DATA AVAILABILITY UNDER ACRESAL

A Presentation at the

"TRAINING ON THE APPLICATION OF GEOGRAPHIC INFORMATION SYSTEM (GIS) AND REMOTE SENSING TECHNOLOGY IN SUSTAINABLE LANDSCAPE MANAGEMENT"

by

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Definition of Watershed / Catchment:

A CATCHMENT IS AN AREA OF LAND WHERE WATER DRAINS INTO A PARTICULAR RIVER, LAKE, OR OTHER WATER BODY.

Definition of Watershed / Catchment and Watershed Management :

- Catchment management, also known as watershed management or river basin management, refers to the holistic approach of planning, implementing, and coordinating activities aimed at sustainable water resources management of a specific catchment area or watershed.

- Catchment management involves the integration of various disciplines, stakeholders, and strategies to address the multiple environmental, social, and economic challenges within a specific catchment. The primary goal is to promote the wise use and protection of water resources while considering the interconnectedness of the land, water, and ecosystems within the catchment.

Why Adopting Integrated Catchment Management Strategy under ACReSAL:

The ultimate aim of integrated catchment management is to achieve sustainable and equitable water resource management while safeguarding the ecological health of the catchment and meeting the diverse needs of society. ***(Everything within the catchment is sustainably taken care of)***. It requires long-term planning, adaptive management, and continuous monitoring and evaluation to ensure the effective and resilient management of catchment areas.

Catchment management focus on sustainable water resource management, water quantity and quality improvement, and protection of water-dependent ecosystems. It also aims to address water-related issues, such as water scarcity, pollution, flood control, and the equitable allocation of water resources. (Within a defined catchment)

Spatial Data Considerations for Catchment/Watershed Management:

- In watershed management, various data types are crucial for effective planning, analysis, and decision-making. Some include:
  - Hydrography
  - Elevation
  - Vegetation
  - Land-use/Landcover – layers of vegetation, wetland, water body, urban/rural areas and their related infrastructure, forests, arid and semi-arid landscapes
  - Soil data – soil suitability, soil capability, soil erodibility
  - Climate data
  - Geomorphology

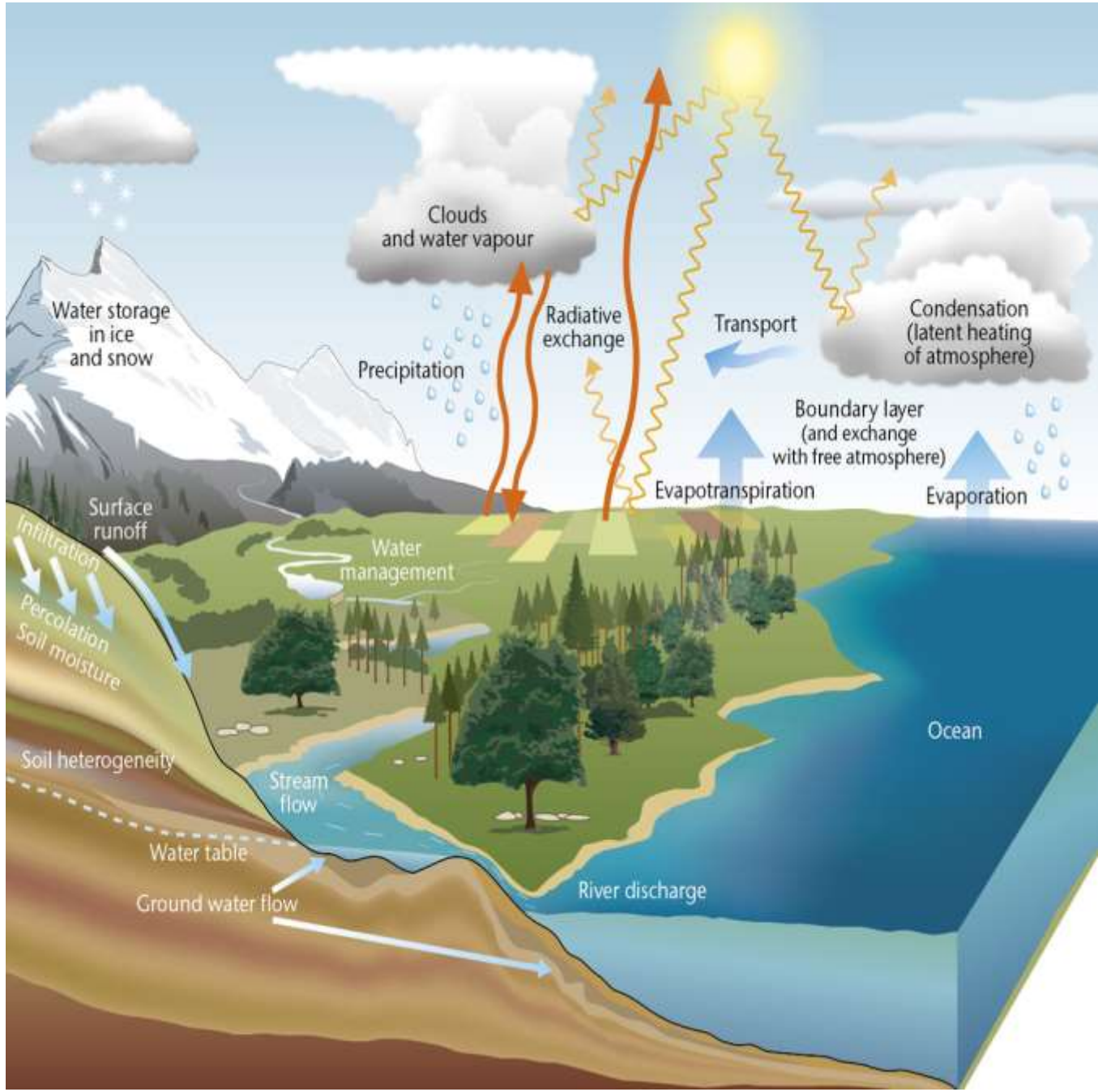
Other data:

- Demography, pests, and diseases etc.

Hydrological Data:

- Hydrological data includes information about the water source, quantity, and quality within the watershed.

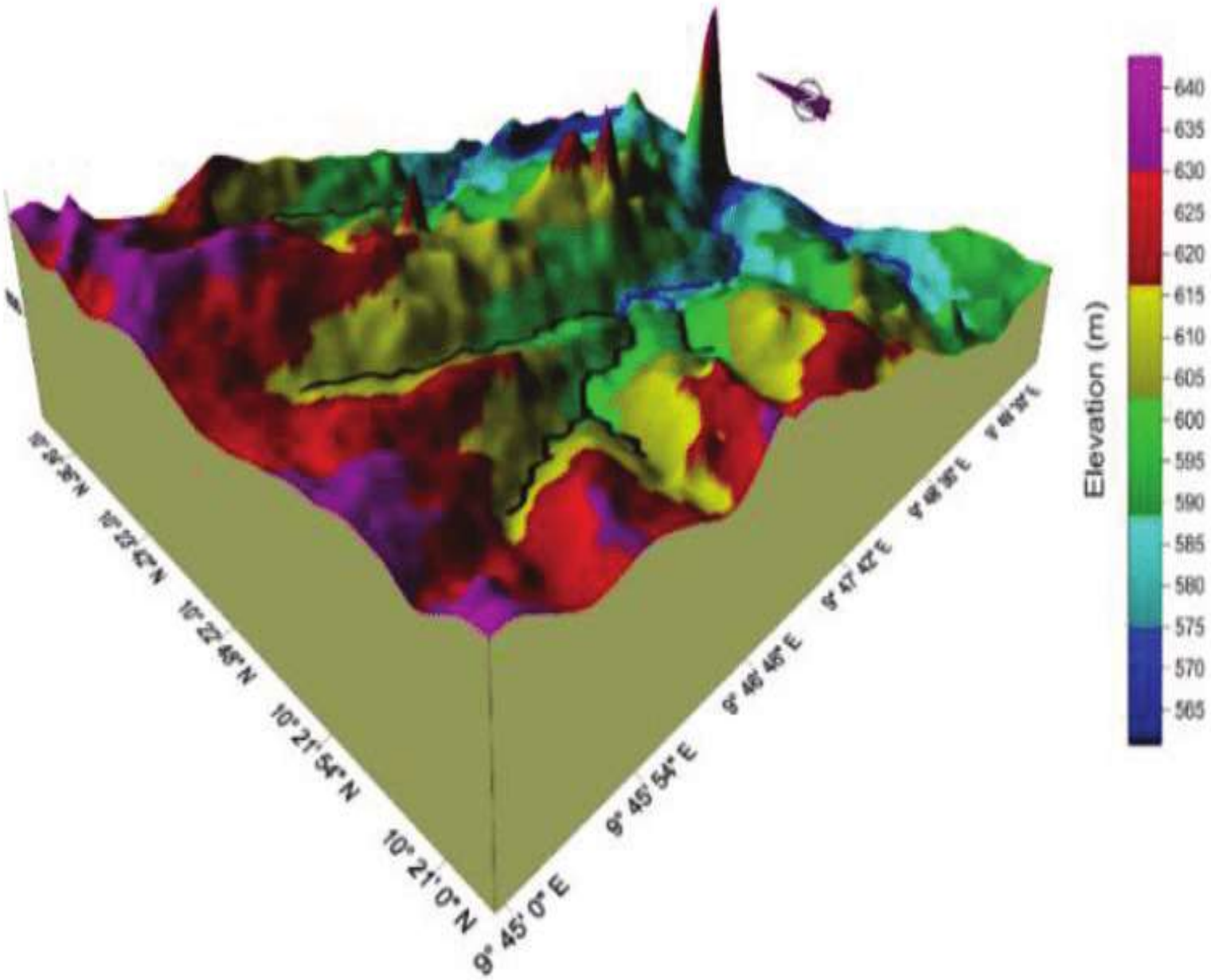
- It encompasses streamflow data, precipitation data, groundwater levels, water quality parameters (e.g., pH, dissolved oxygen, nutrient concentrations), and water temperature measurements.



Elevation Data:

- Elevation data represents the topography of the watershed and is essential for understanding the flow of water across the landscape. It helps in identifying high and low points, slopes, and drainage patterns.

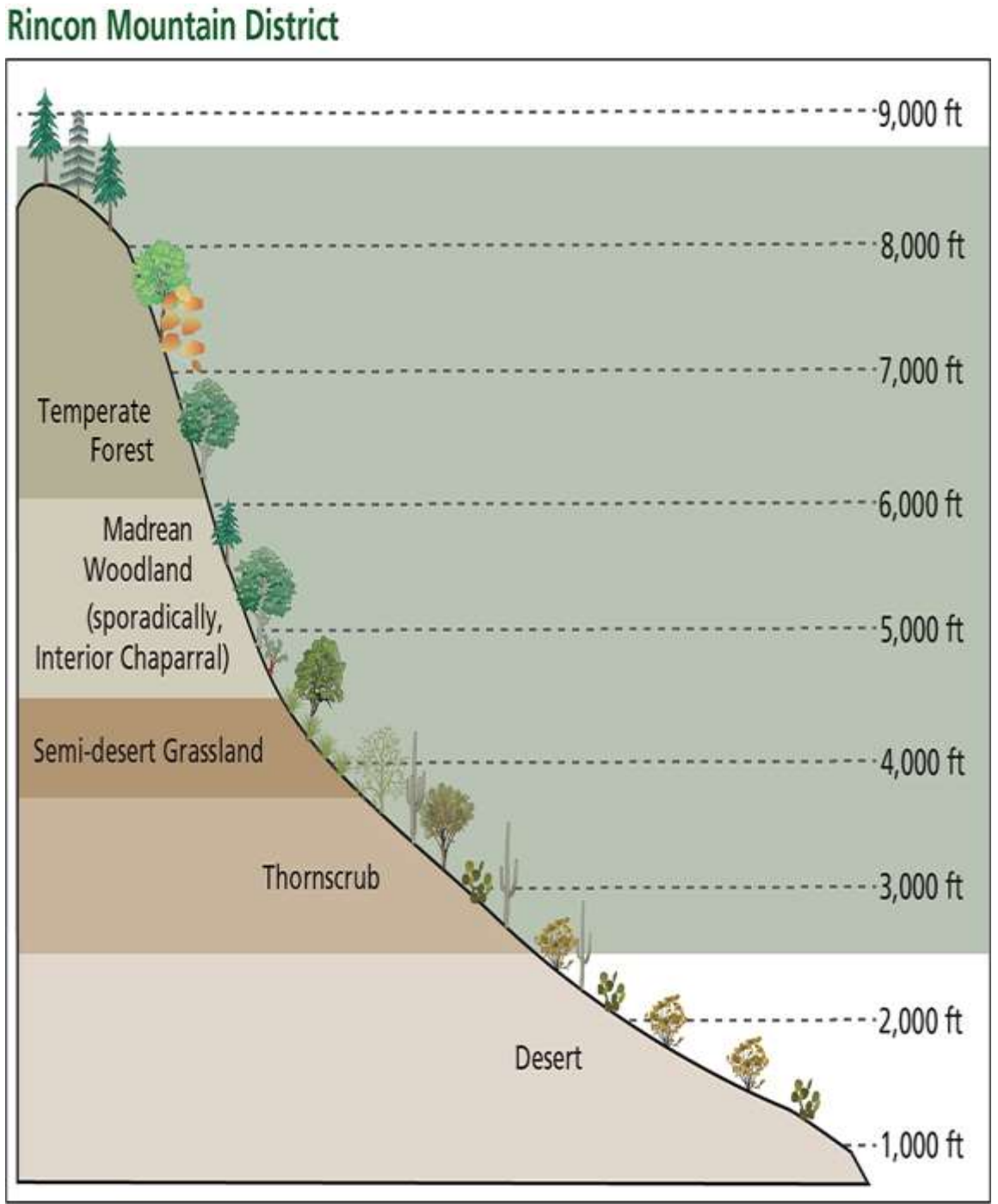
- Examples of elevation data include digital elevation models (DEMs), contour lines, and hillshade maps.



Vegetation Data:

- Plant communities in a watershed can be analyzed based on vegetation data. The data provides information on the distribution, composition, and health of plant communities in a watershed. For example, the Normalized Difference Vegetation Index (NDVI) is a commonly used index to assess vegetation health and vigor.

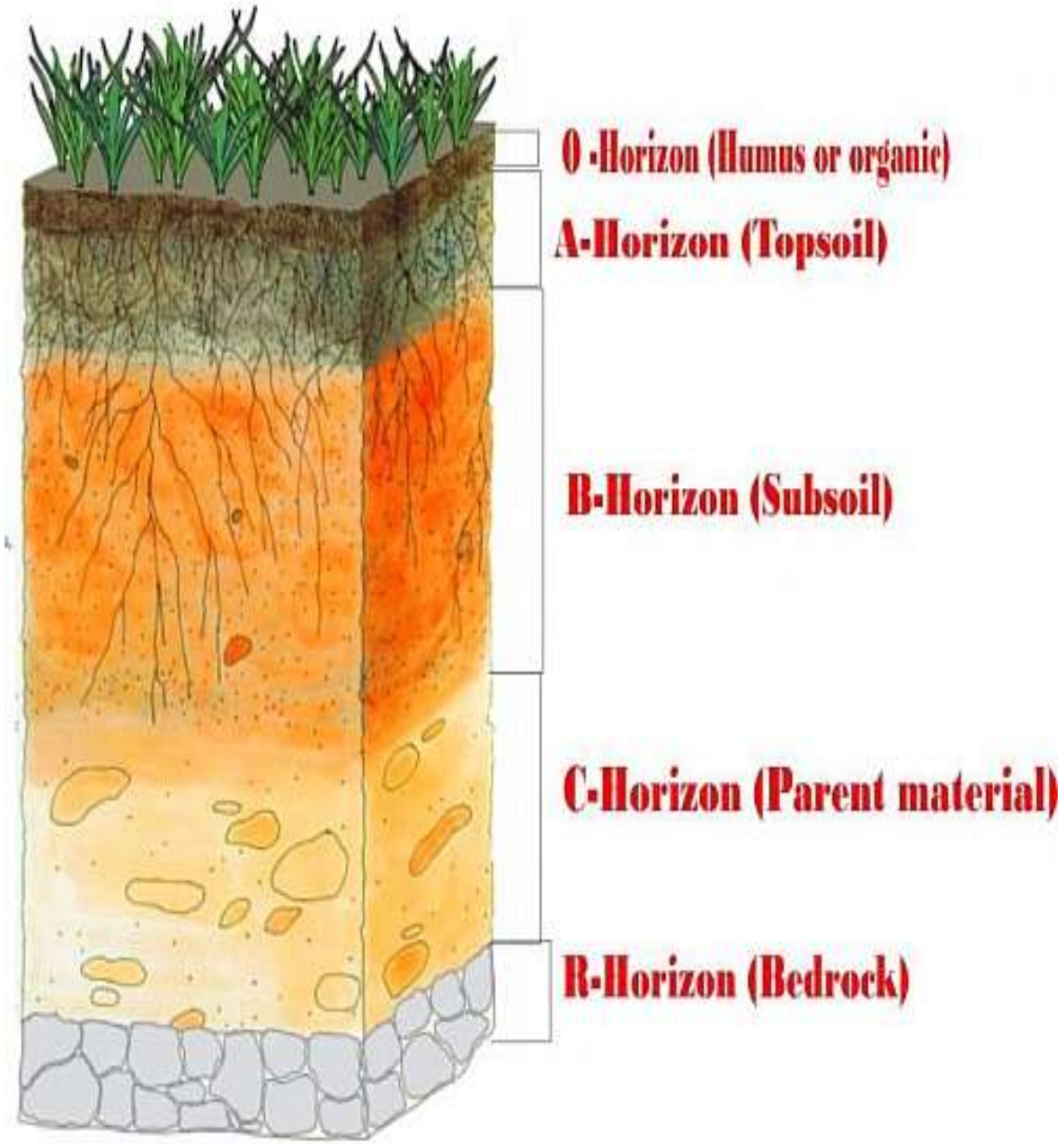
- It involves information about vegetation types, species diversity, biomass, canopy cover, and vegetation indices derived from remote sensing. This data aids in assessing habitat quality, ecosystem services, and the impacts of land management practices on vegetation.



Soil Data:

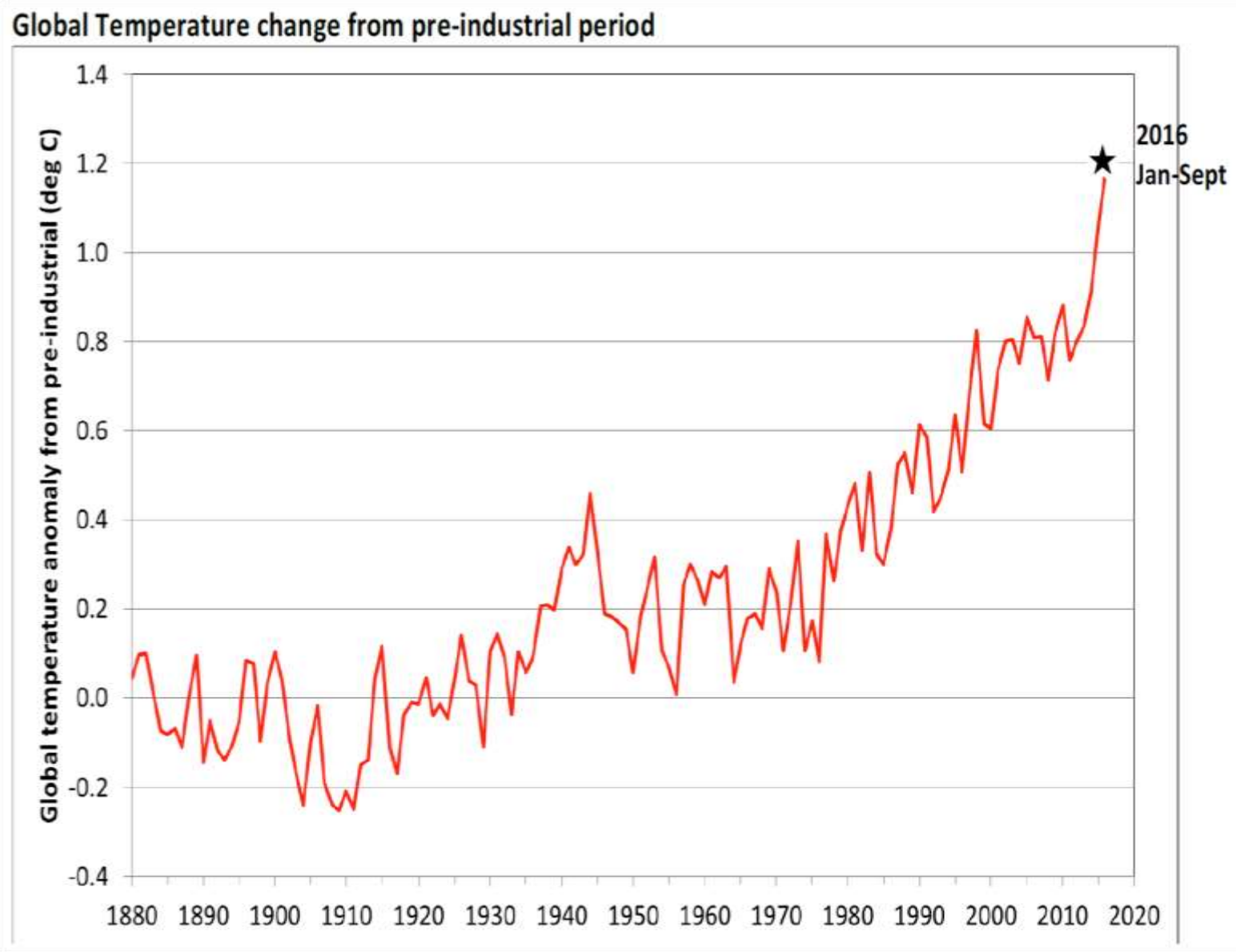
- It is possible to determine the properties and characteristics of soils within a watershed through soil data. In addition to soil types and soil moisture content, soil data takes into account soil fertility, permeability, and erosion susceptibility.

- Understanding soil data helps in assessing infiltration rates, nutrient retention (suitability), and erosion potential (capability), which are essential for land management and agricultural practices.



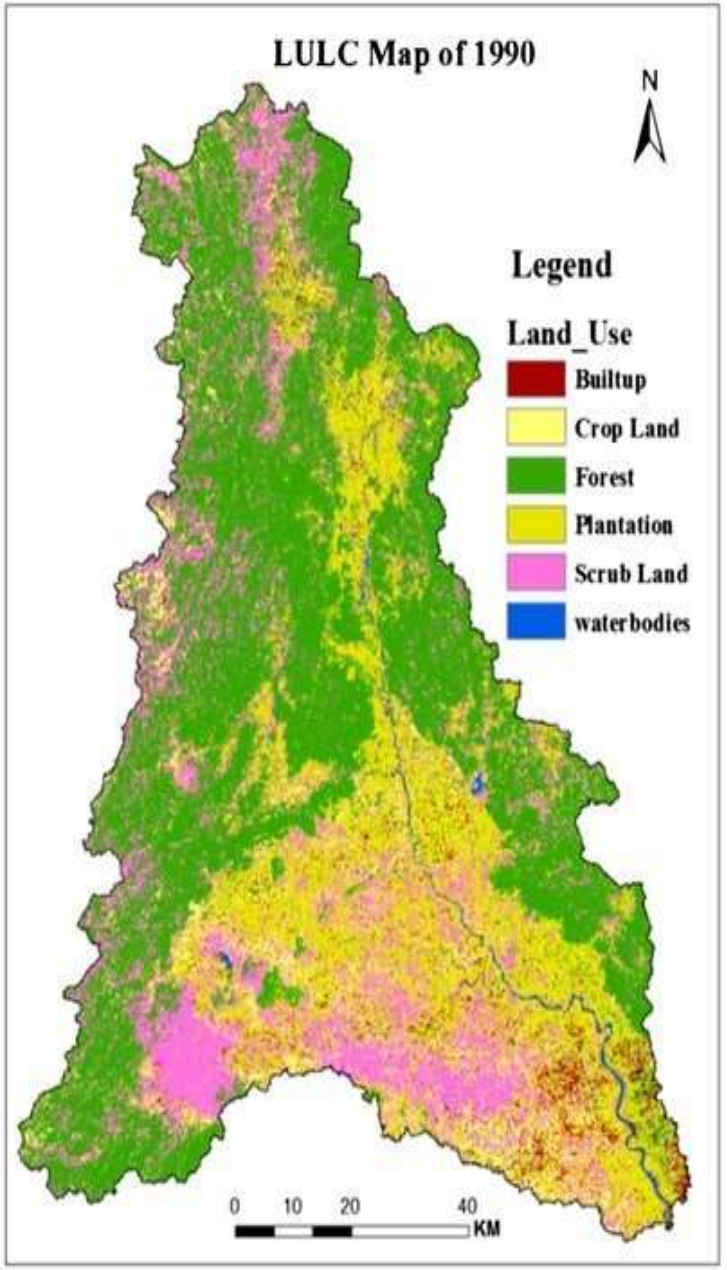
Climate Data:

- Temperature data
- Precipitation
- Relative Humidity
- Wind Speed



Land Use/Land Cover Data:

- Land use/land cover data describe activities on the land within the specified watershed.
- It provides insights into the distribution of urban areas, agricultural lands, forests, wetlands, arid, semi-arid and other land cover categories.
- Such data is useful for analyzing land use changes, estimating land productivity, and identifying areas susceptible to erosion or pollution.



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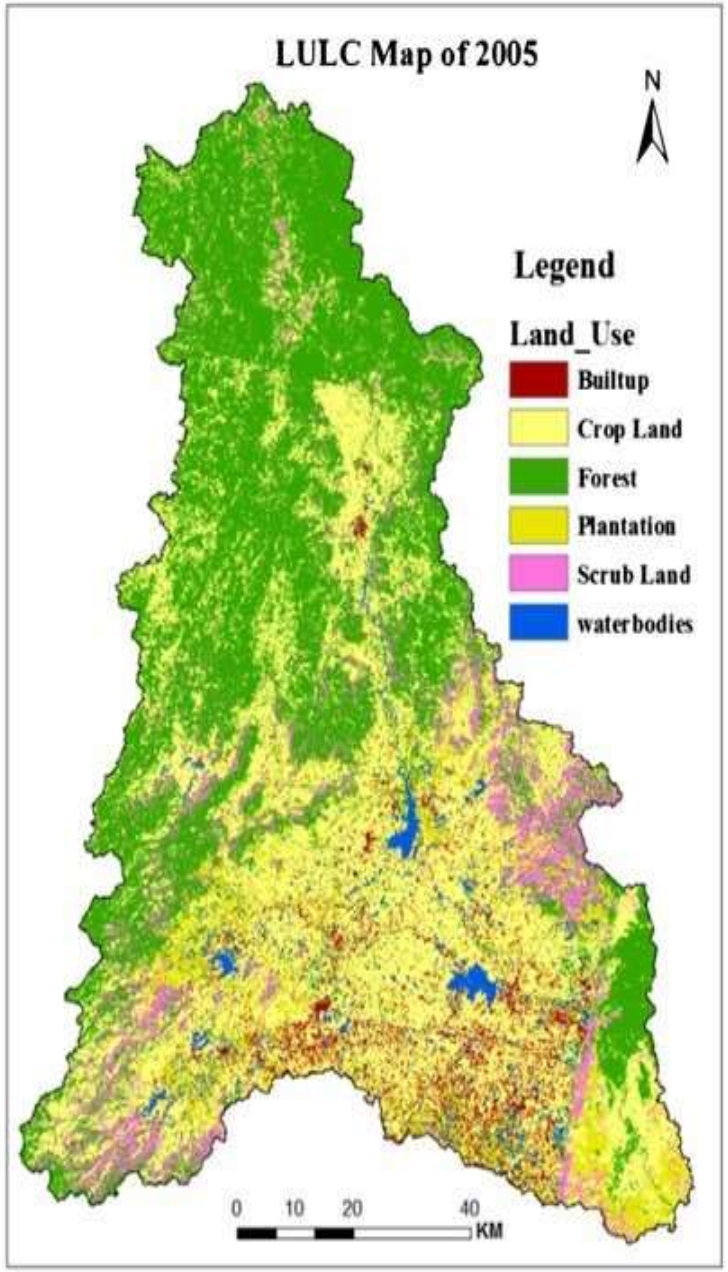


(b)

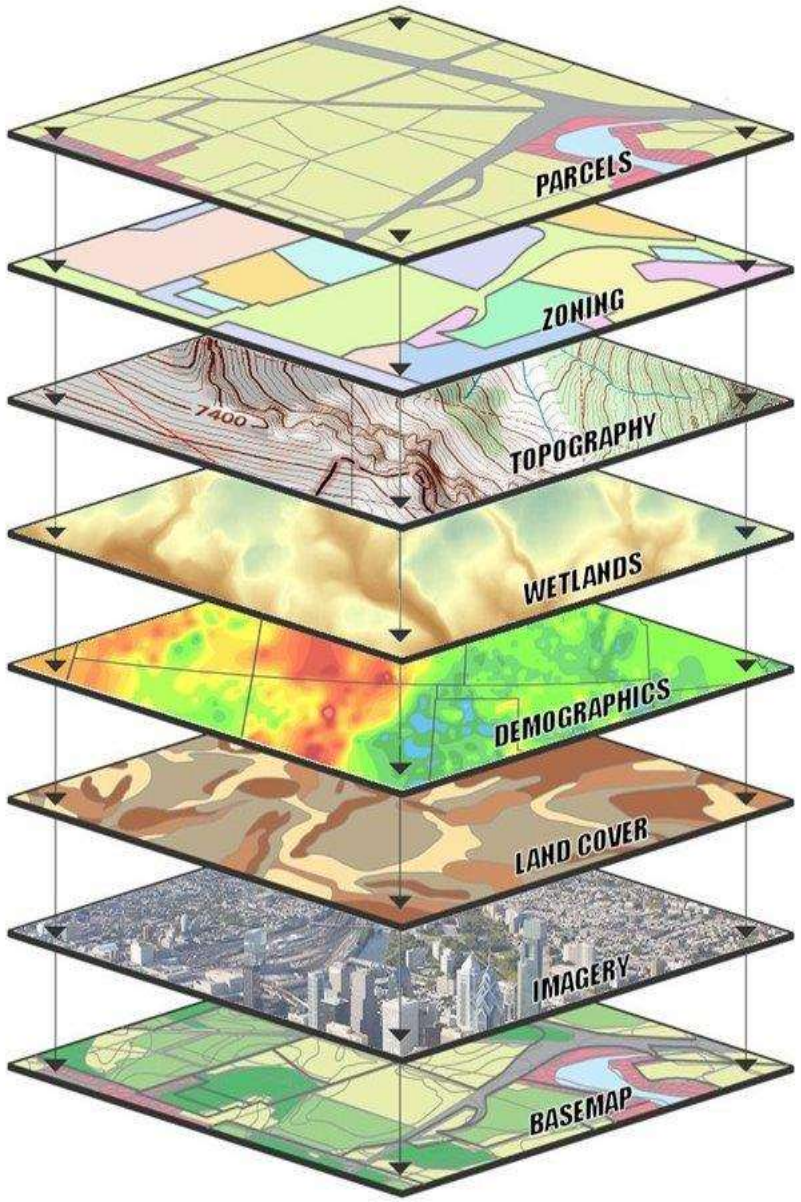
Historical Data:

- Historical data encompasses long-term records and trends related to the watershed, such as historical hydrological data, land use changes over time, climate records, and past management practices.

- This data helps in understanding watershed dynamics, identifying trends, and providing context for current conditions and future projections.

Geospatial Data:

- Geospatial data refers to any data that has a geographic component and is often represented as layers in a geographic information system (GIS).
- It includes the aforementioned data types, such as elevation, land use/land cover, and hydrological data, along with other relevant spatial information like administrative boundaries, road networks, and infrastructure.
- Geospatial data allows for spatial analysis, mapping, and integration of multiple datasets.



GIS DATA LAYERS

Many different types of data can be integrated into a GIS and represented as a map layer.

Examples can include: streets, parcels, zoning, flood zones, client locations, competition, shopping centers, office parks, demographics, etc.

When these layers are drawn on top of one another, undetected spatial trends and relationships often emerge. This allows us to gain insight about relevant characteristics of a location.

Other data:

- Demography, livelihood, health, pests and diseases of both flora and fauna etc

- Combining and analyzing these data types enables professionals to gain insights into hydrological processes, water availability, ecological conditions, and potential impacts of land use changes.
- Accurate integration of various data enabled by the use of GIS/RS Technology **enhances well-guided decision-making** and facilitates sustainable management practices within watersheds.

Key aspects of catchment management Plans:

1. **Water Resource Planning:** Catchment management involves the development and implementation of plans and strategies to sustainably manage water resources within the catchment. This includes assessing water availability, allocating water for various uses (e.g., domestic, agriculture, industry), and setting water quality objectives to ensure the protection of water sources.

2. **Water Quality and Pollution Control:** Catchment management focuses on monitoring and managing water quality within the catchment. This involves implementing pollution control measures, identifying pollution sources, and promoting best management practices to reduce contaminants entering water bodies. It may include measures such as wastewater treatment, stormwater management, and the promotion of sustainable industrial practices.

Contd:

3. **Land Management:** Effective catchment management recognizes the critical role of land use and land management practices in maintaining water quality and quantity. It involves implementing measures to minimize soil erosion, control sedimentation, reduce pollutant runoff, and promote sustainable agriculture and forestry practices. Land management strategies also consider the conservation and restoration of natural habitats and the protection of biodiversity.

4. **Stakeholder Engagement:** Catchment management necessitates collaboration and engagement with various stakeholders, including government agencies, local communities, landowners, industry representatives, non-governmental organizations (NGOs), and indigenous communities. Stakeholders play a crucial role in decision-making processes, information sharing, and implementing actions on the ground.

Contd:

5. **Ecosystem Protection and Restoration:** Catchment management recognizes the importance of healthy ecosystems for maintaining water quality and biodiversity. It involves identifying and protecting critical habitats, restoring degraded areas, and implementing measures to enhance ecological resilience. Conservation activities may include reforestation, wetland restoration, habitat connectivity enhancement, and the control of invasive species.

6. **Integrated Water Resources Management (IWRM):** Catchment management embraces the principles of IWRM, which promote the coordinated development and management of water, land, and related resources. It emphasizes the need for an integrated and interdisciplinary approach, considering social, economic, and environmental dimensions.

Data Availability for Catchment Studies -

Types:

- Primary Data and Secondary Data

- Primary data. Otherwise called raw data are those collected directly from the field by the GIS and other relevant officers and using the relevant tools and applications (Hard/Software)

Sources of Secondary data for catchment

- Hydrological Data – *Nigeria Hydrological Services Agency (NIHSA) / Fed. Min of Water Resources*
- Catchment Management – *Nigeria Integrated Water Resources Management*

(NIWRMC), Fed. Min of Water Resources

- Climate Data – The Nigerian Meteorological Agency (NiMET);
- Satellite Images (Low, Medium and High-Resolution) – National Space Research and Development Agency/National Center for Remote Sensing (NASRDA/NCRS)
- Vegetation/Forestry Data - Forestry Department, Fed. Min of Environment
- Geospatial Data – National Space Research and Development Agency/Office of the Surveyor General of the Federation (NASRDA/OSGOF);
- Soil Data – Fed. Min of Agriculture
- Livelihood – Nigeria Bureau of Statistics (NBS)
- Demography Data – Nigeria Population Commission (NPC)

ACReSAL Strategy to Catchment Management

The Project adopts an Integrated catchment/watershed management approach to increase the adoption and implementation of sustainable catchment management practices in targeted watersheds in northern Nigeria… (ACReSAL PDO)

- Specifically, **Sub Component A1 - Strategic Watershed Planning** would support development of 20 number strategic watershed management plans and will be developed to guide appropriate management of major watersheds under the 8 Hydrological Areas of Nigeria and covering the 19 ACReSAL implementing States and the FCT and

(To address challenges of large-scale watershed degradation in northern Nigeria's Arid and Semi-arid Landscapes).

- **Sub component B1, Community Strengthening,** will build on the outcomes of the higher-level (strategic watershed) planning (Subcomponent A1), and support the development of 200 micro-watershed plans and will be supported to prioritize investments.

ACReSAL Project Components

Components
Component A. Dryland Management
A1 Strategic Watershed Planning
A2 Landscape Investments
A3 Special Ecosystems
Component B. Community Climate Resilience
B1 Community Strengthening
B2 Community Investments
Component C. Institutional Strengthening and Project Management
C1 Institutional and Policy Strengthening
C2 Project Management
Component D. Contingent Emergency Response

KEY PDO LEVEL INDICATORS:

- Land area under sustainable landscape management practices (ha), disaggregated as:
  - ❖ Area under improved catchment management (ha);
  - ❖ Area under community-led landscape restoration (ha);
  - ❖ Protected areas under improved management (ha);
  - ❖ Area provided with new/improved irrigation or drainage services (ha);
  - ❖ Area under rainwater harvesting (ha); quantity of water harvested (m3)
- Enabling environment for integrated landscape management strengthened (Text);
- Increase in Normalized Difference Vegetation Index (NDVI) in targeted areas, correcting for natural variability (Percentage)
- Direct project beneficiaries (Number)
- Number of direct project beneficiaries - Female (Number)

INTERMEDIATE INDICATORS:

- Multisectoral Strategic Watershed Plans, Integrated micro catchment Management Plans etc, etc, etc

The place of GIS and Remote Sensing Technology in Catchment Management

The Primary function of GIS in catchment studies and management is integrating data for Environmental Modeling and Watershed Analysis

- The interdisciplinary nature and complexity of environmental and water resource problems require a modeling approach that integrates information from the involved scientific fields (Leavesley et al., 1996). The functions of a GIS, or the tasks that it is capable of accomplishing, make it a highly effective tool in performing such integration. The major functions that GIS provides for integration are:

  - Spatial inventory/feature characterization;
  - Preprocessing and development of input data;
  - Spatial analysis and data manipulations;
  - Communication of results among models; and
  - Provision of a common user interface.

- These functions allow modeling steps such as data development, parameterization, and visualization to be integrated in simulation runs

Data Strategy:

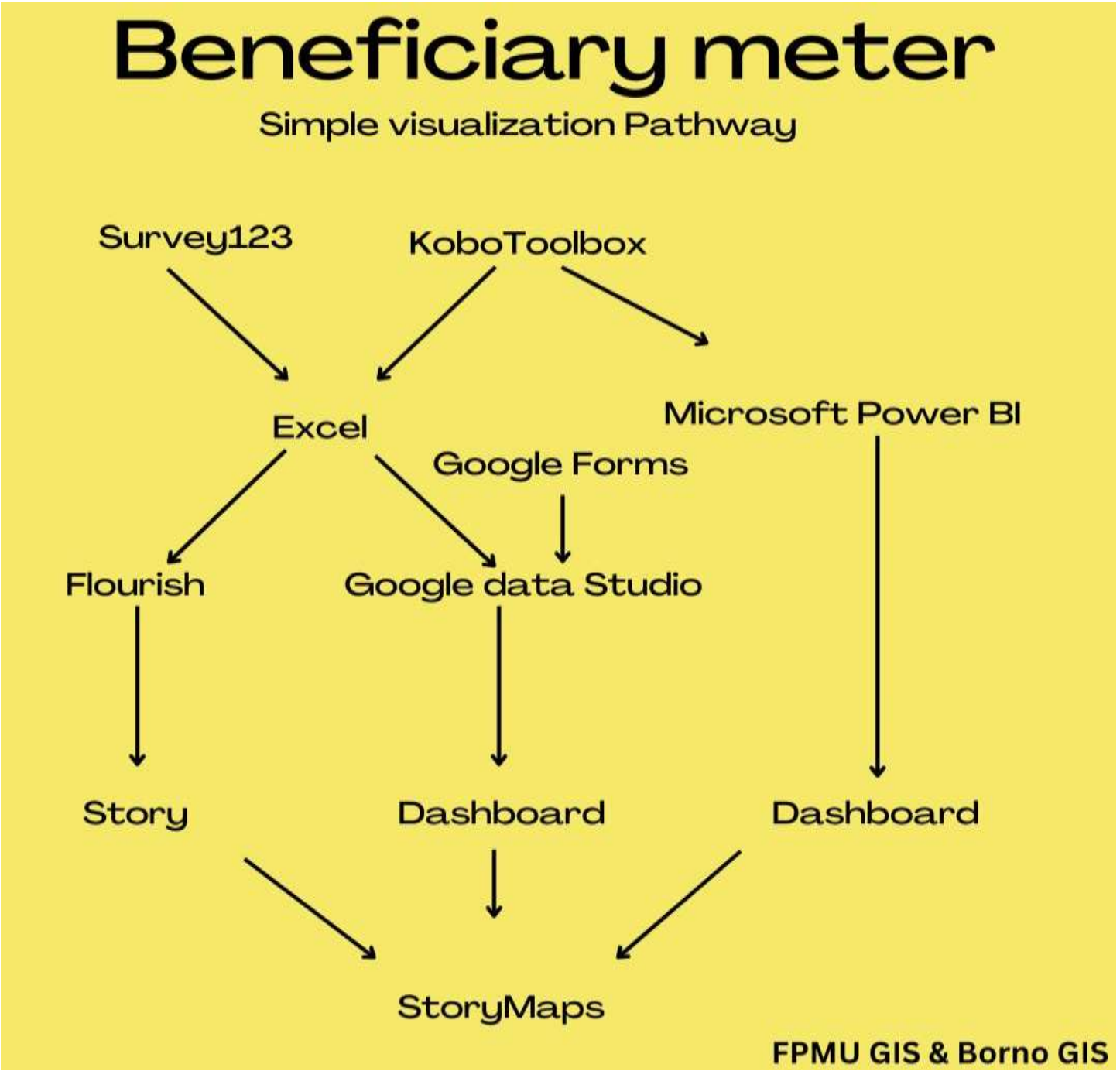
- Drone/Camera image capturing
- Desktop analysis of medium and high resolution images - Satellite/Drone/Camera
- Ground truthing and other on-site data collection
- Data presentation - visualization

Some Data Collection Software:

- Kobo Toolbox
- Survey 123
- Google form
- Field Map
- Excel;

Some Data Presentation Software :

- Flourish;
- Google Data Studio
- Story Maps
- Dashboard
- Microsoft Power BI



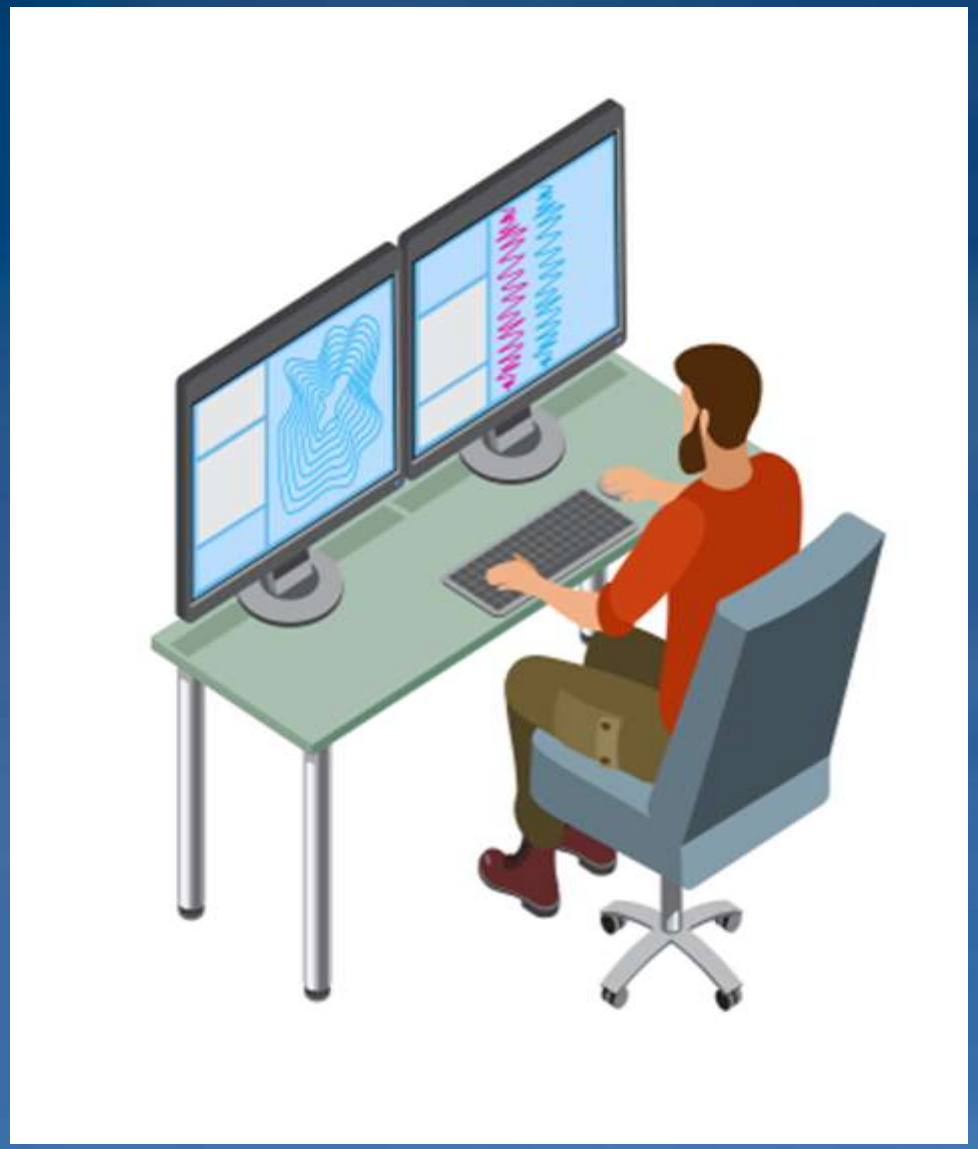
Way Forward:

- Conduct GIS/M&E Baseline Studies – Guided by any soon-to-be-engaged GIS Expert Advisor, FPMU **is to urgently lead** each of the SPMUs to conduct state-specific GIS/M&E Baseline Studies; (using their already procured GIS tools)
- Engage a world-class firm to guide in developing the Strategic Watershed Management Plans
- Building on the outcomes of the strategic watershed plans, support the development and implementation of the 200 micro-watershed plans whilst prioritizing investments (all GIS-related activities towards effective implementation of the micro watershed/catchment plans)
- Any other

References:

- Presentations from Nagaraja Rao Harshadeep (Dr. Harsh)
- www.esri.com
- www.google.com
- www.researchgate.net
- ACReSAL PAD and PIM
- Leavesley et al., 1996; A modeling framework for improved agricultural water supply.
- Outcome of discussion with ACReSAL Officers and the Task Team – ***(GIS Officers especially)***

Thank You!




Data collection
Archiving
Management
Analysis
Visualization
Dissemination