Watershed – Concept and Management

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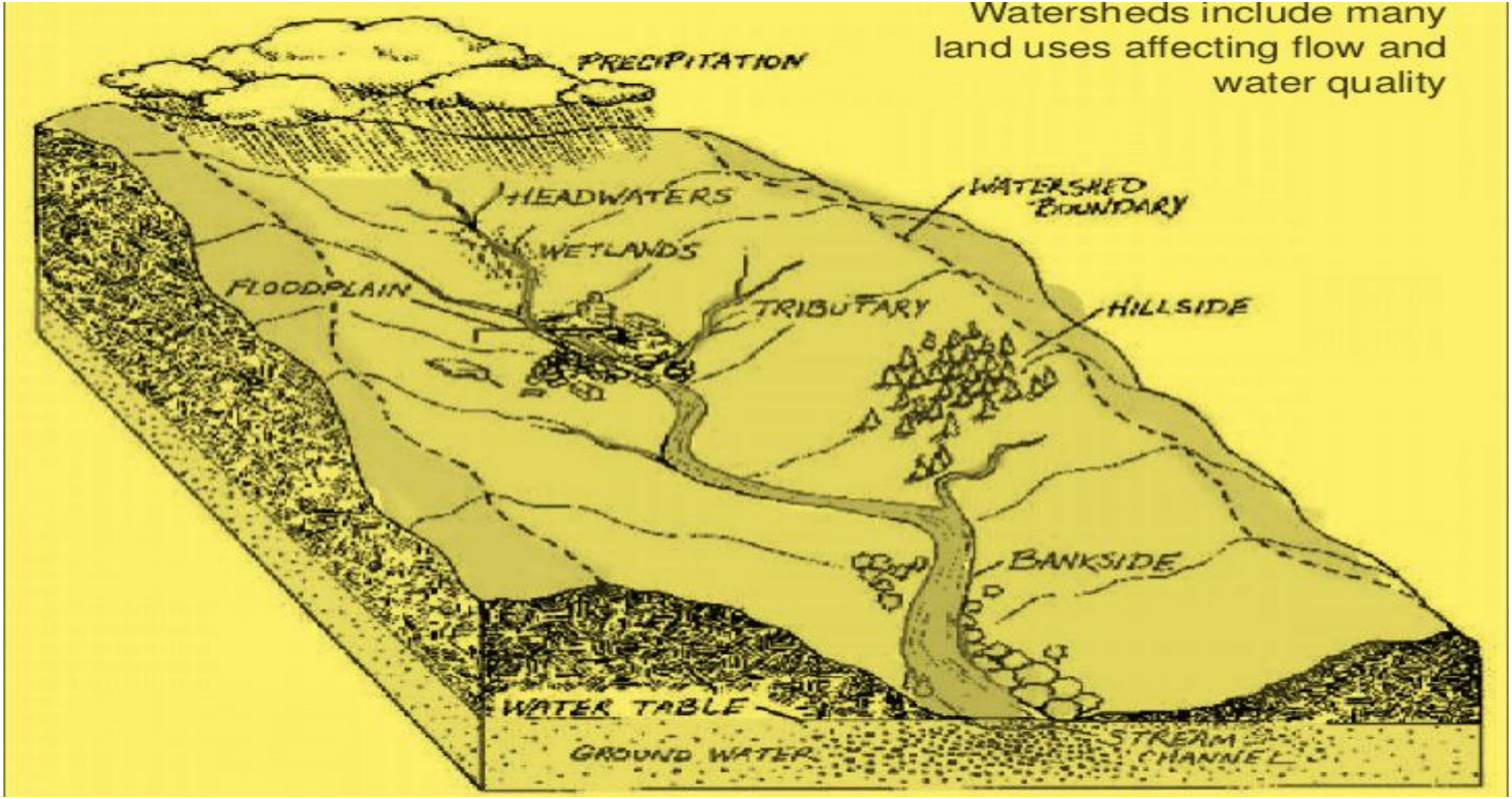
Definition

- **Watershed may be defined as a Natural hydrologic entity that cover a specific expanse of land surface from which the rainfall and runoff flows to a defined drainage channel, stream or river at any particular point**


Watersheds include many land uses affecting flow and water quality
PRECIPITATION
HEADWATERS
WATERSHED BOUNDARY
WETLANDS
FLOODPLAIN
TRIBUTARY
HILLSIDE
BANKSIDE
WATER TABLE
GROUND WATER
STREAM CHANNEL

Classification of watershed

	Mean size (+50% sq.km.)
Water resources region	5,00,000
River Basin	50,000
River sub basin	5,000
Watershed	500
Sub watershed	50
Mini watershed	5
Micro watershed	Below – 2.5
Nano watershed	a few hectares of land

- Source : MOA (1990) Watershed Atlas of India

Characterisation of water sheds - Taking stock of Resources

Climatic Resources

- Rainfall
- Temperature
- Humidity
- Bright Sunshine hour
- Wind velocity and wind direction (monthly)
- Evaporation and evapo-transpiration
- Any other pertinent features eg. Hailstorms, dew, hot winds, soil moisture variations etc.

Physical Resources

Land

Physiography / landforms

- Topography / relief
- Ruggedness
- Slopes
- Geology
- Rock formation
- Parent material
- Stratigraphy

Water Resources

- Surface drainage
- Surface water resources – reservoirs, tanks, ponds etc.
- Sub surface water resources – open wells, tube wells etc.
- **Assessment of ground water zones and mapping**
- Depth of water table in different seasons
- Quality of ground water

Soil Resources

- Profile description
- Site characterization (erosion, internal drainage, slopes etc.)
- Morphological characteristics (colour, texture, structure etc.)
- Physical and chemical characteristics

  (moisture status, infiltration, permeability, clay

  type, organic matter, fertility status)
- Preparation of soil map and other thematic maps

Land Capability Classes

Capability class and area under each capability class

Brief description of each class mentioning clearly the prominent hazard

Biological Resources

Vegetation / present land use

- Agriculture
- Rainfed area (area, crop yield, rotation and management practices)
- Irrigated area (area, crop yield, rotation and management practices)
- Forest (type existing management, canopy density, species etc.)
- Farm forestry
- Orchards
- Grazing land / grass land

Livestock

- **Animals**
- **Poultry**
- **Fishery**
- **Rabbit / pig**
- **Rearing**
- **Kind, Numbers, Age groups, Hybrids, Availability of fodder etc.**

Socio-economic Resources and Infrastructure

- Ultimate benefit should increase the economic status of the local people.

  Existing status will be helpful in planning, development of watershed in a holistic way

  Data to be collected
- Number of villages, households in each village,
- Population (male, female, SC/ST, farmers etc.)
- House hold by farm sizes, land use, workforce
- Ownerships education and literary
- Public facilities like water supply, communication, markets, hospitals, schools, shops, banking, credit facilities, fertilizers and pesticides
- Village cooperatives, agricultural implements and fuel availability

Land Recourses Management - Watershed Approach

- A "watershed approach" is advantageous because it considers all activities within a landscape that affect watershed health.
- To develop and improve the utilization of land and water resources so as to be environmentally sound and sustainable
- To control soil erosion, conserve water, improve farm income, encourage wild life and prevent flood damage to the lands.
- Utilization of natural resources for improving agriculture and allied occupation, industries in order to improve socio – economic condition of the local people
- Provision of optimal water for agricultural, Industrial, domestic and other purposes.
- Amelioration of soil, water and air pollution etc.

Watershed Management - Step wise implementation

Problems and Needs of the Area

- Soil and water conservation,and problems such as salinity, sodicity
- physical features like gravelliness stoniness etc.
- Land problems such as hills, steep escarpments, laterite capping, floods etc.
- Flooding and sedimentation problems
- Special problems
- Shifting cultivation, over grazing fire, land slides, mine spoils etc

Socio-economic problems

- **Major obstacles in carrying out watershed management programme in the area**
- **Serious socio-economic problems should be identified at the initial stage of planning.**
- **These may be related to land tenure, poverty**
- **Lack of education, low acceptance of innovation,**
- **Seasonal shortage of labour etc**

Needs of the people

- **Agricultural needs**
- **Fuel and fodder requirement** etc.

Prioritisation of watersheds and peoples participation in implementation

- Based on the problems of the watershed the critical areas in the watershed may be demarcated
- Based on priority, development programmes is to be undertaken.
- Peoples participation is to be ensured right from planning,decision making, local needs of the community.
- Necessary training, and involvement at every stage is absolutely necessary for the success of the programme

Benefits of Watershed Management

- Sound watershed management controls flood, reduces erosion and sedimentation
- Maximizing productivity per unit area, per unit time, and per unit amount of water
- Increasing cropping intensity
- Proper utilization of marginal or waste lands through alternate land use systems.
- Ensuring ecological balance
- Maximizing the combined income from crop-livestock- tree and peoples participation over the years
- Stabilizing income under unfavorable conditions

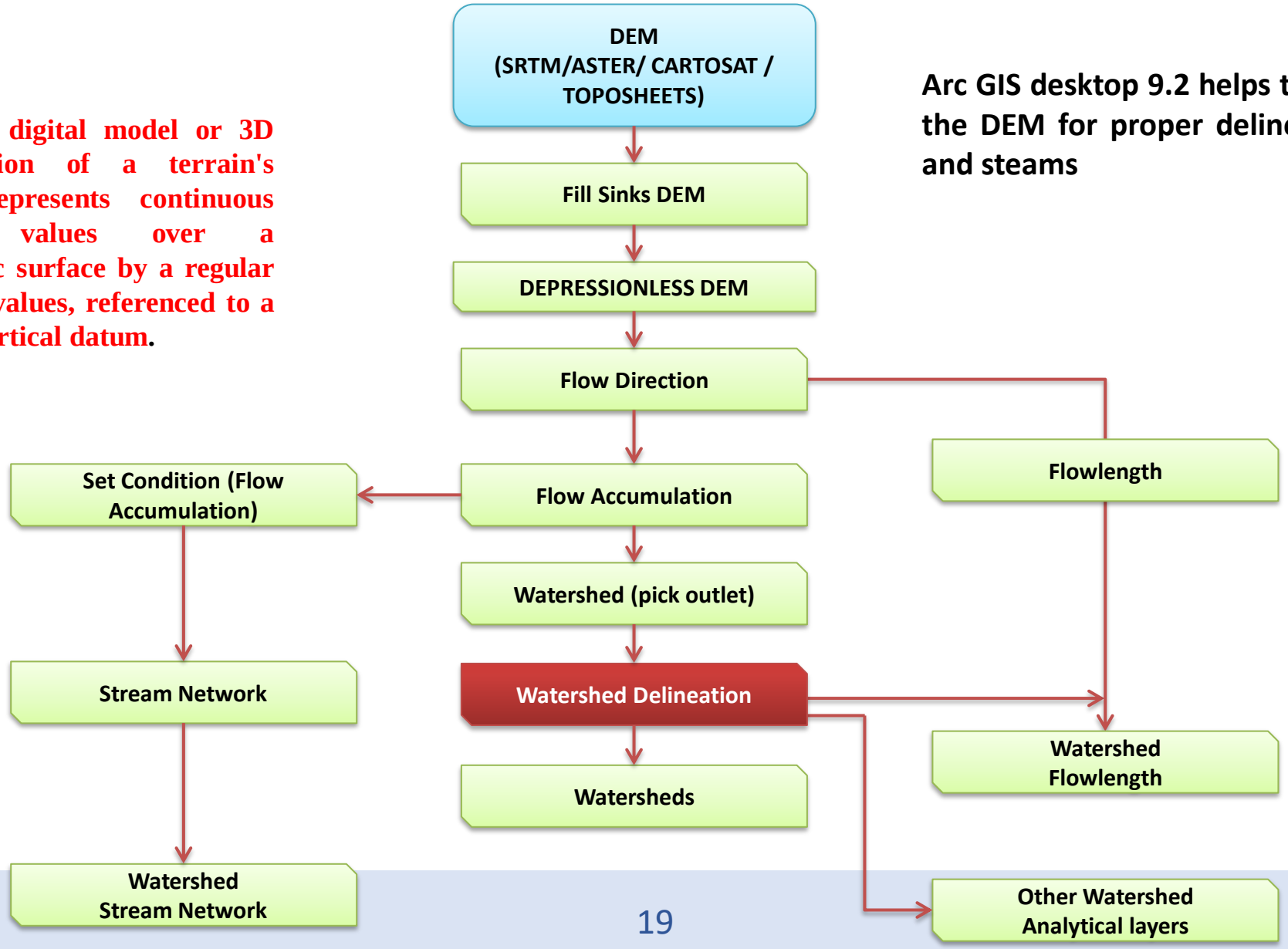
Applications of GIS in Watershed Management

- Remotely sensed data have been used to obtain information on current land use, soil association and their boundaries, ground water prospects, extent of surface bodies, erosion prone areas and other characteristics of the watershed
- Availability of stereo data at 5.8 m would facilitate delineation of watershed boundaries and partitioning of micro watersheds.
- Remote sensing data also facilitates monitoring the effect of conservation schemes taken up in a watershed.

- **Landsat and IRS data were used by Remote Sensing and GIS department of Tamil Nadu Agricultural University to prepare the soil resource maps of Kottakarayar, Gundar, Pambar Nagavathi Agaram, Vellar and Palar Manimuthar watersheds launched by National Remote Sensing Agency (NRSA), Department of Space**
- **The soil resource data in conjunction with the thematic maps generated by other agencies on land use, geomorphology, ground water potential, drainage and geology etc., provided the basis for preparing developmental plans on alternate land uses and construction of water harvesting structures in the rural areas.**

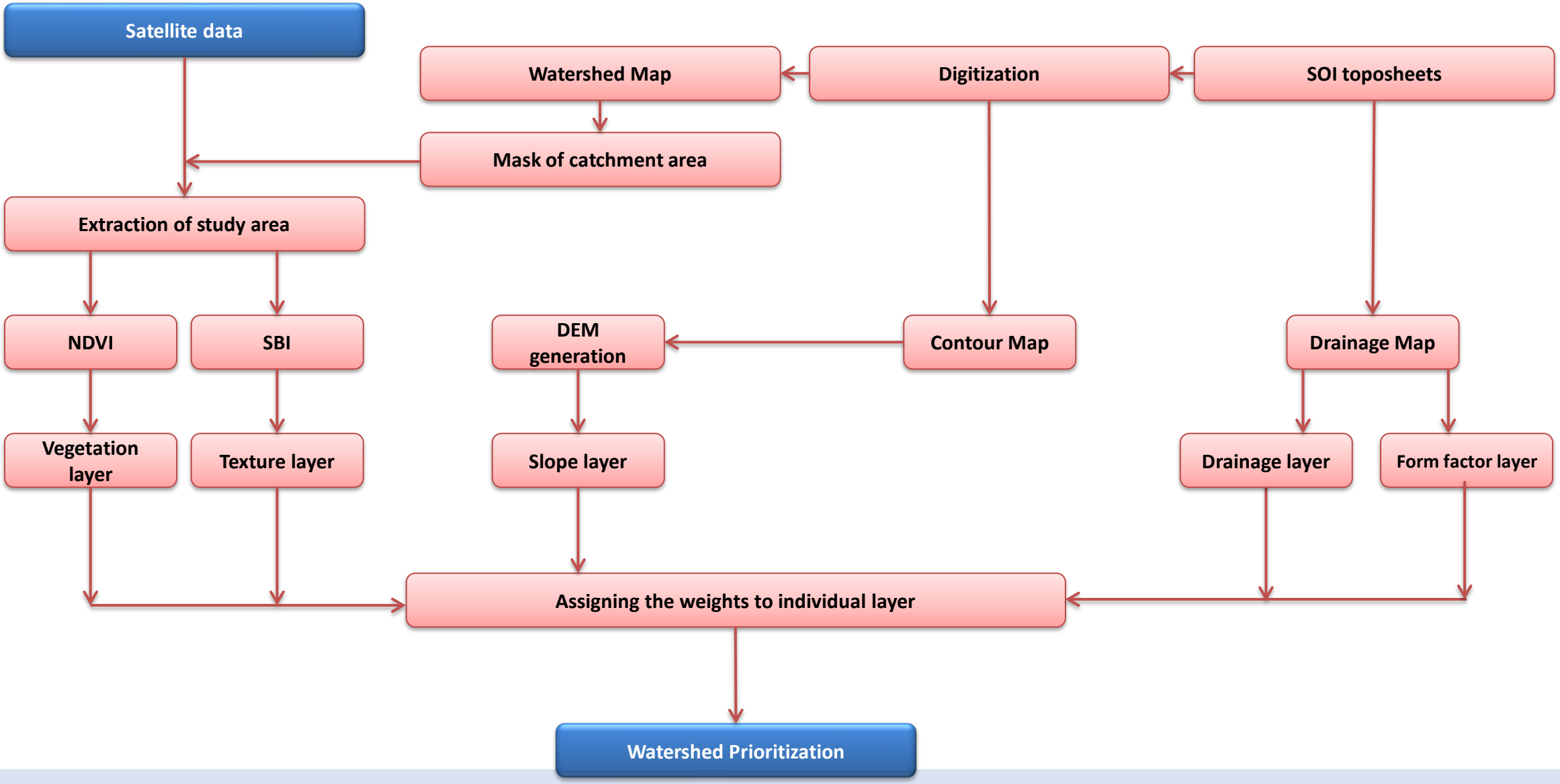
Methodology: Watershed and stream network delineation

DEM is a digital model or 3D representation of a terrain's surface Represents continuous elevation values over a topographic surface by a regular array of z-values, referenced to a common vertical datum.



Arc GIS desktop 9.2 helps to fill the links in the DEM for proper delineation of basins and steams

Methodology: Watershed prioritization



Watershed development- Case Study

- **Land Evaluation of Watershed Areas**
- **Basic data is generated through traversing, analysis of physiographical features, detailed soil survey and socio-economic parameters.**
- **The maps given below are of the Kuthinagere watershed in Karnataka and depicts an exercise of resource inventory and utilization of natural resource data for land evaluation and inputs for land use planning**

References

ISSS,2012,Fundamentals of Soil Science,Revised, Indian Society of Soil Science, New Delhi

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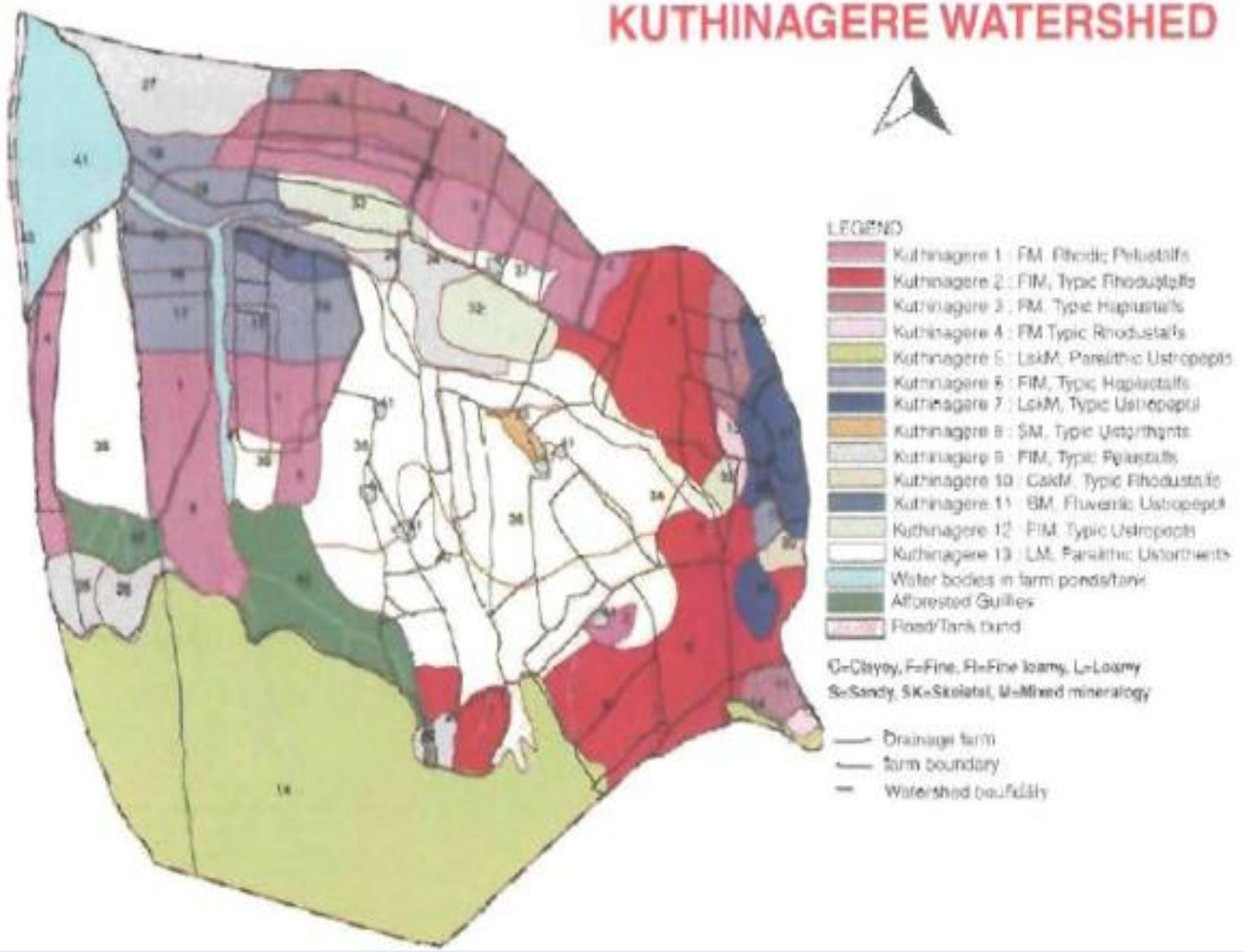
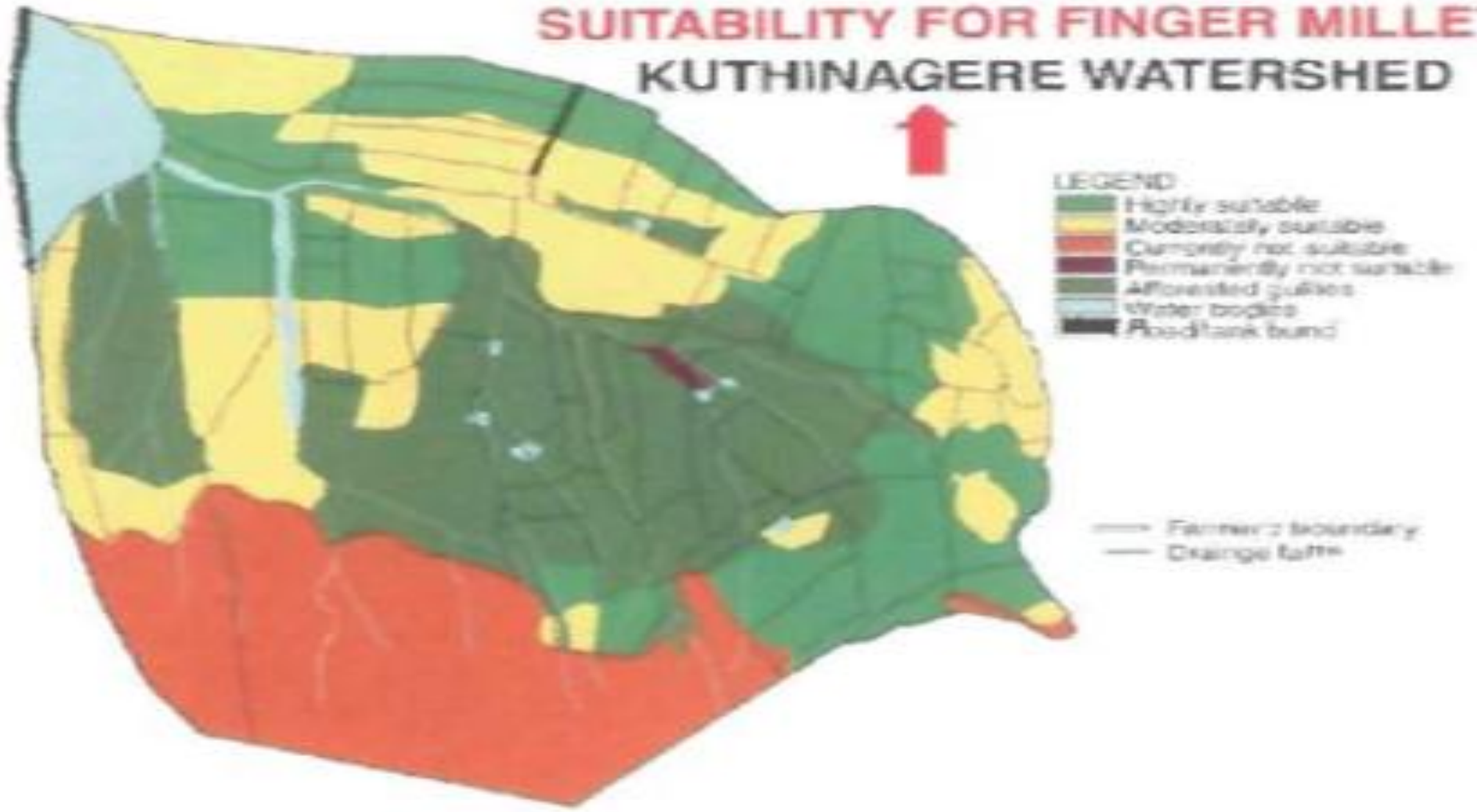
SOILS

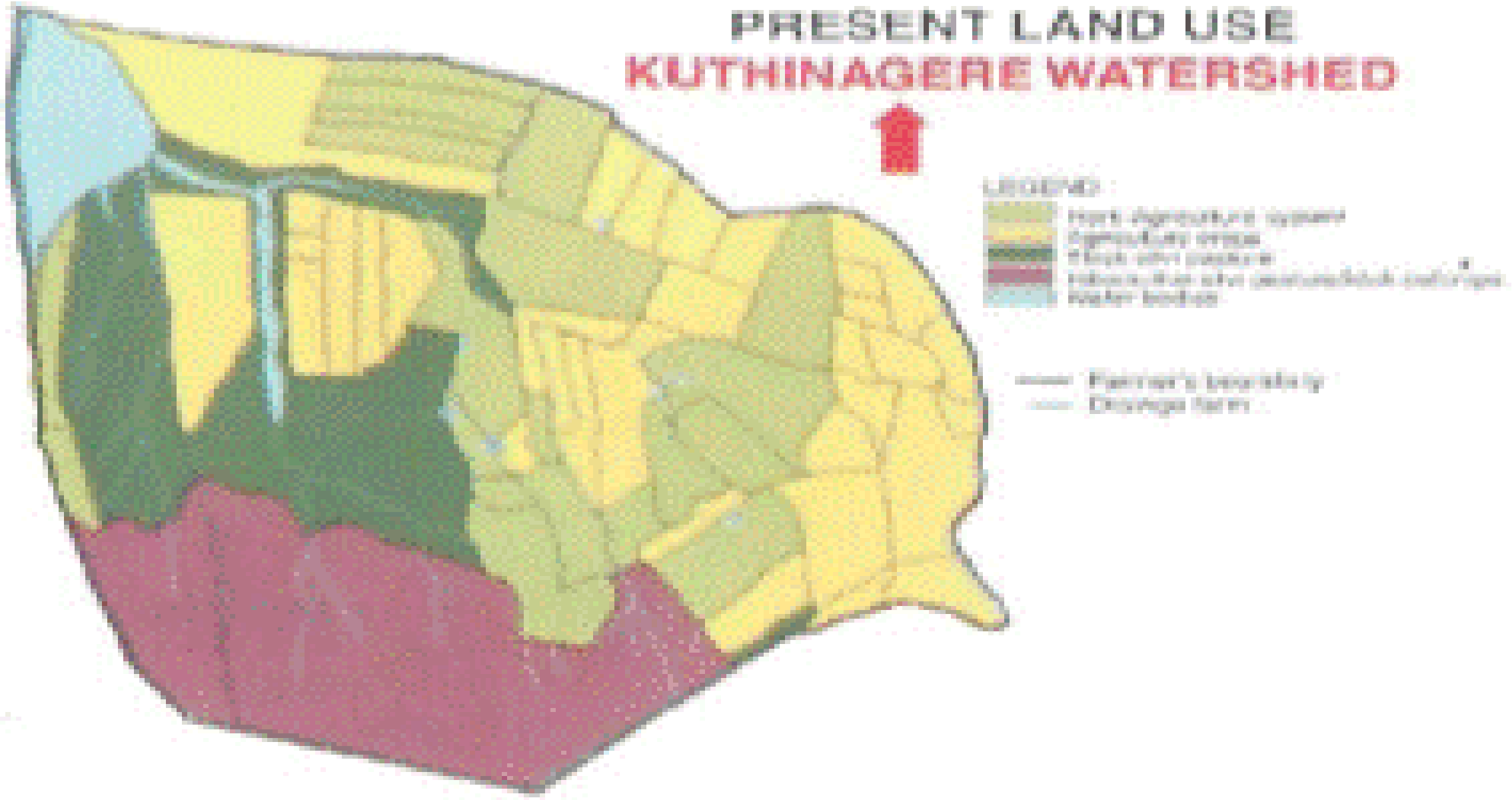
KUTHINAGERE WATERSHED



SUITABILITY FOR FINGER MILLETS

KUTHINAGERE WATERSHED




PRESENT LAND USE
KUTHINAGERE WATERSHED


Thank You