recipe
1	Meghalaya	Khasi,Garo, & Jaintia	Boiled Vegetable Fried vegetable Pickle Fermented product	Jhur/Khasi Jingtah/Khasi Achar lung Khasi Syrwa/Khasi.	Plain boil with salt or with meat/fish etc. Fried with vegetable/ non-veg component, dry fish, black pepper other species. Sliced/chopped young shoots with moistened with plain water &fermenting them for 5-10 days in a heap container. Sliced Chopped bamboo with musterd oil pickle powder chilli and other local Species.

5.2.6 Table: – Bamboo species of Meghalaya.

Sl. No.	Bamboo Species.
1	Arundinaria hirsute.
2	Arundinaria manni.
3	Arundinaria microphylla.
4	Arundinaria suberecta.
5	Bambusa arundinacea.
6	Bambusa balcooa.
7	Bambusa glauscescens.
8	Bambusa khasiana.
9	Bambusa longispiculata.
10	Bambusa nutans.
11	Bambusa pallida.
12	Bambusa tulda.
13	Bambusa vulgaris.
14	Cephalostachyum capitatum.
15	Var.decompositum.
16	Cephalostachyum fuchsianum.
17	Cephalostachyum pallidum.
18	Cephalostachyum polystachya.
19	Cephalostachyum hookeriana.
20	Cephalostachyum khasiana.
21	Cephalostachyum polystachys.
22	Dendrocalaumus Hamiltonii.
23	Dendrocalaumus hamiltonii.
24	Dendrocalaumus hookeri.
25	Dendrocalaumus sikkimensis.
26	Dendrocalaumus strictus.
27	Dinichloa compactiflora.
28	Gigantochloa macroschya.
29	Gigantochloa takeserah.
30	Melocanna baccifera.
31	Neohouzeoua dullooa.
32	Neohouzeoua helferi.
33	Oxytemanthera albociliata.
34	Oxytemanthera nigrociliata.
35	Phyllostachyum mannii.
36	Pseudostachys polymorphum.
37	Teinostachyum griffithii.
38	Thamnocalamus prainii.

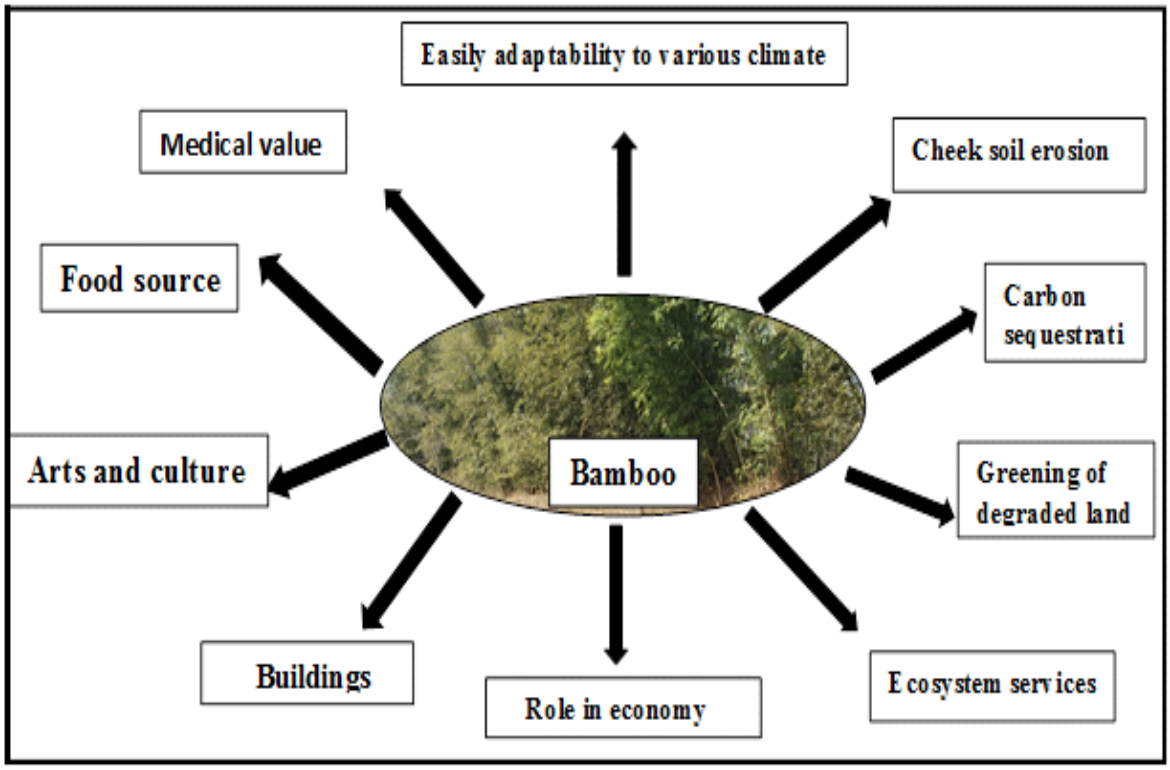


Fig- Various uses of Bamboo.

Fig 5.2 6 Types of Bamboo in Study area.

- Bambussa Balcoca.
- Bambussa Bambos.
- Bambussa Tulda.
- Dendrocalamus asper.
- Dendrocalamus hamiltonii.
- Dendrocalamus strictus.

CHAPTER-6

CONCLUSION

This paper presents the feasibility of using bamboo and changes of bamboo cover area over a period of time in the study area. Bamboo solutions are a highly sustainable, cost- effective and beautiful construction material for homes. It can be used throughout the entire structure (inside and out) and if preventative measures are utilized, can last for many years. Bamboo construction requires good preparation and accurate calculate especially the bamboo amount given in the field. if there is a storage of bamboo will lead to lower the quality of construction. Using other bamboo, the quality is not guaranteed either age, the water content and durability. Bamboo is used in medicine from ancient time in India. Other uses of bamboo include food, paper-pump, fencing and structural material. Bamboo has wide application in furniture, structural, appliances. Bamboo limited to local tribal people and to be explored further. Bamboo can play a role as a non-supporting or finishing material. bamboo is naturally fastest growing plant. This paper gives a clear picture about the bamboo cover area and bamboo changes area of 2009,2014,2019, years of the study area of umsning block. Development of Bamboo is affected by several climatic and biotic factors. The Bamboo enterprises of the areas studied, however, suffer from many problems. No profound bamboo management is practiced in both handicraft making and bamboo cultivation. The study area people are basically depending upon agricultural and business purpose, all people are bamboo used in food and architecture also. Human impact are basically effect the bamboo cover changes. Bamboo forest are cutting and those place are used in jhum cultivation and other agricultural factor. Study areas bamboos are naturally growth forest not human

cerate forest. Those study areas soil are very useful to growth bamboo plant. Bamboo, the poor man's bonanza is nature's wonderful gift to mankind since time immemorial. Bamboo is a multipurpose plant to family of the study area. Bamboo is an income source of umsning block, they are making various kinds of hand making architecture and sell in nearest market. The problem is there are no good market the selling those architectures a good and proper prize. The Small scale bamboo craft industry has a vital role in expanding employment opportunities and increasing the income of rural communities. The industry can employ a greater number of workers and its raw material grows abundantly in umsning block. With relatively little capital, rural communities can develop this business and provide their own employment opportunities.

Umsning block is a very small and hilly area block. There are lots of bamboo cover area in those block. Various human impact and transportation development and agriculture purpose are effect bamboo cover area changes in umsning block.

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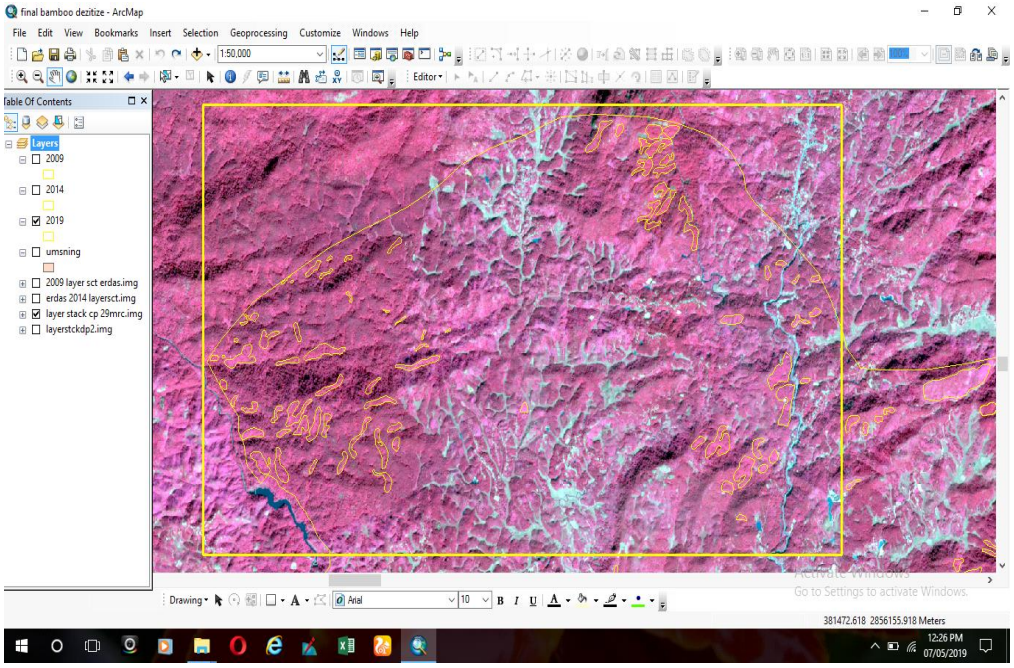
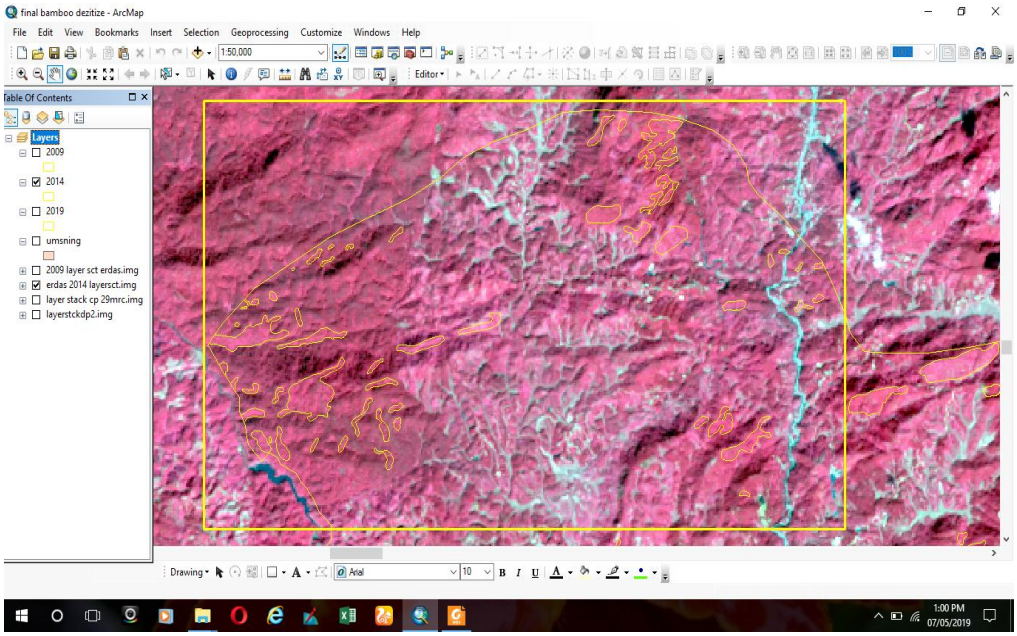
ANNEXURE

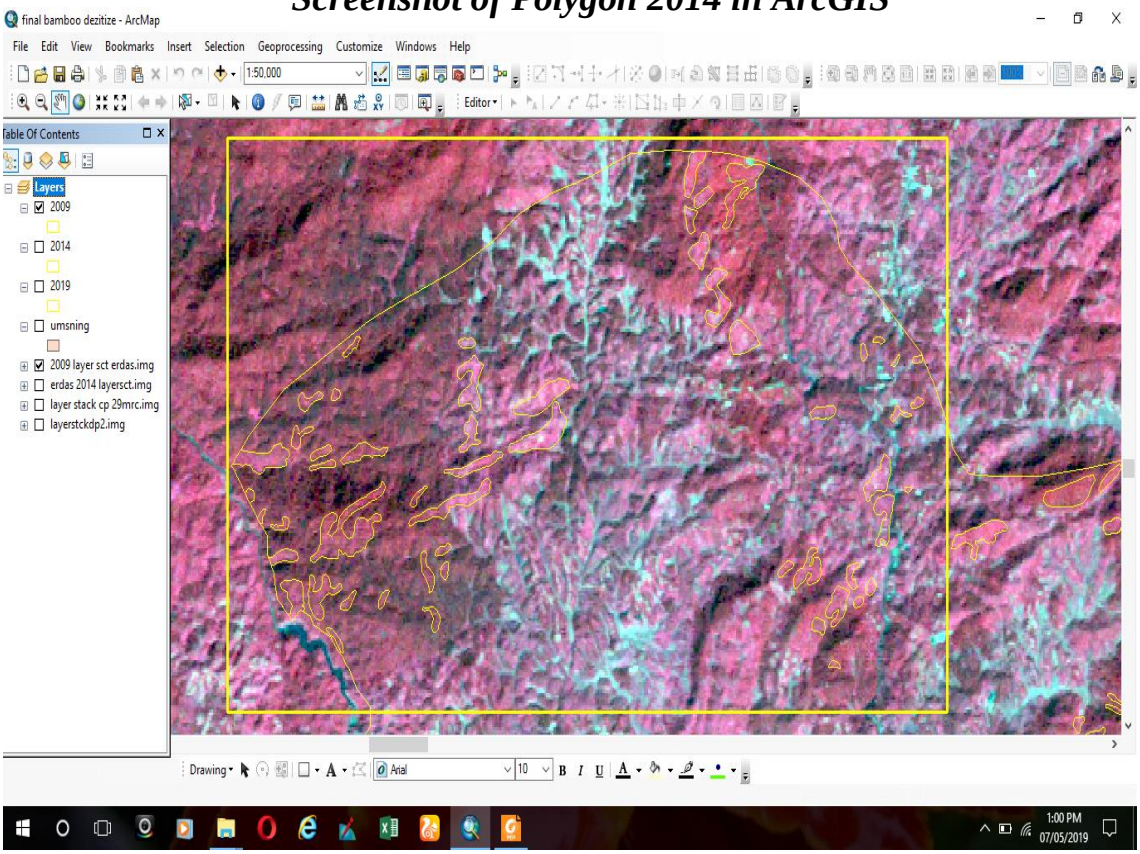
BAMBOO CHANGES AREAS OF STUDY AREAS:-



Screenshot of polygon 2019 in ArcGIS



Screenshot of Polygon 2014 in ArcGIS



Screenshot of Polygon 2009 in ArcGIS

FIELD PHOTOS

Bamboo Forest Damaged/forest fire

BAMBOO HOUSE

BAMBOO WALL

BAMBOO COVER AREA

PREPARING JHUM CULTIVATION

Bamboo Clum