LANDUSE MAPPING BY GIS

BY

ANU.M.BABU
RAMYA.P
SMITHA.K.E

Department of
Land and Water Resources and Conservation Engineering
KELAPPAJI COLLEGE OF AGRICULTURAL ENGINEERING AND TECHNOLOGY
Tavanur-679 573, Malappuram
Kerala, India
2005

LAND USE MAPPING BY GIS

BY

ANU.M.BABU.
RAMYA.P.
SMITHA.K.E.

PROJECT REPORT
Submitted in partial fulfilment of the requirement for the degree

BACHELOR OF TECHNOLOGY
IN
AGRICULTURAL ENGINEERING

Faculty of Agricultural Engineering
Kerala Agricultural University

Department of
Land and Water Resources and Conservation Engineering
KELAPPAJI COLLEGE OF AGRICULTURAL ENGINEERING AND TECHNOLOGY
Tavanur-679 573, Malappuram
Kerala, India
2005

DECLARATION

We hereby declare that this project entitled "**Land Use Mapping by GIS"** is a bonafide record of project work done by us during the course of project and that the report has not previously formed the basis for the award to us of any degree, diploma, associateship, fellowship or other similar title of any other university or society.

Place: Tavanur
Date:

Anu.M.Babu

Ramya.P

Smitha.K.E

CERTIFICATE

Certified that this project report entitled "**Land Use Mapping by GIS**" is a record of project work done jointly by **Anu. M. Babu, Ramya. P** and **Smitha, K.E** under my guidance and supervision and that it has not previously formed the basis for the   award of any degree, diploma, fellowship or associateship to them.

Er. Vishnu, B,
Project guide
Assistant Professor
Dept. of LWRCE
K.C.A.E.T, Tavanur

Place : Tavanur
Date :

ACKNOWLEDGEMENT

Dedicated

To

Our Loving Parents

CONTENTS

SYMBOLS AND ABREVIATIONS

C	-	Crop Factor
Cm	-	centimetre
CRP	-	Crop Reserve Programme
Dept	-	department
Dpi	-	dots per inch
DEM	-	Digital Elevation Model
et al	-	and others
etc	-	etcetera
Fig	-	figure
GIS	-	Geographical Information System
ha	-	hectare
hr	-	hour
IARI	-	Indian Agricultural Research Institute
ILWIS	-	Integrated Land and Water Information System
J	-	Journal
K	-	Soil Erodibility Factor
K.C.A.E.T	-	Kelappaji College of Agricultural Engineering and Technology
km	-	kilometre
LS	-	Land slope factor
m	-	metre
min	-	minute
N	-	North
P	-	Conservation Practice Factor

R	-	Rainfall erosivity Factor
RUSLE	-	Revised Universal Soil Loss Equation
SCS	-	Soil Conservation Service
SYI	-	Sediment Yield Index
USLE	-	Universal Soil Loss Equation
yr	-	year
%	-	percentage
/	-	per

LIST OF TABLES

LIST OF FIGURES

Introduction

INTRODUCTION

Land resources are of paramount importance for the survival and welfare of people. The type of land varies from place to place because of differences in the interaction of various factors, geological, topographical and hydrological, under the influence of climate and people's activities over centuries. Agricultural land use, one of the primary uses of land has been of prime importance since the beginning of civilization. Agricultural development has been the foundation of the industrial superstructure in the developing countries.

Land use change is the temporal shift in human exploitation of biospheric resources in terrestrial ecosystems. In view of the rapidly increasing need for more food production and the claims of different types of users for a share in land resources, it is necessary to accord high priority to the promotion of optimum land use and it's conservation. Land use management is the process by which human land use is controlled to attain a specific goal, such as the maximization of resource extraction, minimization of environmental impact, or some combination of both.

1.1 Land Use

Land use is the result of a continuous field of tension created between available resources and human needs and acted upon by human efforts .Land cover refers to different features covering the earth's surface including vegetation cover, water bodies, rock outcrops etc. The land use term refers to man's use of the land and its cover. Although land use and land cover are conceptually different, they are used synonymously in many instances.

Land use can change over the years. The causes of the land use change are different. Land use / land cover changes with time because of many factors like land-ownership, population pressure etc. The major procedure in achieving the temporal figure of land use is through the application of remote sensing data, which provide an aid in the rapid assessment of the land use in a GIS environment.

1.1 Land Use Mapping

Land use mapping encompasses a wide range of procedures and data sources that are employed to measure the spatial arrangement of human activities in terrestrial ecosystems. Land use mapping techniques are widely employed to monitor and predict the environmental and human health impacts of different land uses.

Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental change. Since the late 1960's, the rapid development of the concept of vegetation mapping has lead to increased studies of land use and land cover change worldwide.

1.2 GIS

A GIS has been variously defined in literature as follows:

A special case of information systems where the data consists of observation on spatially distributed features, activities or an automated spatial information system designed for data management, mapping and analysis .GIS is a system of hardware, software and procedures designed to support the capture, management, manipulation, analysis, modelling and display of spatially referenced data for solving complex planning and management problems.

GIS can be applied towards answering questions regarding parcel location, condition, trends, patterns and modelling for analysis and problem solving. This powerful planning tool can aid decision makers for finding and classifying the most sensitive and critical open space areas in order to prioritize future acquisition strategies.

1.2.1 History of GIS

The initial developments originated in North America in 1960's with the organization such as US Bureau of Censes, the US Geological Survey and the Harvard Laboratory for Computer Graphics and Environmental System Research Institute (ESRI) etc. Later, commercial agencies started to develop and offer GIS software. Among them, today's market leaders are ESRI, Intergraph, Lasers Scan and Auto Desk etc. A sound and stable data structure to store and analysis map data became dominant in the early 1970's. Potentiality of GIS is realised in the recent past and now it has popular among many users for variety of uses. Recently commercial organizations in India have realized the importance of GIS for many applications like natural resource management, infrastructure development, facility management, business / market application etc and many GIS based projects according to the user organization requirements.

1.2.2 GIS objectives

- Maximise the efficiency of planning and decision making
- Provide the efficient means for data distribution and handling
- Capacity to integrate information from many sources.
- Routing of roads, transmission lines, pipelines, sewer lines and network analysis through these transportation routes.
- Mapping and managing urban infrastructure included base map, tax, water supply, drainage, electricity, telephone and gas.

The objective of the study is

- To prepare the landuse map of K.C.A.E.T Campus using GIS.

Review of Literature

REVIEW OF LITERATURE

2.1 GIS

GIS is a computer system which can hold and use data describing on earth surface. GIS has the powerful capability of spatially representing the complex interactions such as land use, climate, vegetation, slope, soils, population density, topography, wildlife distribution and migration pattern.

2.1.1 GIS in Landuse

Lin Xinhong *et al* (1992) conducted study on evaluation of land use in a selected area in south of Guilin by using GIS. The system includes four functions: input, storage, analysis and output. While the map of land use is overlaid on the map of slope classification, the analysis of land potentialities can be made.

Desmet *et al* (1996) conducted a GIS procedure for automatically calculating the USLE LS factor on topography complex landscapes units. A computer algorithm to calculate the USLE and RUSLE LS factors over a two dimensional landscape is presented. The computer procedure has the obvious advantage that it can easily be linked to GIS software. If data on land use and soils were available, specific K, C and P values can be assigned to each land unit so that predicted soil losses can then be calculated using a simple overlay procedure.

Richard et al (1997) made few studies on comparison of GIS verses manual techniques for land cover analysis in a Riparian restoration project. In this case study land cover maps created as a part of Riparian restoration research projects were used to compare the cost involve in calculating land cover areas with a GIS and manually with a planimeter and dot grid. While estimates of land cover areas were similar for two methods, GIS cost were much higher than manual technical cost.

Wu *et al* (1997) studied about evaluating soil properties of CRP land. Remote sensing and GIS Techniques are used to evaluate the present CRP in terms of its main goal and to give recommendations for the future of the program in Finney country,

Kansas. With GIS technology, calculation of erosion index was more efficient and value was more accurate than that calculated by hand.

Van Liehout *et al* (1998) calculated the total water requirement for a common area with different crops and soils. The table and map calculation features of ILWIS for Windows are used to combine different map layers and table attributes.

Van Westen *et al* (1998) conducted a study on methods of combining multiple maps for empirical modelling in a GIS. Several approaches to annualize multiple maps (Boolean logic models, Binary evidence maps, Index overlay with multi class maps and Fussy logic method) are introduced by means of basic exercises.

Hoobler *et al* (2003) conducted a study using the GIS combined with land evaluation and site assessment (LESA) which enhances land use planning by delivering a versatile and dynamic model to assist state policy and decision makers, county and local officials, landowners and interested citizens in making wasteland management decisions. Objective of this study is to integrate LESA methods and GIS to assess their use for land use planning in East Park County, Wyoming. Study results were fairly consistent with a park county land use plan, suggesting the combination of LESA and GIS is a rapid, versatile and up to date approach to assist in land management decisions.

Bathgate *et al* (2003) studied about GIS based landscape classification model to enhance soil survey. The objective of the research was to develop a quantitative tool to model landscape elements using GIS and digital elevation model for application in soil survey. The model was tested at a case study site in a quarter section of Massac County, Illinois. Potential productive capabilities of the model are great and should be extended to heterogeneous landscape through further testing model for communities that contend with landslide risk.

2.1.2 GIS in Watershed Management

GIS has wide range of application in watershed management including prioritization of watershed, determination of erosion status of watershed etc.

Hamlett *et al* (1992) studied about the state-wide GIS based ranking of watersheds for agricultural pollution prevention. GIS combined with a pollutant generation and transport model can be used to identify and rank critical pollutant source areas on a region basis. This model was used to rank the agricultural pollution potential of 104 watersheds in Pennsylvania. The ranking allowed identification of critical non-point source pollutant contributing watersheds in Pennsylvania and is useful for targeting further investigations and control Programs.

Kwong Fai *et al* (1995) conducted a study on erosion assessment of a large watershed in Taiwan. The objective of this study was to integrate the Agricultural Non-point source pollution model and the technology of GIS to quantify erosion problems at the Bajun river basin and Tswengwen reservoir watershed in Taiwan. They found that the annual sedimentation depth for the Tswengwen reservoir is approximately 5.9 mm, which is not significantly different from the observed rate.

Sidhu *et al* (1998) prioritized the upper Machukund watershed covering an area of 16111 ha by Remote Sensing and GIS Techniques. Based on secondary and tertiary drainage pattern, watershed areas were subdivided into 8 sub watersheds. By using GIS, land use, land cover and slope maps were combined to generate erosion intensity and composite maps. Watershed was prioritized by following sediment delivery index approach

De Roo *et al* (1998) conducted a study on modelling runoff and sediment transport in catchments using GIS. Existing erosion models can be loosely coupled to a GIS, such as the ANSWERS model. More models can be fully integrated by embedded coupling, such as the LISEM model.

Tripathi et al (2001) conducted a study using a calibrated Soil and Water Assessment Tool (SWAT). The model was verified for a small watershed (Nagvan) and used for identification and prioritization of critical sub-watersheds to develop an effective management plan. The study revealed that the SWAT model could successfully be used for identifying and prioritizing critical sub-watersheds for management purposes.

Fernandez *et al* (2003) studied about estimating water erosion and sediment yield with GIS and RUSLE. The method was applied to a typical agricultural watershed in the state of Idaho, which is subjected to increasing soil erosion and flooding problems. The spatial pattern of annual soil erosion and sediment yield was obtained by integrating RUSLE and raster GIS. Required GIS data layers included precipitation, soil characteristics, elevation and landuse. Thus it provides a useful and efficient tool for predicting long term water erosion impacts of various cropping systems and conservation support practices.

2.1.3 GIS in General Purposes

GIS can be applied in various fields such as siting farm ponds, rural planning etc.

Cheryl *et al* (1990) conducted a study about GIS as a tool for siting farm ponds. GIS was developed for identifying potential sites for a farm pond to serve as a permanent livestock. Watering system amenable to rotational grazing and independent of ephemeral streams. Using water balance calculations for 10 years of simulated climate data, the potential amount of water harvested at each site was determined using water harvesting potential. Location and negative impacts of a pond at a specific site as criteria, nine sites were ranked as most desirable.

Novelize *et al (*1992) conducted a study on wasteland development using GIS techniques. Soil p^H, soil texture, soil drainage and permeability conditions, rainfall, altitude, slope, water availability, water quality forms the layers which were analyzed for land suitability. Favourable sites for conducting percolation ponds have been selected by adopting GIS techniques to augment the ground water potential. The same methodology can be extended to develop the cultivable wastelands elsewhere**.**

Joseph (1992) conducted a study on the highway route production line using a GIS-based approach for economic road planning. It can be used to predict probable road construction and maintenance costs. The generalized, probabilistic analysis methods are based on GIS concepts and applied to a test area in Nigeria. GIS concepts allow the creation of predictive cost models that can support road way planning. This numerical model defines road way cost factors by assessing database from Remote Sensing Image Interpretation.

Srivastava *et al* (1992) conducted a study on RS and GIS for natural resource study. The effectiveness of this technique increases manifolds when it is integrated with other kind of data sets. GIS permits integration of different sets specially referenced data of interrelated parameters or periodic data sets about a resource type for its better utilization and management.

Norberto Fernandez (1993) conducted a study on the design and implementation of a soil geographic database for rural planning and management. The physical design of a database involves the evaluation of implementation alternatives using the data model of the Data Base Management System. This database, which is part of a GIS, will provide information for soil erosion and soil management studies, and land appraisal for tax assessment. The results of the conceptual design of a soil database were mapped to the relational data model.

Pascal Storck and Laura Bowling (1997) made a GIS based distributed hydrology model for prediction of forest harvest effects on peak stream flow in the Pacefic Northwest. The model, known as Distributed Hydrology Soil Vegetation Model provides a dynamic representation of the spatial distribution of soil moisture, snow cover, evapotranspiration and runoff prediction, at the scale of digital topographic data.

Zaitchik et al (2003) studied about applying a GIS slope stability model to site specific and landslide prevention in Honduras. This model was applied to an agricultural region of Honduras that suffered extensive landslide damage during Hurricane milth. Zones of predicted instability were subsequently categorized according to local slope gradient and relative wetness (w) based on steady hydrology for Hurricane conditions. Knowledge about, w in potentially unstable zones allows for informed stability, management practices, improving the utility of hazard.

Materials and Methods

MATERIALS AND METHODS

3.1 Location

The experiment was conducted in K.C.A.E.T. campus at Tavanur in Malappuram district. It is situated at 10^0 52' 30" North latitude and 76^0 East longitude. The total geographical area of the region is about 40.25 ha.

3.2 List of Maps and Data Used

3.2.1 Contour Map of KCAET Campus

The contour map of K.C.A.E.T campus prepared in 1986 was used by giving modifications to it to incorporate the changes taken place over the last 19 years.

3.2.2 Land Use Data

Field observation of the 40.25 ha area of the campus was made and change in land use was recorded. Elevation difference of the ground was found out by theodelite survey.

3.3 Digitizing

Data input is the operation of encoding the data and writing them to the database. The creation of a clean, digital database is a most important and complex task upon which the usefulness of the GIS depends. Two aspects of the data need to be considered for GIS, these are first the positional or geographical data necessary to define where the geographic or cartographic features occur, and second the associated attributes that record what the cartographic features represent.

In the raster form, the object space is divided into a group of regularly spaced grids (some times called pixels) to which the attributes are assigned. The raster form is basically identical to the data format of remote sensing data.

Most objects on a map can be represented as a combination of a point (or node), edge (or arc) and area (or polygon). The vector form is provided by the above geometric factors. The attributes are assigned to points, edges and areas. A point is represented by geographic coordinates. An edge is represented by a series of line segments

with a start point and an end point. A polygon is defined as the sequential edges of a boundary.

The most common method of entering the spatial data is digitizing. The features on the existing maps can be digitized with a scanner or tablet digitizer. Raster data are obtained from a scanner while vector data are measured by a digitizer. Raster scanner of flat bed design was used for scanning the land use map of K.C.A.E.T. The scanned data were retained in the form of pixels.

3.3.1 Creation of Raster Image by Scanning

Tracing
- Topographic map was traced on a tracing paper.

Scanning
- The flatbed scanner available had only A4 size. Hence the traced map was cut into 10 pieces of size 21 cm x 29.7 cm.
- Each of the pieces was scanned at a resolution of 300 dpi.

Image Editing
- Each of the pieces of the image was imported into different layers.
- The images in different layers were carefully aligned to form the final picture.
- Finally all the layers were merged to obtain the topographic map.

Image Manipulation
- The background of the image had many contrasting pixels, which could interfere with the automatic digitization process. So the background of the image, excluding the lines was selected using the "magic wand" tool and removed.
- The scanned image contained lot of speckles, so "despeckling filter" was applied to the image.
- Finally a clean image devoid of any orphan pixels is obtained.

Contrast stretching:
- In order that the foreground black lines are clearly visible compared to the background, the "levels" of the image has been adjusted.

3.3.2 Vectorization:

In this study, WinTopo was used for vectorization

WinTopo

WinTopo is a high quality tool for converting raster images to vector data. The following options are available on the view menu:

-Toolbar

This option selects whether or not to show the Tool Bar buttons. The Tool Bar contains buttons for the most popular options from the menu.

-Status Bar

This option selects whether or not to show the Status Bar at the bottom of the WinTopo main window. The Status Bar displays information pertinent to options and progress.

-Zoom In

WinTopo can magnify the raster image and vectors up to 32 times. Selecting the Zoom In option increases the magnification by 1. Pressing Control-D on the keyboard also performs a Zoom-In operation.

-Zoom Out

WinTopo can reduce the raster image and vectors up to 32 times. Selecting the Zoom Out option decreases the magnification by 1. Pressing Control-A on the keyboard also performs a Zoom Out operation.

-Pan Real time

We can pan the image by selecting this menu option, or clicking the toolbar button. The button will stay depressed until it is clicked again to release the option. When in Pan mode the cursor shows as a hand symbol and when click the image and drag the mouse (keeping the mouse button held down) the image will get dragged, so that the same part of the image stays under the cursor. We can use the pan mode when working with other functions - for instance, digitizing polylines.

-Zoom All

This option zooms the image so that it is all visible within the view window. This is useful if we want to quickly return from high magnification to see the whole image.

-Show Raster Image

This option selects whether or not the raster image is displayed. You may wish to turn off the raster image to see the vectors more easily.

-Show Vector Lines

This option selects whether or not the vector lines are displayed. Turn off the vector lines to see the raster image more easily.

-Show Line Colour

When a raster is vectorized the vectors are normally displayed in green, so that they show up against the raster background. If we select the Show Line Colour option the vectors will be displayed in their actual Colour

3.3.2.1 Stages of Vectorization

WinTopo employs a two stage vectorization process**:**

1. Thinning of the raster image to single pixel width lines.

2. Extraction of vectors from the pixel lines.

Thinning

In order for WinTopo to extract vectors from a raster image it needs to determine which parts of the image constitute lines, and where those lines start and end. For example, the lines may be fairly obvious to a human observer, until the image is magnified, at which point it may be seen that the lines are several pixels wide, uneven along the edges and fade out into the background. The approach used by WinTopo is to reduce thick or blobby regions down to single pixel width items, so that the image is transformed into *lines* of pixels. This process is called thinning.

Thinning of the image can be done by three methods: Stentiford, Zhang Suen and Best combination. It was found that the Stentiford method gave a better digitization for the map we have used.

Vector Extraction

Once a raster has been thinned down to lines of single width pixels, the vectorize button can be used to extract real vectors. This also occurs as the last stage of the One Touch Vectorization option. During vectorization a progress meter window shows the stage of vectorization, and the number of pixels processed when complete, the vectors will be displayed over the top of the raster image.

Automatic vectorization was used in this study to trace the lines. The automatically vectorizied image had lot of anomalies like overhanging lines, breakage in continuous lines, dotted lines represented as different polylines etc.

3.3.4 Editing: Error Detection and Correction

All digital map data can be assumed to include errors of some sort. They arise from a combination of inaccuracies in source data and from limitations of the digitizer operator and computer system in use. Certain type of errors, such as that due to inaccuracy of the original surveyed data, is implicit in the map source and cannot be rectified without obtaining another source of data. Other errors arise due to the operator failing to position the curser accurately over the graphic object to be digitized or, missing objects from the map or wrongly entering the identity of an object. As a general rule, if an error can be detected at the time of data acquisition, it will be easier to correct it than if it is not detected later.

The errors in automatically vectorized vector image were corrected by the editing tools available in WinTopo. The editing tools used for editing were: insert node, move node, delete line, join polylines etc. The vector obtained was having screen coordinates which were different from the actual spatial values. Hence the vector image was 'georeferenced'.

Georeferencing was done by entering 'control points'. Four points on the vector map which were easily distinguishable was selected and the distance between them were actually measured in the field. The (x,y) coordinates of these points were determined by fixing the left most and bottom most point as (0,0). The (x,y) coordinates of these control points were entered to georeference the vector image. Now, the points in the vector map represented the actual ground co-ordinates. The vectors can be saved in different file formats from WinTopo.

3.4 Database creation using ILWIS

ILWIS is commonly used GIS software with image processing capabilities. It is a synonym of Integrated Land Water Information System. ILWIS allows inputting, managing, analyzing and presenting geographical data. From the data we can generate information on the spatial and temporal patterns and processes on the earth surface.

To start ILWIS, double click the ILWIS icon on the desktop. After opening we can see the ILWIS main window. From this, we can start all operations.

3.4.1 Creation of a Polygon Map

Already digitized map was checked for errors and polygonized here.

3.4.1.1 Checking Segments

• In the Catalog, click the segment map with the right mouse button and select Edit from the context-sensitive menu. Before a map could be polygonized, it should be checked whether the segments had been digitized and snapped in a proper way. This check was done using the option Check Segments from the File menu of the Segment editor map window. Mouse pointer could be used to make corrections.

• From the File menu of the editor window, select Check Segment and Self Overlap to open the Check Segments dialog box . Accept the defaults and click OK.

• Click Yes to automatically zoom in on the part where the error occurs.

The next check that would be made was on dead ends in segments.

• From the File menu in the Segment editor, select Check Segments and Dead Ends to Open Check Segments dialog box.

• Click OK. The map was checked for segments that were not connected to others (dead ends).

• Click Yes to zoom in on the area. The situation is shown in the Figure

• Use the mouse pointer to move the nodes of the segments until they connect. Return to Select Mode and click the Entire map button when finished.

• From the File menu of the Segment editor, select Check Segments, Dead Ends to Open Check Segments dialog box.

• Continue checking dead ends until no more error messages appear.

The last check that will be made is on intersections without nodes

• Display the entire map.

• From the File menu of the Segment editor, select Check Segments and Intersections. The Check Segments dialog box was opened.

• Click OK. The map was now checked for segments that were intersecting without a node.

3.4.1.2 Creating a label point file

While creating a polygon map, the best procedure is to digitize the boundary lines of the segments in a segment map, and the labels or names of the polygons as points in a point map.

• In the map window displaying the corrected segments, open the File menu and select Create, Point Map. The Create Point Map dialog box is opened.

• Type 'Landuse' in the Map Name text box.

• Type for the Description: 'Points indicating the labels of Landuse polygons'.

• Click the Create button next to the Domain list box. The Create Domain dialog box is opened.

• Type 'Landuse' in the text box Domain Name.

• Select the option Class and click OK. The Domain Class editor is opened.

• Close the Domain Class editor. Now we came back in the Create Point Map dialog box.

• Click OK. The Point editor and the Point Editor command box are opened

• Digitize a point within each of the units. Digitize points with the mouse pointer.

• When the digitizing of the points is finished, click the Exit Editor button in the Point editor. The point map Landuse was displayed on top of segment map.

3.4.1.3 Adding an Annotation Text layer.

•From the File menu in the map window, select Create and select Annotation Text. The Create Annotation Text dialog box is opened.

•Enter the Annotation Text Name: 'lu_labels'.

•Make sure the check box based on map is selected and choose point map landuse from the drop-down list box.

•Accept all other defaults and click OK. The Annotation Text editor is opened.

3.4.1.4 Saving as Map View

The map window with all data layers, the annotation text layer and the grid lines can be Saved in a map view.

•From the File menu in the map window, select the Save View as command. The Save View dialog box is opened.

•Enter the MapView Name: 'Landview'.

•Enter the Title: 'Landuse map of KCAET'.

•Click OK. The view is now saved.

•Close the map window.

•Open the map view Landview. All layers that combined earlier are now appearing in the same way as displayed them before.

3.4.1.5 Layout and Annotation

Creating a Layout

•From the File menu of the Main window, select Create, Layout. The Layout editor is opened.

•From the File menu of the Layout editor, select Page Setup. The Page Setup dialog box is opened.

•Make sure the paper size is A4, change the orientation to landscape and click OK. The orientation of the layout is now changed into landscape.

Digitizing contour lines

• From the File menu of the Main window, select Map Reference. The Map Reference dialog box is opened.

• Expand the create item in the operation-tree and double-click New Segment Map. The Create Segment Map dialog box is opened.

• Type 'Isolines' for the name of the map.

• Select landuse from the list box Coordinate System.

• Click the Create Domain button. The Create Domain dialog box appears.

• Type 'Isolines' for the Domain Name and select domain Type Value.

• Type 0 and 50 in the Min, Max text boxes, and type 0.1 in the text box Precision.

• Close the Create Domain dialog box by clicking OK. You are now back in the Create Segment Map dialog box. Click OK.

• From the Edit menu of the segment editor, select Insert Code.

• The Edit dialog box is opened.

• Type the value: 8. This will be the default value for all segments that will digitize from now on. Click OK.

• Digitize the contour lines with the altitude 8. After you finished digitizing each line, click OK in the Edit dialog box.

• Subsequently digitize a contour line of altitude 10. In the Edit dialog box, which appears after you finished digitizing the line, change the value into 10 and click OK.

• Continue to digitize the rest of the contour lines.

• Make sure to snap different parts of the same contour line.

• From the File menu of the segment editor, select Check Segments, Code Consistency.

• Accept the defaults in the Check Segments dialog box and click OK. If the program finds an error, it will indicate the place of the error with a red box and a dialog box appears stating the nature of the error: Different codes 'value' and 'value' at node. Zoom in on error?

• Click Yes to zoom in and correct the errors (if any) by recoding the wrong segments.

• Press the Exit Editor button when the digitizing is finished. When the segment editor is closed, the segments are displayed in a map window; segments are displayed with system representation Pseudo.

• Close the map window when you have seen the result.

3.5 Creation of a Digital Elevation Model

3.5.1 Creating a Contour Map

• Open the digitized segment map of the contour isolines.

• Check for segmentation errors, correct, save and close.

• Right click on isolines and select contour interpolation

• Select isolines as contour map, contour as output raster map, KCAET as georeference, and for the domain value, range 0 to 50, and precision 0.1. Click show.

3.5.2 Creating a Digital Elevation Model: Contour Interpolation

• Click with the right mouse button on segment map contour and select contour Interpolation from the context-sensitive menu. The Interpolate contour map dialog box is opened.

• Type 'Dem' as Output Raster Map.

• Select Georeference as KCAET.

• Type for the Description: DEM created from the segment map contour.

• Accept all other defaults and click show.

3.5.3 Creating a Slope Map from Digital Elevation Model

• Double-click the Filter operation in the Operation-List. The Filtering dialog box is opened.

- Select Raster Map 'Dem' and Filter Name DFDX.

- Type for Output Raster Map: 'Dx'.

- Accept all other defaults and click Show. The map is calculated, after which the Display Options – Raster Map dialog box is opened.

- Click OK in the Display Options – Raster Map dialog box. The map is now displayed.

- Repeat the procedure to create a gradient map in the y-direction, but select the Filter Name DFDY and type 'Dy' for the Output Raster Map name.

- Close the map windows.

- Type 'Slope=HYP(Dx,Dy)/pixsize(Dem)*100' on the command line to obtain a slope map 'slope' with the percentage slope values.
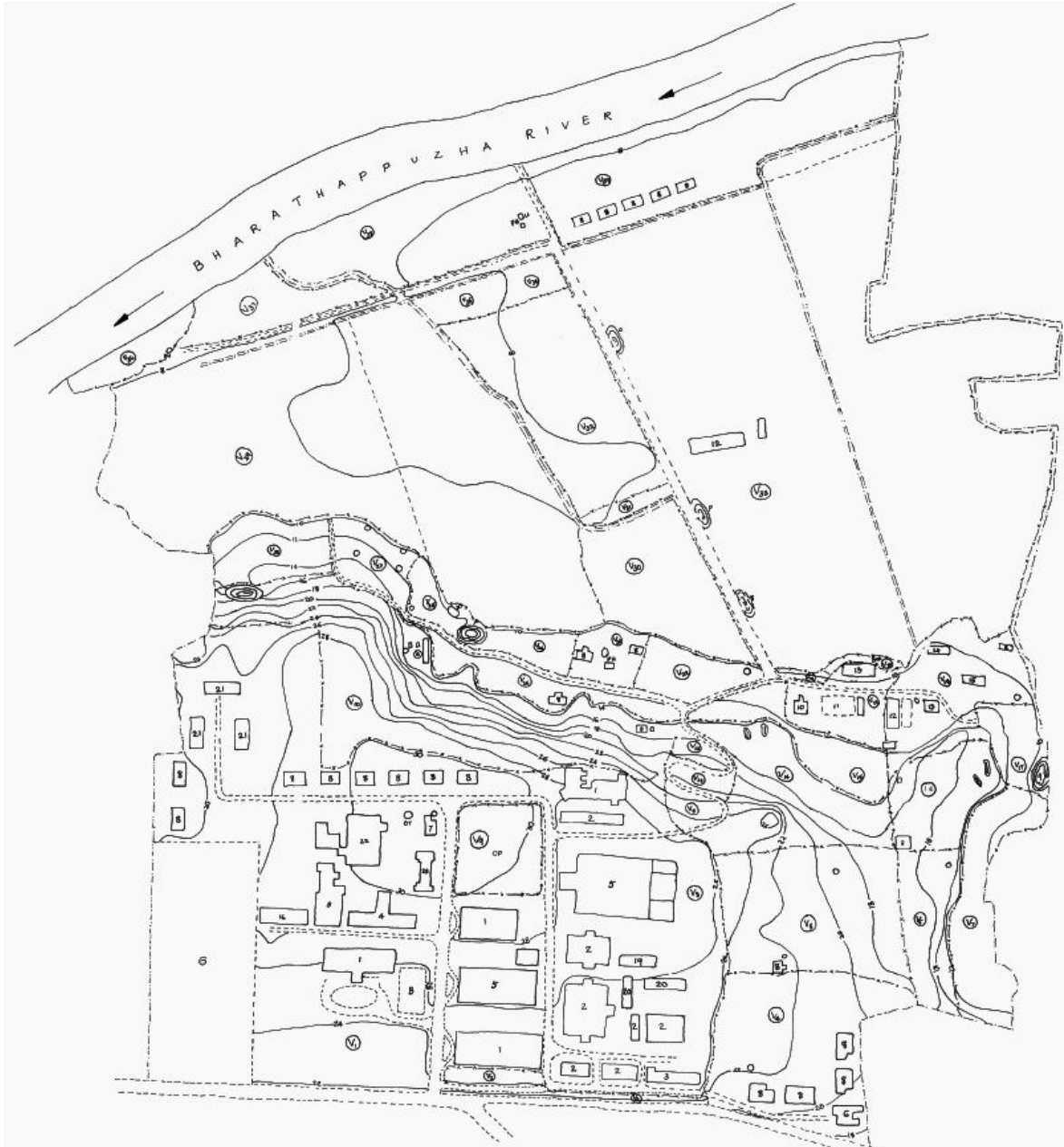
Fig 1. Topographical map of K.C.A.E.T campus
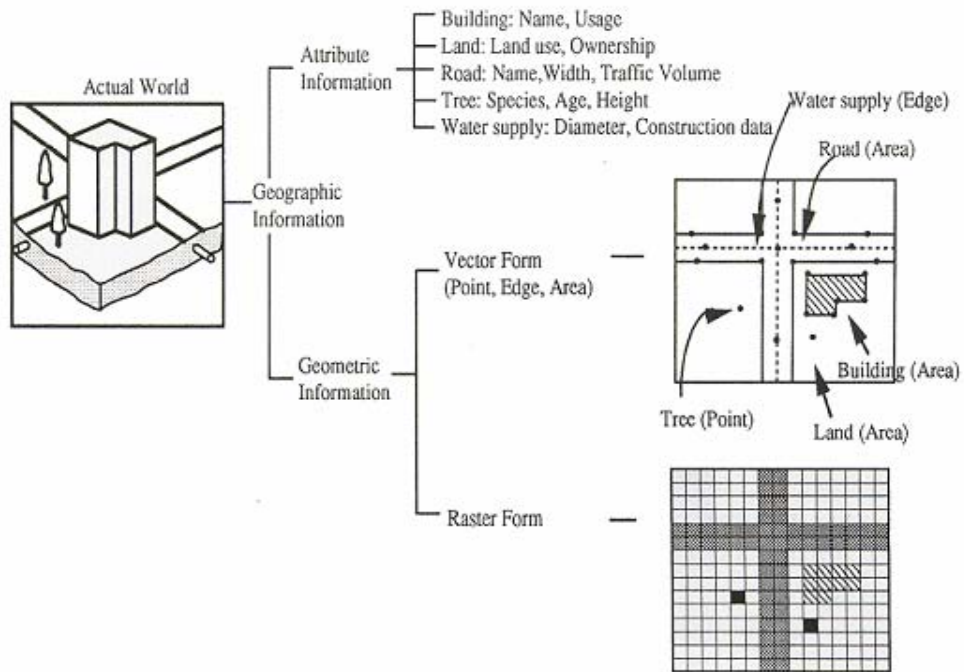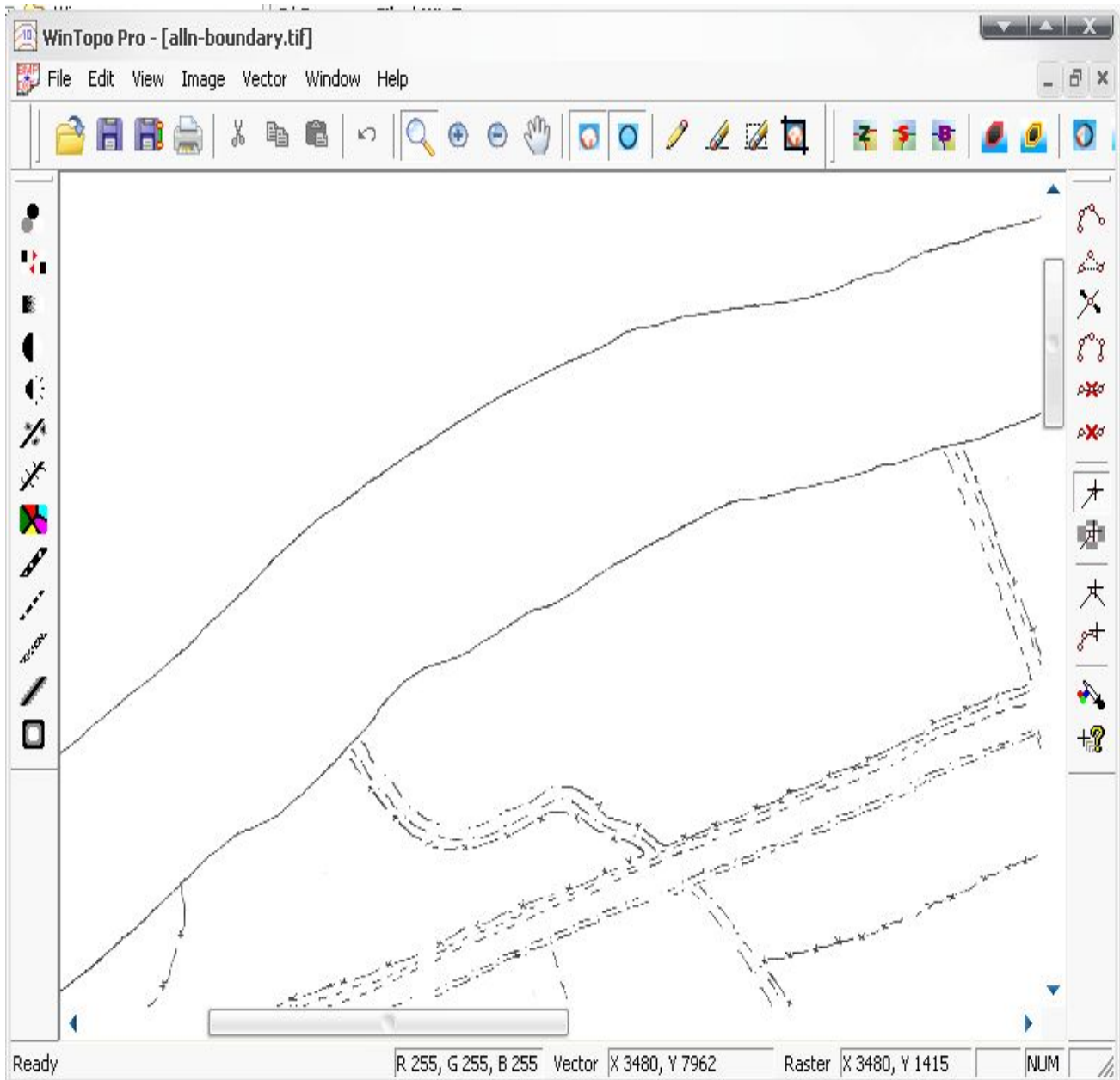
Fig.2 Raster and Vector Representation
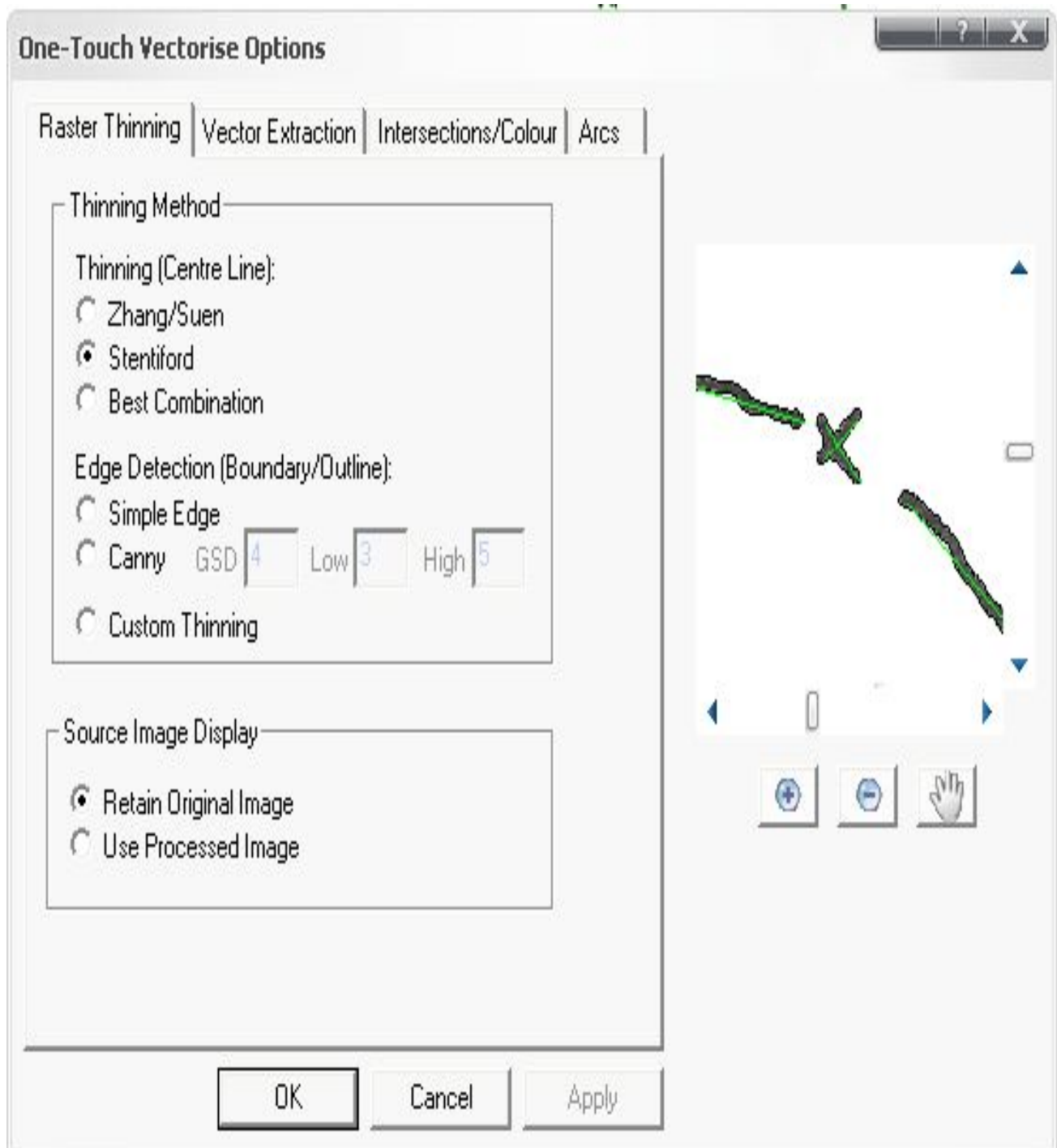
Fig 3. Wintopo screen showing tool bars

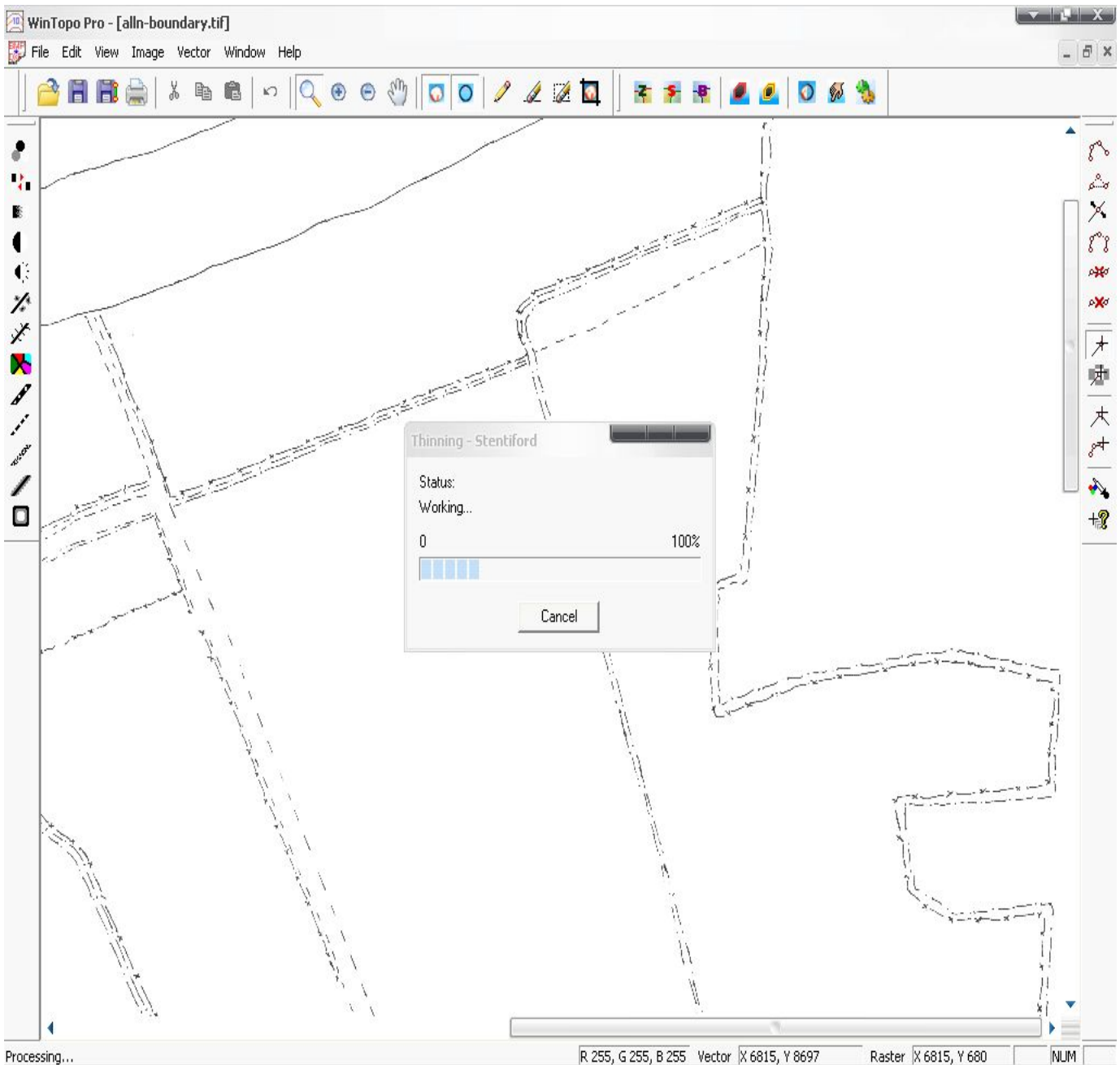Fig 4 Thinning by Stentiford method
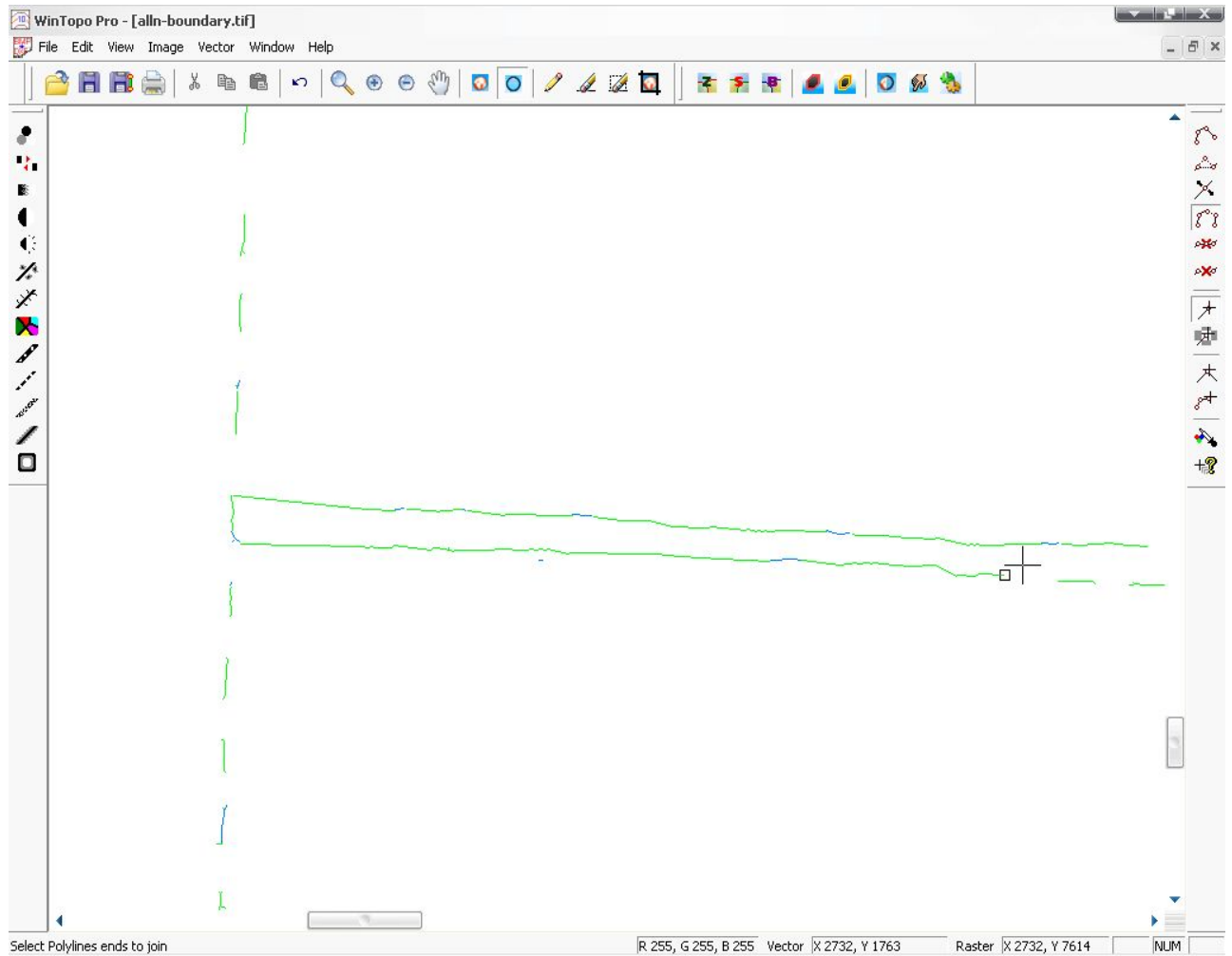
Fig 5. Vectorization process

Fig.6. Editing Process

Results and Discussion

RESULTS AND DISCUSSION

This chapter describes the results of the study conducted for mapping the land use pattern of K.C.A.E.T Campus using GIS. This can be used as a basis for further planning and management purposes.

4.1 Landuse

The land use term refers to man's use of the land and its cover. Although land use and land cover are conceptually different, they are used synonymously in many instances.

The present change in landuse was noted by field observations. The change in ground slope was found out by theodolite survey and it was estimated to be 0.67 %.

4.2 Land Use Mapping

The Land use map of K.C.A.E.T was prepared using WinTopo and ILWIS software. The topographic map of K.C.A.E.T is given in chapter 3. (Fig.1) and the present land use distribution are represented in Fig. 12.

The map of buildings in K.C.A.E.T campus is shown in Fig. 13. The digital elevation model (DEM) of K.C.A.E.T campus (Fig. 14) was obtained using the contour map. From the DEM many useful information like hill shading map, slope aspect, 3D terrain view etc. can be easily obtained, if required. The slope map of the K.C.A.E.T campus is obtained from the DEM and is shown in Fig. 15. This slope map can help in making decisions regarding the type of crop to be grown, soil conservation practice to be followed, siting of water conservation structures etc.

As the land use map is already prepared in ILWIS, further analysis like estimating the irrigation water requirement, finding soil erosion rate, yield from each land parcels etc. can be very easily done by adding appropriate layers with parameters for estimating the different factors. This database can act as a basic planning tool for agricultural as well as other land management functions. An example use of GIS for finding the runoff is shown in the flowchart (Fig. 8).
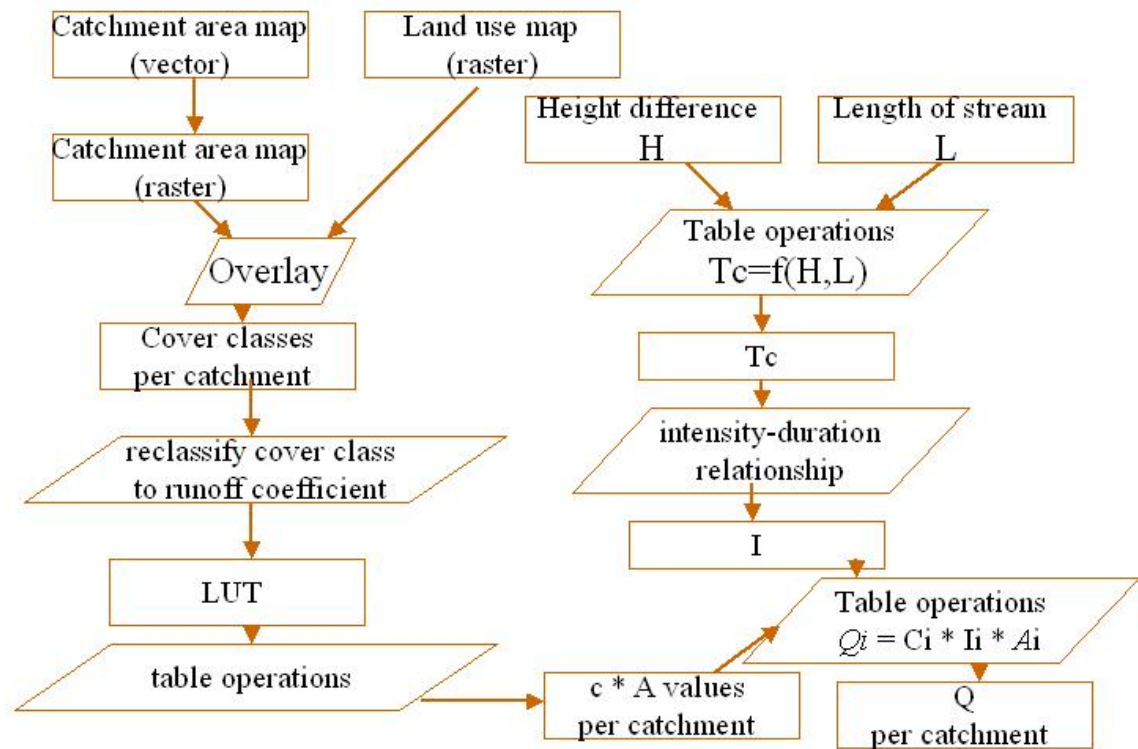
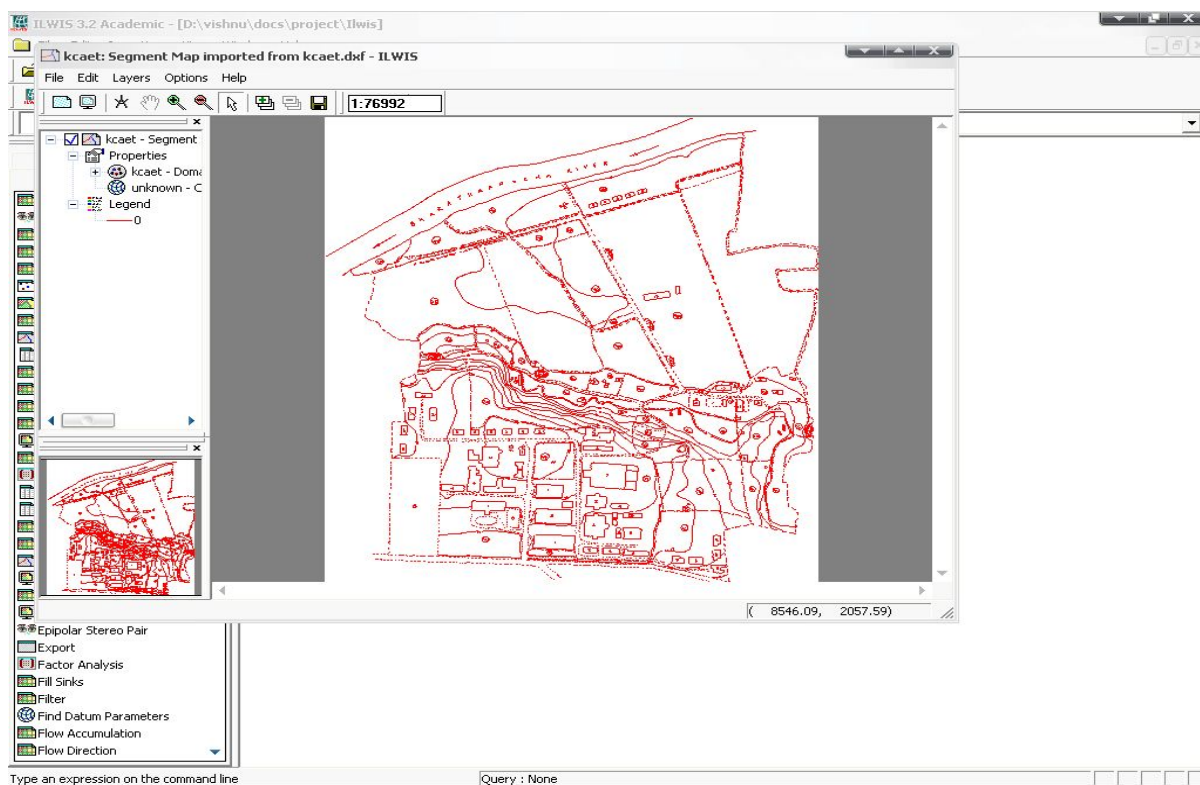Fig. 8. Flow chart for finding runoff by GIS

Fig. 9. Vectorized map of K.C.A.E.T Campus in ILWIS

Table 1 Land use pattern of K.C.A.E.T campus

Area code	Land use	Area (ha)
V_1	Uncultivated	8.00
V_2	Cashew and Acacia	0.17
V_3	Cashew, Acacia and coconut	0.07
V_4	Cashew, Mango, and Jack	1.60
V_5	Coconut	1.70
V_6	Miscellaneous trees	0.30
V_7	Areca nut	0.43
V_8	Miscellaneous trees and shrubs	0.32
V_9	Acacia and Mango	0.40
V_{10}	Miscellaneous trees	2.40
V_{11}	Cashew	0.20
V_{12}	Coconut and nutmeg	0.20
V_{13}	Coconut	0.23
V_{14}	Cashew	0.85
V_{15}	Coconut and nursery	0.29
V_{16}	Cashew and coconut	0.37
V_{17}	Cashew	0.24
V_{18}	Miscellaneous trees	0.64
V_{19}	Uncultivated	0.27
V_{20}	Plantation and coconut	0.02
V_{21}	Suppotta	0.01
V_{22}	Coconut	0.25
V_{23}	Jack, Pepper, Mango	0.20
V_{24}	Areca nut	0.12
V_{25}	Coconut	0.15
V_{26}	Coconut	0.33
V_{27}	Miscellaneous trees and Pepper	0.23
V_{28}	Coconut and Trees	0.33
V_{29}	Coconut	4.40
V_{30}	Paddy and Banana	1.92
V_{31}	Plantation and coconut	0.08
V_{32}	Vegetables	1.35
V_{33}	Paddy	8.40
V_{34}	Plantation and banana	0.18
V_{35}	Plantation and coconut	0.17
V_{36}	Miscellaneous trees	0.16
V_{37}	Coconut	0.39
V_{38}	Mango	1.18
V_{39}	Coconut	1.70

Table 2. Percentage Area Distribution of landuse in K.C.A.E.T.

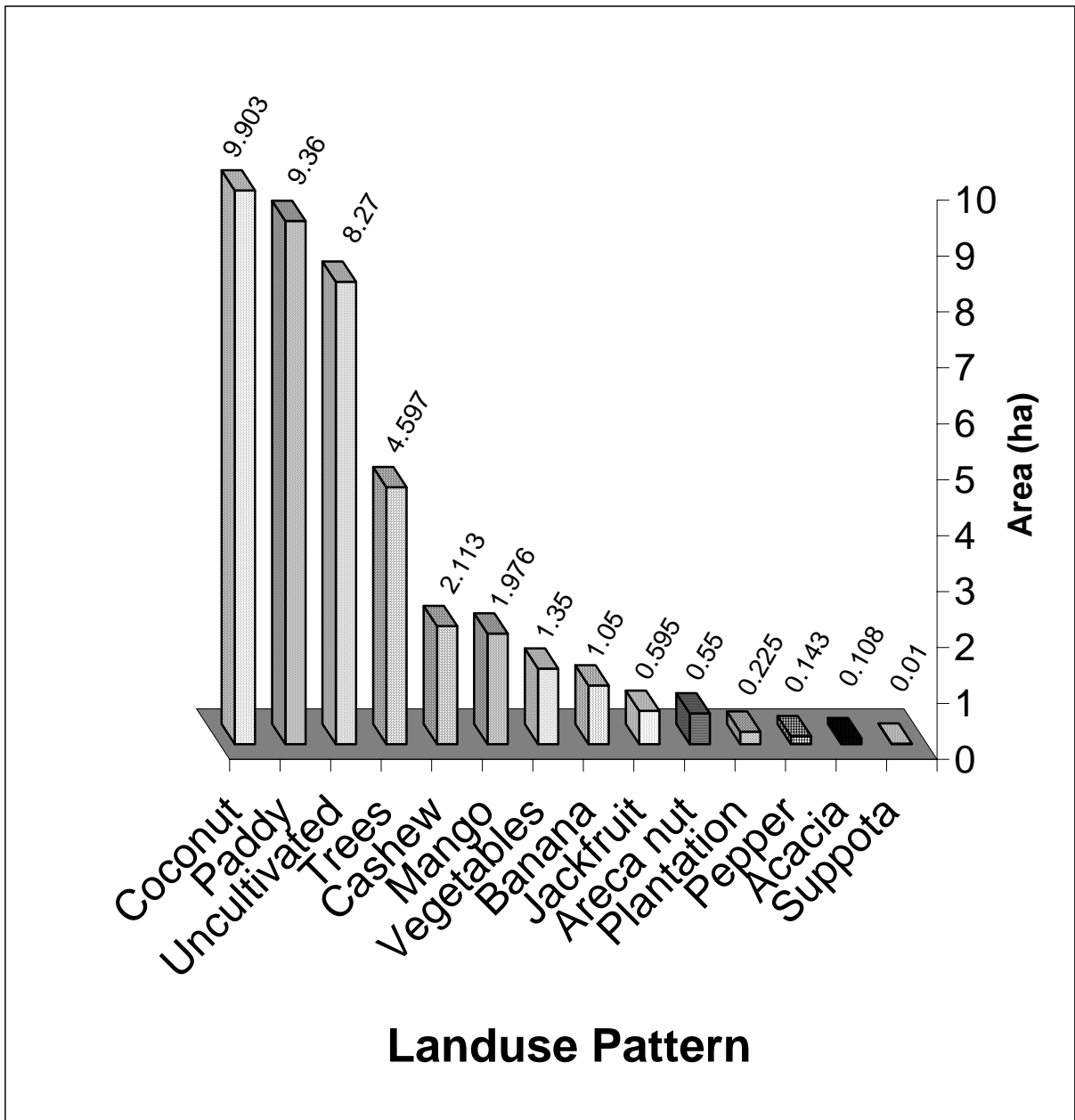| Landuse	Percentage Area
Coconut	24.60
Paddy	23.25
Uncultivated	21.22
Trees	11.33
Cashew	5.24
Mango	4.90
Vegetables	3.35
Banana	2.60
Jack Fruit	1.47
Areca nut	1.36
Plantation	0.56
Pepper	0.36
Acacia	0.26
Suppota	0.03

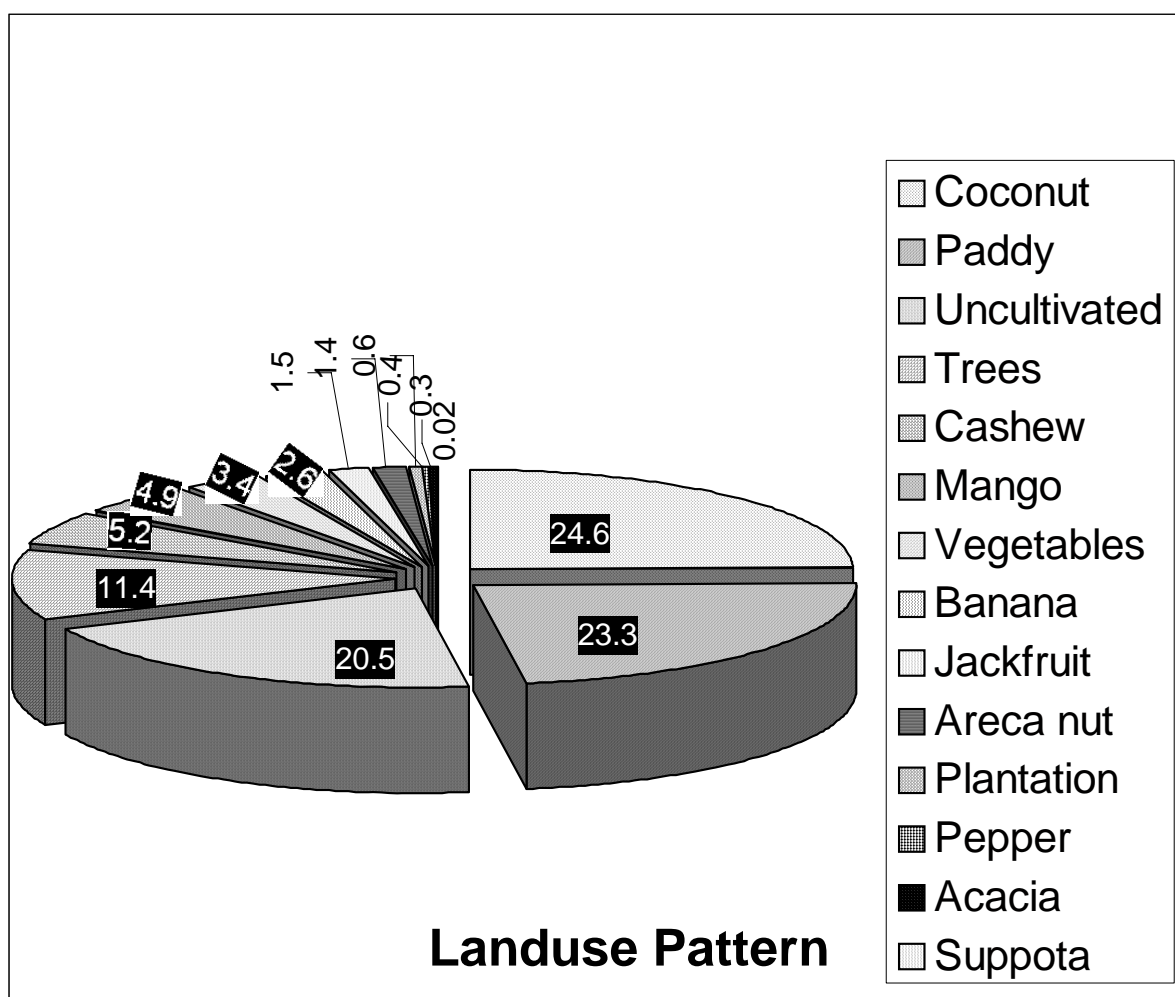Fig 10. Area Distribution of Different Landuses

Fig 11. Percentage Area Distribution of Land Use in K.C.A.E.T
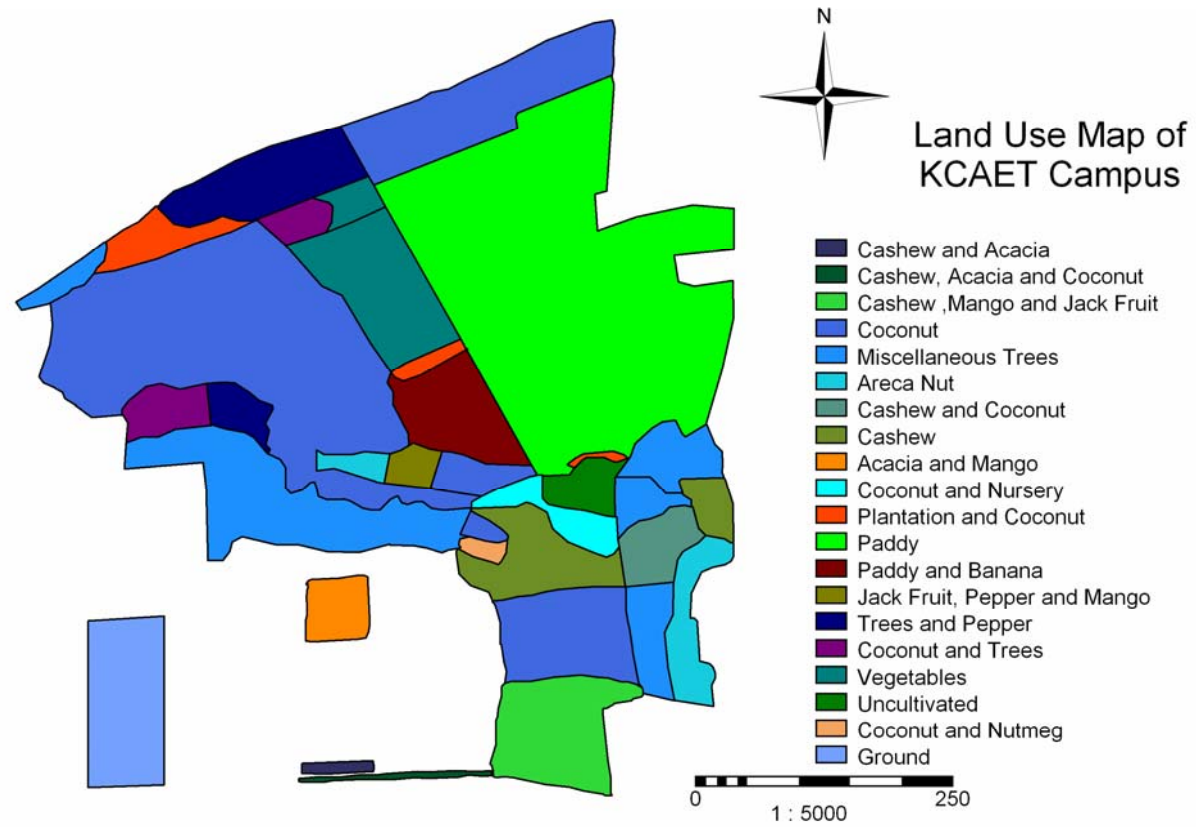
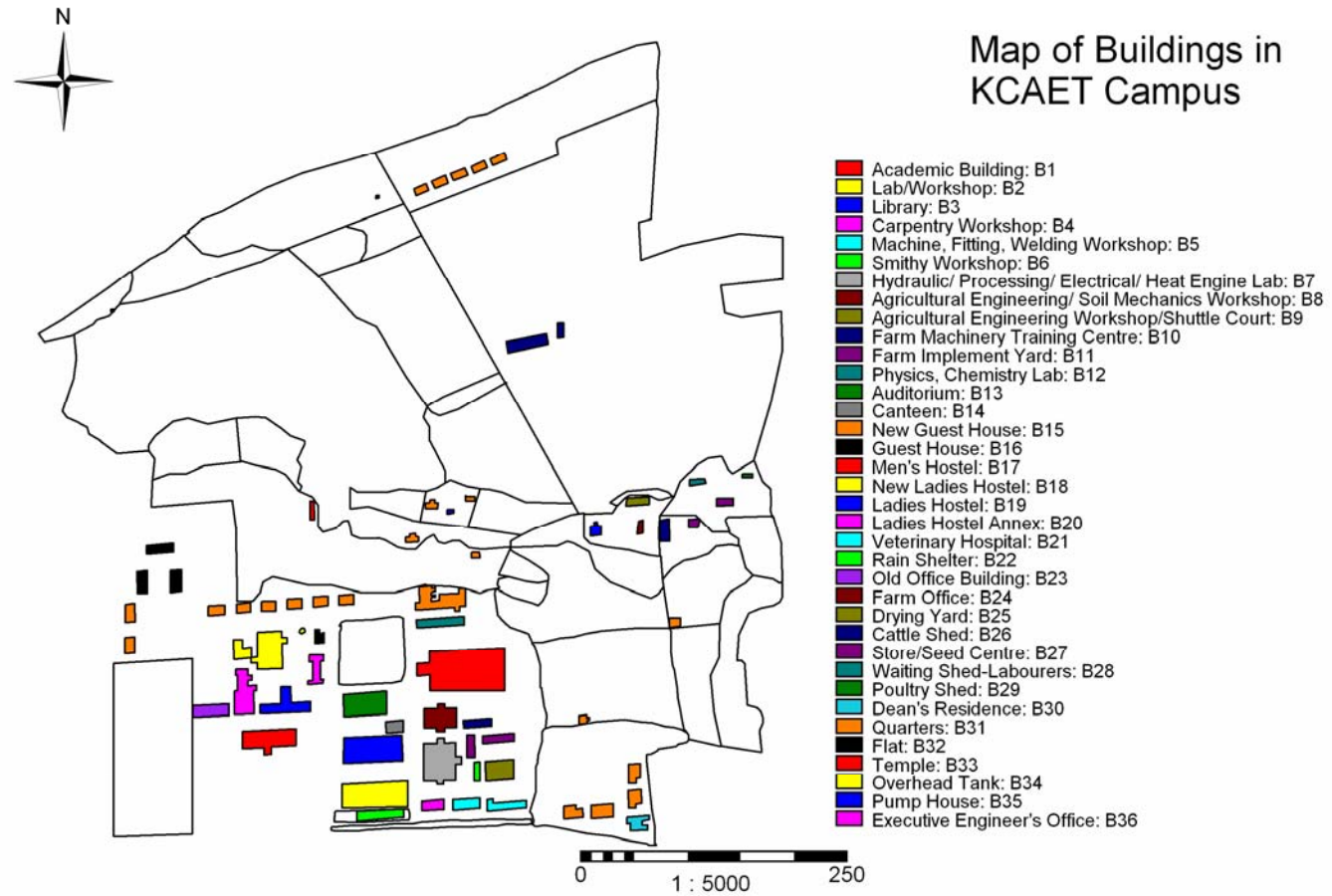Fig. 12. Land use map of KCAET campus

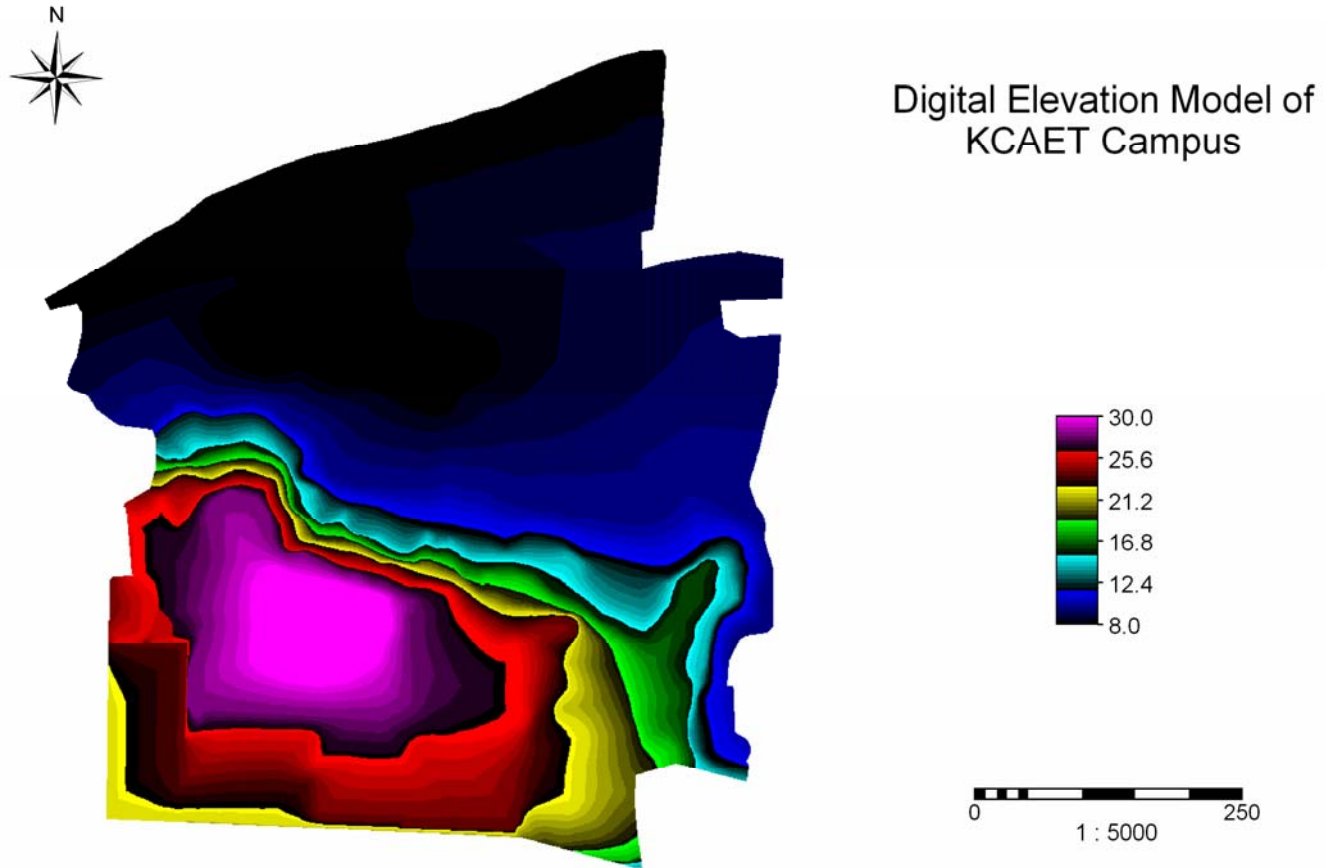Fig 13. Map of buildings in KCAET Campus
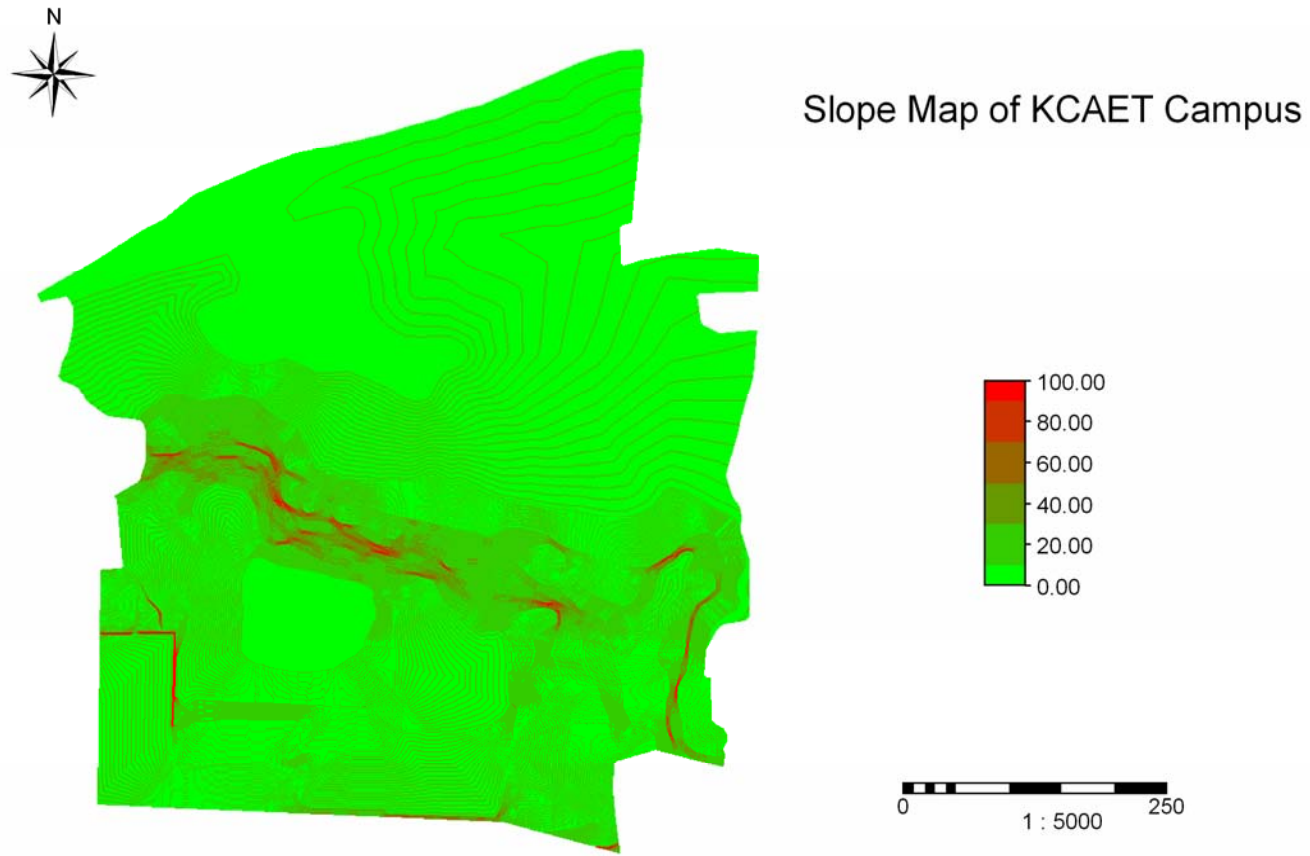
Fig 14. Digital Elevation Model of KCAET Campus

Fig 15. Map showing the slope variation

Table 3. Buildings in K.C.A.E.T Campus

No.	Features
1	Academic Building
2	Lab/ Workshop
3	Library
4	Carpentry workshop
5	Machine, Fitting, welding workshop
6	Smithy workshop
7	Hydraulic / Processing / electrical / Heat Engine Lab
8	Agricultural Engineering / Soil Mechanics workshop
9	Shuttle court
10	Farm machinery Training Centre
11	Farm implement Yard
12	Physics, Chemistry Lab
13	Auditorium
14	Canteen
15	New Guest House
16	Guest House
17	Men's Hostel
18	New Ladies Hostel
19	Ladies Hostel
20	Ladies Hostel Annex
21	Veterinary Hospital
22	Rain Shelter
23	Old Office Building
24	Farm Office
25	Drying Yard
26	Cattle Shed
27	Store / Seed Centre
28	Waiting Shed- Labourers
29	Poultry Shed
30	Dean's Residence
31	Quarters
32	Flat
33	Temple
34	Overhead Tank
35	Pump House
36	Executive Engineers Office

Table 4. Area Code for Different Land Uses

Area code	Crop
V1	Cashew and Acacia
V2	Cashew, Acacia and Coconut
V3	Cashew ,Mango and Jack Fruit
V4	Coconut
V5	Miscellaneous Trees
V6	Areca nut
V7	Cashew and Coconut
V8	Cashew
V9	Acacia and Mango
V10	Coconut and Nursery
V11	Plantation and Coconut
V12	Paddy
V13	Paddy and Banana
V14	Jack Fruit, Pepper and Mango
V15	Trees and Pepper
V16	Coconut and Trees
V17	Vegetables
V18	Uncultivated
V19	Coconut and Nutmeg
VG	Ground

Summary and Conclusion

SUMMARY AND CONCLUSION

Land cover refers to different features covering the earth's surface including vegetation Land cover, water bodies, rock outcrops etc. The land use refers to man's use of land and its cover. Land use can change over the years. Land use change is the temporal shift in human exploitation of biospherical resources in terrestrial ecosystems.

Land use mapping encompasses a wide range of procedures and data sources that are employed to measure the spatial arrangement of human activities in terrestrial ecosystems. GIS enables the effective and efficient manipulation of the spatial and nonspatial data for land use mapping. ILWIS which is the most common software of GIS is used in this study for land use mapping.

Field observations of the entire study area were done and change in land use was recorded. The traced topographical map was cut into 10 pieces of size 21cm x 29.7cm. Each of the pieces was scanned with A4 size flat bed scanner. Finally all the layers were merged to obtain the topographical map.

The software WinTopo was used for vectorization of the scanned topographical map. After vectorization, editing was done to correct the errors. Data input and editing were very important procedures and it occupied 80 % of the total expenditure in GIS. This database can act as a basic planning tool for different fields like agricultural development, Land evaluation analysis, Change detection of vegetated areas, analysis of deforestation and associated environmental hazards, monitoring vegetation health, soil resources mapping, ground water potential mapping, monitoring forest fire, monitoring ocean productivity etc.

References

REFERENCES

Bathgate, J.D and Duram, L.A. (2003). GIS based landscape classification model to enhance the soil survey. A southern Illinois case study. *J. soil and water conservation* 58(3): 119-127

Cheryl, F.V. and James, M.H. (1996). GIS - a tool for siting farm pond units *J. soil and water conservation.* 51(5): 434-439

Dermet, B.G., Xon, K. and Paul, A.M. (1996) GIS procedure for automatically calculating the USLE, LS factor on topographic complex landscape units *J. soil and water conservation.* 50(3): 134-143

De Roo, Paul, A.N and Zein, K (1998) Modelling runoff and sediment transport in catchments using GIS *J. soil and water conservation* 50(6): 158-164

Fernadez, C., Win J.Q. and Stockle, C.O. (2003). Estimating water erosion and sediment yield with GIS, RUSLE and SEDD. *J. Soil and Water Conservation* 58(1): 128-137

Hamlett, J.M., Miller, D.A., Day, R., Peerse, G.W., Baumer, G.M and Russo, J. (1992) State wide GIS based ranking of watersheds for agricultural pollution prevention. *J. soil and water conservation* 47(5): 399-405

Hoobler, B.M., Vans, H and James, D (2003) Application of land evaluation and site assessment (LESA) and GIS in East Park County, Wyoming. *J. soil and water conservation* 58(2): 105-113

Joseph, O.A. (1992) .Highway route production line: a GIS based approach for economic road planning. RS application and GIS. Tata Mc Graw-hill publishing company ltd, New Delhi. 406-410

Kwong, A.C. (1998). Erosion assessment of large watershed in Taiwan *J. soil and water conservation* 50(2): 180-184

Lin, X., Joseph, P.M and Perce, J.M . (1992). Evaluation of land use in selected areas in south of Guilin by using GIS *J. soil and water conservation* 46(5): 280-292

Michael, F. and William, M.D (1997) Use of GIS in hydrology and water management *J. Soil and Water Conservation* 52(4): 250-259

Noveline, R.A. and Sundaram, A. (1992). Wasteland development using GIS technique. Tata Mc Graw-hill publishing company ltd, New Delhi.388-394

Pascal, S and Laura, B.C. (1997). GIS based distributed hydrology model for forest harvest effect on peak flow in the Pacific North West. *J. soil and water conservation* 52(4): 148-155

Richard, R.H., Hopkinson, P., Caffery, S. and Huntsinger, L. (1997) .Comparison of GIS verses manual techniques for land cover analysis in a Riparian restoration project. *J. soil and water conservation* 52(2):112-118

Sarangi, A. and Bhattacharya, A.K. (2001). Use of GIS in assessing the erosion status of watersheds, *Indian J. soil conservation*.29 (3): 190-195

Sidhu, G.S., Singh, R.S., Sharma, R.K and Ravisankar, R.(1998). Remote sensing and GIS techniques for prioritization of watersheds, Indian *J. soil conservation*.26 (2): 71-75

Sooraj Kannan, P.V., Saritha, S.S and Anish, J.E. (2003) Estimation of erosion and runoff. Unpublished B-Tech Report, K.C.A.E.T, Tavanur.

Srivasthava, D., Singh, R.S and Ravishankar, R. (1992) Remote Sensing and GIS for natural resource study. *J. soil and water conservation* 52(5): 150-158

Tripathi, M.P., Pandya, R.K. and Raghuvamshi, N.S. (2001). Identification and prioritization of critical sub-watersheds for soil conservation management using the SWAT model, *Biosystems engg*. 85(5):365-379

Van, L., Thomas, K.M and Fred, O.M. (1998). Calculation of water requirement using GIS. *J. soil and water conservation.* 51(4): 214-218

Van, W., Caffery, Sand Xoneg, S,G. (1998) Methods of combining multiple maps for empirical modelling in GIS. *J. soil and water conservation.* 52(5): 150-175

Wu, J., Nellis, M.D., Ranson, M.D. and Price, K. (1997). Evaluating CRP land soil properties by using GIS and Remote Sensing. *J. soil and water conservation* 52(5): 358-363

Zaitchik, B,F and Van, H,M. (2003). Applying a GIS slope stability model to site specific land slide prevention in Honduras. *J. soil and water conservation* 58(1): 45-53

LAND USE MAPPING BY GIS

BY

ANU.M.BABU.
RAMYA.P.
SMITHA.K.E.

ABSTRACT OF THE PROJECT REPORT

Submitted in partial fulfilment of the requirement for the degree

BACHELOR OF TECHNOLOGY
IN
AGRICULTURAL ENGINEERING

Faculty of Agricultural Engineering
Kerala Agricultural University

Department of
Land and water resources and conservation engineering
KELAPPAJI COLLEGE OF AGRICULTURAL ENGINEERING AND TECHNOLOGY
Tavanur-679 573, Malappuram
Kerala, India
2005

ABSTRACT

Land use is the fundamental to sustainability. Agricultural land use, one of the primary uses of land has been of prime importance since the beginning of civilization. Agricultural development has been the foundation of the industrial superstructure in the developing countries. GIS enables the effective and efficient utilisation of spatial and nonspatial data for land use mapping.

The preparation of land use map of KCAET campus was done in this study using WinTopo and ILWIS. The raster scanner of flat bed design scanned the traced topographical map. The raster image was converted to vector form by using a high quality tool called WinTopo. This database can act as a basic planning tool for different fields like agricultural development, land evaluation analysis, change detection of vegetated areas, irrigation water requirement etc.