



## **COMPUTER AND INTERNET ASSISTED ANALYSIS IN THE STUDY OF DIVERSITY OF THE TREE SPECIES IN MELGHAT SANCTUARY, MTR, MAHARASHTRA**

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### **ABSTRACT**

A vast amount of biological information existed in the world today. This information was diverse and huge, thus it was the need to process and integrate this extensive biodiversity information for conservation, management and decision making purposes by applying information technology tools. In present study researcher done mapping of the forest research compartment no. 1016. The huge area of the MTR was focused through digital satellite maps to for understanding the complexity of the forest, which provided accurate and real picture of geographical distribution so as to expose this hidden area to the world peoples, which describes relationship in between real world and its computer representation. The present study was carried out on the basis of computer assisted monitoring of vegetation using satellite and geospatial data. The study was conducted in order to understand the complexity of the forest.

**Key Words:** Bioinformatics, Biodiversity informatics, Information System, Mapping, Forest cover, MTR,

### **INTRODUCTION**

Bioinformatics is quickly becoming indispensable to all researchers and scientists alike. There has been an explosive growth in recent years in biological data. There is a great need for the storage and managing of this data to be protected and secure. The managed data also needs to be kept up to the date with the latest technology. The relevance of bioinformatics plays a key role in this process. Without the use of bioinformatics, there could be a stagnant period in this field of research, medicine and biology. The enormous growth of biological data in the last few years has created the need for better data management, capabilities, and thus bioinformatics is a critical piece of the puzzle. The technology of bioinformatics is both versatile and is able to be applied wherever research is being done on genetics, proteins and cells for

herbicide-resistant products for crops in agriculture.

#### ***Computational Grid***

A computational grid is hardware and software infrastructure that provides dependable, consistent, pervasive and inexpensive access to the high end computational capabilities. These computational grids can play a major role in applications such as computational fluid dynamics, particle, simulation, bioinformatics etc. Grid computing offers an ideal platform for a biologist to analyze the data by using computing resources and also databases available at different locations.

#### ***Biotechnology Information System***

India was the first country in the world to establish in 1987 a distributed Biotechnology Information

System (BTIS) network. BTIS is today recognized as one of the major scientific networks in the world dedicated to provide state-of-the-art infrastructure, education, manpower, and tools in bioinformatics.

### ***Applications of Biodiversity Informatics***

Biodiversity Informatics is the application of informatics to recorded and yet-to-be discovered information specifically about biodiversity, and the linking of this information with genomic, geospatial and other biological and non-biological datasets. According to Soberon and Peterson (2004) Biodiversity Informatics includes the application of information technologies to the management, algorithmic explorations, analysis and interpretation of primary data regarding life, particularly at the species level of organization. It covers the information generated by the fields of systematics, evolutionary biology, population biology, behavioral sciences, and synecological fields ranging from pollination biology to parasitism and phytosociology. Presently, the overriding objective of research and other activities in Biodiversity Informatics is to provide a sound information management infrastructure for biodiversity and global change research. In the pre study aerial digital satellite maps provided accurate and real picture of geographical distribution of the compartment 1016 so as to expose this hidden area to the world peoples. It was easy to mark out the compartment 1016, location of villages Gullarghat and Dharghad, Narnala Fort, forest cover, area under cultivation, stream, dam, and tourist spot nisarg sankul.

### ***Review of Literature***

Cotter and Bauldick (2000) presented a paper on Biodiversity Informatics Infrastructure. Biodiversity informatics infrastructures are being called for at national, regional, and global levels, and plans are in place to coordinate these efforts to ensure interoperability. A vast amount of information on biological resources exists throughout the world today. It has been collected by government agencies, universities, museums, and private organizations. This is an opportunity to apply this technology to develop an information infrastructure that would enable us to unlock the wealth of biodiversity information that exists

around the world. Stockwell *et al.*, (2000) commented on an interface between computing, ecology and biodiversity. Environmental Informatics. In view of Schnase (2000) the biodiversity enterprise is a vast and complex information domain. There is a need to built infrastructure for that domain, major research thrusts needed to improve its work practices, and areas that could contribute to the advance of the field. He emphasizes that the science of biodiversity is fundamentally an information science, worthy of special attention from the computer and information science communities because of its distinctive attributes of scale and socio-technical complexity. Phattaralerphong and Sinoquet (2005) developed a method for 3D reconstruction of tree crown volume from a set of eight photographs taken from different angles. This photographic method of reconstruction included three steps. The actual crown dimensions and volume of 3D-digitalized trees were computed from 3D-digitalizing data using the Tree Box Software. They described a fast and nondestructive photographic method, implemented in the Tree Analyzer software, for estimating crown volume made by the photographic method and were compared with values computed directly from 3D-digitalized plants. Kagan (2006) has shed light on the challenges and opportunities for applying biodiversity information to management and conservation. Information on vascular plant taxonomy, as addressed by global biodiversity information facility and key partners, serves as an example of current efforts to integrate information. In order to describe GBIF methodology he used vascular plants as an example, with a particular focus on the way the information is developed applied in North America. Lobo (2008) analyzed the results of the best comparative study of the performance of different modeling techniques, which used pseudo-absence data selected at random. He provided an example of variation in model accuracy depending on the type of absence information used, showing that good model predictions depend most critically on better biological data.

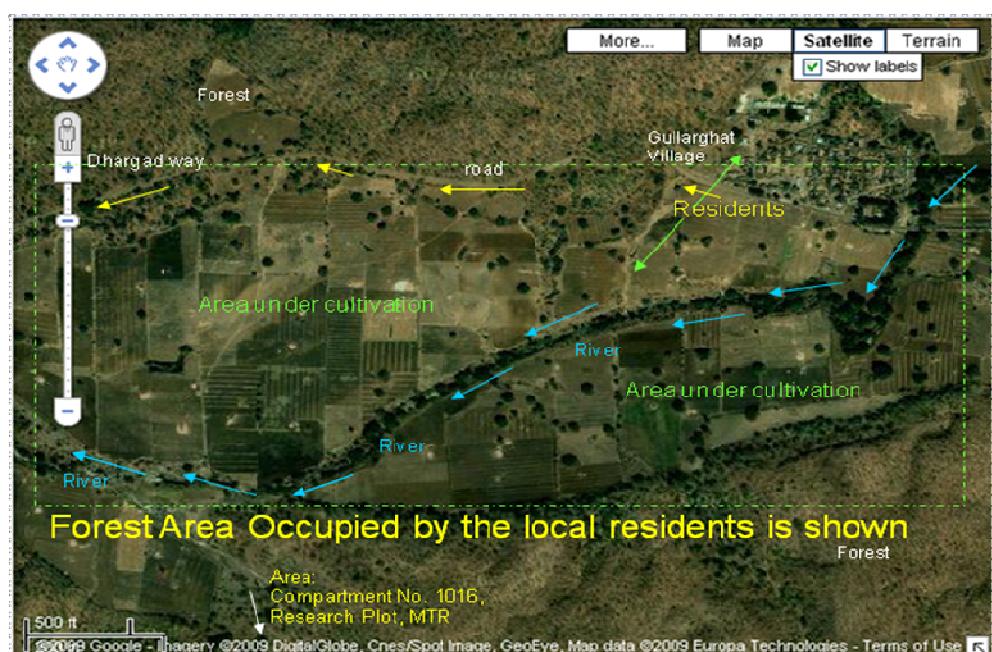
## MATERIALS AND METHODS

Bioinformatics is more of a tool than a discipline. Information technology makes use of software, hardware and internet based communication systems for the analysis of Biological Data. The dataset and databases are useful as a management information system (MIS) in decision making. This modern day technical facility was fully utilized for the study of biodiversity in tree species of compartment 1016. Using Internet Technologies: Satellite forest cover maps of the Melghat Tiger Reserve were down-loaded through World Wide Web or Internet technologies using Google search engine through Earth satellite map. The web browser i.e. Internet explorer software was used. Actual topographic locations of vegetation-spot potential from the satellite photographic images were studied. A total of 15 different sites, aerial photographs were taken.

## OBSERVATIONS AND RESULTS

The study was carried out with the help of computer and Internet for mapping forest digitally. The satellite maps were downloaded to understand the area broadly. The study site was located in Satpura mountain ranges. Present study explored the current forest status of the compartment 1016, of Melghat Sanctuary. During monitoring study the area was highlighted properly and visually labeled. 26 satellite photographs of different views of the research area were prepared and studied. This data was useful to identify the forest category as tropical dry deciduous type. The satellite map indicated small visual patches of forest vegetation cover comprising dense forest, open forest and non forest areas which were well labeled showing thereby the topographic situation of the area.

**Aerial view: Using Internet Technologies...**



During this study MTR forest was explored and its statewide, countrywide and worldwide existence was captured. Satellite data was mapped and magnification of areas was done to focus it in maximum possible closer view. Overall the Melghat forest exhibited dense crowded patches of

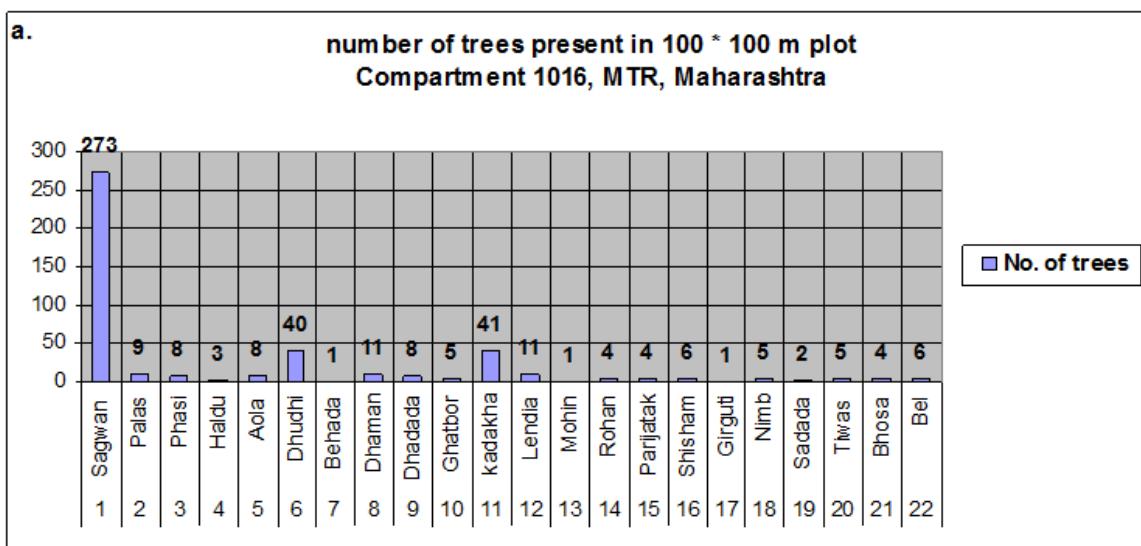
vegetation. The Melghat sanctuary and its peripheral area was clearly demarcated by labeling surface area. The visual spatial maps presented the real status of the forest cover demarking topographic positions of Narnala Fort, Dharghad, and Gullarghat villages, Nisarg Sankul, forest fire

area, guest house, area under cultivation, roads, bandhara and hills.

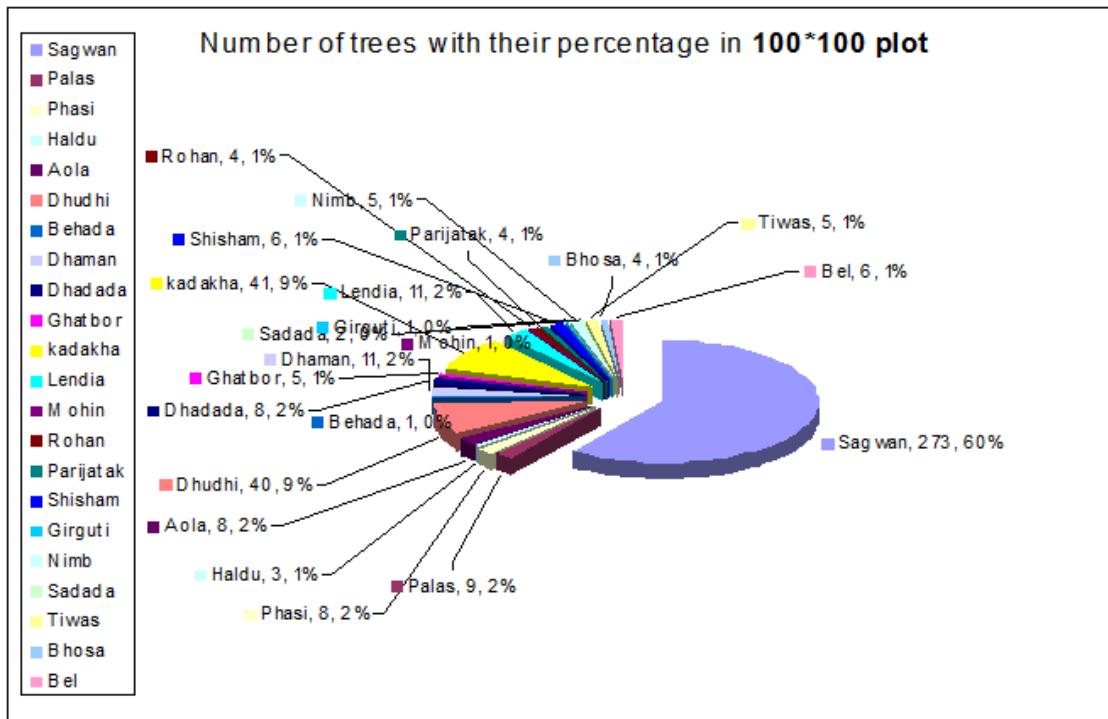
### **Girth and Height of Trees**

A total number 456 trees were found in the single 100×100m plot (Table 4.2) which included 22 tree species belonging to 20 genera and 15 families.

The Girth and height of trees were measured and the chart was drawn representing tree number (Fig. No. 4.2 a and b). Within 22 species, large sized trees species 7 in number, middle sized 10, and small sized 8 were recorded among 456 population.



**Figure: 4.2 a.**  
**Chart representing local names and tree number**



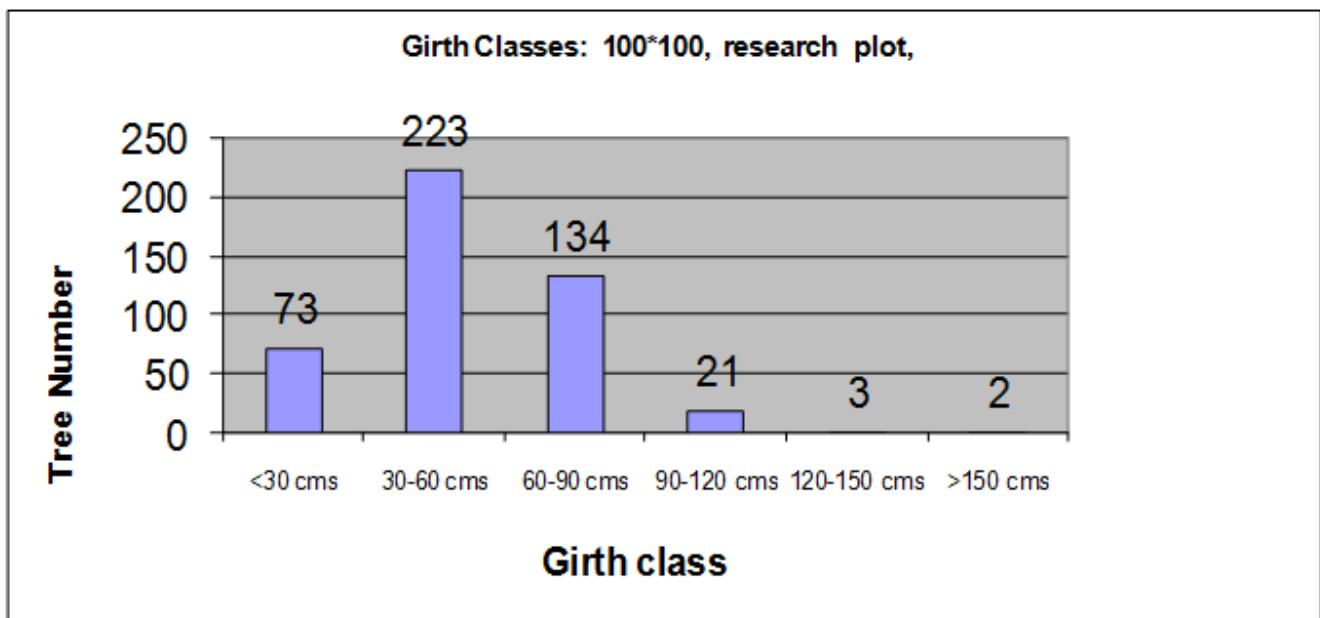
**Figure: 4.2 b.**  
*Graphic presentation of tree types and their percentage*

**Girth Class**



**Figure. 4.3 a. Girth classes**

**Figure. 4.3 b. Girth measurement, (*T. bellirica*)**



**Figure. 4.3 c.**  
*Girth classes chart*

**Girth Class**

A systematic survey was carried out of 456 trees located in the research plot and the girth classes data of the trees was prepared (fig. 4.3 a, b and c). The measurements were done using measuring

tape of individual tree, marked by code number. Trees were grouped under six girth classes as <30 cms, 30-60 cms, 60-90 cms, 90-120 cms, 120-150 cms and >150 cms. After analysis of the data it was found that there were 73 individuals falling

within the girth class <30 cms, 223 individuals within 30-60 cms, 134 individuals within 60-90 cms, 21 individuals within 90-120 cms, 3

individuals within 120-150 cms and lastly 2 individuals within the girth class >150 cms (Table 4.4).

### Height classes

Height classes	
10-15 feet:	48
15-20 feet:	150
20-25 feet:	109
25-30 feet:	72
30-35 feet:	42
35-40 feet:	28
>40 feet:	7



Figure 4.4 a. Height class

Figure. 4.4 b. Height measurements (*T. arjuna*)

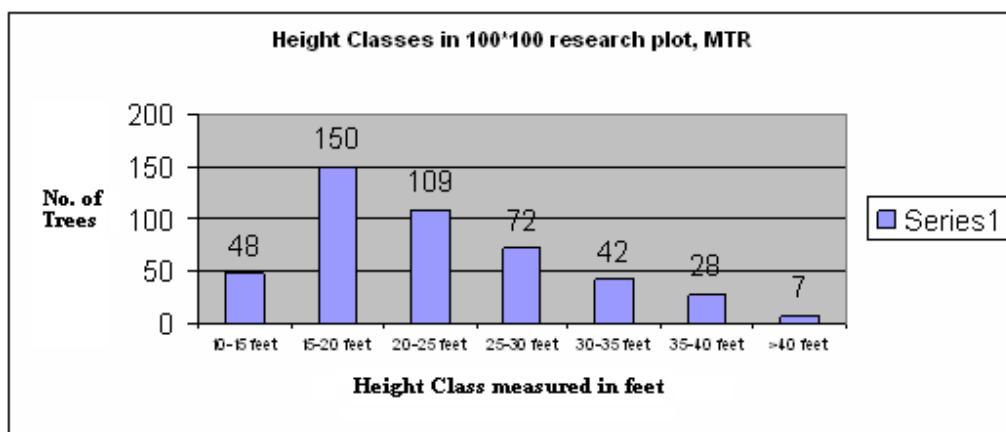


Figure. 4.4 c.  
Height Class Chart

### Height Class

The tree height of 456 trees were measured and they were categorized into definite height classes (Fig. 4.4 a, b and c). It was found that within 10-15 ft interval class 48 individual trees, 15-20 ft, 150 individuals; 20-25 ft, 109 individuals; 25-30 ft, 72 individuals; 30-35 ft 42, individuals; 35-40 ft,

28 individuals and above 40 ft, 7 individuals were present. (Table 4.5).

### The Girth and Height Classes

The most of trees included in the category of girth class 30-60 cms. and height class 15 to 20 ft. The vegetation site was mostly representing young and

middle sized trees. The maximum and minimum girth and height of trees were recorded. Among the tree species *Tectona grandis* L.f. Suppl. (Table 4.6) exhibiting maximum girth (170 cms) and height (58 ft). Species diversity, height and girth i.e. growth of the trees was dependent primarily on age of the individuals and truly on ecological conditions of the forest area of research. This study provided a base line information to understand the diversity of the species in the tropical dry deciduous forest of MTR.

## DISCUSSION

The Specimen Browser System was developed for easy access; all the specimen images were stored in the directory and subdirectory in listing format which were further linked with the data table using hyperlink option; just by single click on it, the system could be operated and implemented in a very simple way. The herbarium, bark specimens along with field maps were linked to the table. The specimen browser provided specified image and table data in its desirable form rapidly. Schneider *et al.*, (1998) pursued the more specific project of transferring the field information into electronic form. Specimens collected within Texas were used by the Specimen Browser. For each of those, the following items have been recorded: accession number and source herbarium, collector's name, a collector-specific number for the specimen, data of collection, country of collection, and scientific name. Future revisions to the Specimens to be used as they were entered; future data-gathering passes were anticipated to input data from annotations and images of the plants themselves. Cotter and Bauldick (2000) assumes that information technology provides us tools to digitize information and store it in accessible systems; discover and retrieve data pertinent to the issue at hand; analyze data from diverse distributed databases input and promote interactions among colleagues through collaboratoria, internet-based communication facilities which enable discussions, document development and revision, and decision making in real time.

In view of Kagan (2006) Biodiversity informatics has to provide consensus reference system in structural features (e.g. in database

design) and content definitions (controlled vocabularies, i.e., list of applicable terms). Taxon based information system (or system using taxon names) must find ways to map individual taxon concept reliably. Information on vascular plant taxonomy, as addressed by the global biodiversity information facility and key partners, serves as an example of current efforts to integrate information of the plant biodiversity. Efforts of Roderic and Page, (2008) have relied on taxonomic names as the share identifier linking record in different databases. Integrating diverse sources of digital information is a major challenge facing biodiversity informatics. Not only authors have faced with numerous, disparate data providers, each with their own specific user communities, but also the information in which author interests are diverse, and includes taxonomic names and concepts, specimen in museum collections, scientific publications, genomic and phenotypic data and images. In the present work the table was catalogs 40 tree plants with family, genus local and botanical name of each tree, in addition images of herbarium, bark and location map as supporting documents. It was an opportunity to apply this technology to develop an IT infrastructure that would enable us to unlock the wealth of biodiversity information that existed around forest of Melghat. Specimen browser system formulated by the candidate on biodiversity of 1016 compartment was one of the tools for accessing botanical specimen collections which were allowing the rapid input of specimens with dynamic zooming facility. It was the easiest and effective way for retrieving the biological data just by pressing the computer keys. A vast amount of biological information existed in the world today. This information was diverse and usually found in assorted form, thus it was the foremost need to greatly increase our computing capacity to process and integrate extensive biodiversity information for conservation, management and decision making purposes by applying informatics tools.

Aerial satellite monitoring method helps to understand better the complexity of the forest. The main intention of using this digital image processing system was to provide current status of forest with its potentially important data for monitoring, planning, conservation and

management of the forest. Lertlum and Murai (1995) illustrated the use of object-oriented data model to handle the integration problem of multi-resolution, multi-temporal data sets by defining an object oriented data model that could handle multi-resolution, multi temporal remote sensing GIS data sets. A semi-automated classification procedure was adopted by Meyera *et al.*, (1996) for identification of forest species from digitized large-scale, colour-infrared aerial photographs to simulate imagery from future sensors with high spatial resolution capability. With the help of applied computer-assisted classification approaches involving a tree by tree approach an average about 80% of the trees could be classified. A GIS database of environmental and management data for 40,000 hectare segment of Kinleith Forest, New Zealand, has been built by Hock, *et al.*, (2003). The digital forest provides a stable database to develop and test models, and is accessible for planning new experiments and future research. The database has proved to facilitate research efficiency and capability. The wealth of digital data permitted the development of new approaches in using spatial information for forest management. Joshi *et al.*, (2004) explored the potential of multi-temporal IRS-ID WiFs (Wide Field Sensor) data for characterization of tropical forest in Central India. The WiFS product provided information on forest types, Viz., tropical moist deciduous, dry deciduous and mixed deciduous. The WiFS derived forest maps could be very useful as input to biogeochemical models that require timely estimates of forest area and type. The analyses of IRS-ID WiFS data highlighted significant seasonal difference among the various forest types in the study area and type. The present study on 1016 compartment dealt with the data collection for Vegetation-Spot potential through aerial satellite photograph monitoring method to evaluate the potentially important data in

identification of forest land. The map clearly indicated that this area was located under Central Forest Land Area situated in Satpura hills of India which was meeting place of ghats, which divided MTR in well defined northern and southern parts. The compartment was digitally mapped along with its original form. It showed an overall picture of the forest, recognizing fields under cultivation, water resources, river, dam, stream, rocky land, open area, dense forest, core area of forest and forest fire affected locations. These are the usage of new technology in monitoring forest cover which describes relationship in between real world and its computer representation. Aerial digital satellite maps provided accurate and real picture of geographical distribution of the compartment 1016 so as to expose this hidden area to the world peoples.

## CONCLUSION

Mapping of the forest digitally assisted in understanding the complexity of the forest which could not possible even by using any other technical device. Huge area of the MTR was focused through digital satellite maps. It was easy to mark out the compartment 1016, location of villages Gullarghat and Dharghad, Narnala Fort, forest cover, area under cultivation, stream, dam, and tourist spot nisarg sankul. Specimen Brower System: SBS was applied as a tool for accessing botanical specimen collections and this information was used in linking sources and destinations. SBS established links with herbarium, bark and location maps of compartment 1016, research plot for its easy access and to explore images and data with its desirable form rapidly. This linking information could share in different ways in the study of forest biodiversity and could access in developing large databases.

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