Tools and Softwares in Plant Identification

6.1. PLANT IDENTIFICATION

6.1.1. Introduction

The act of identifying a plant involves classifying it according to its taxonomic category, and then according to its species. **Determination of whether a plant specimen is identical to or similar to another, previously recognised plant** is known as **plant identification**.

Identification is when a taxon is determined to be identical to or similar to another and have known elements; the assessment may or may not be made with the use of literature or by comparing with a plant whose identity is known. It is not necessary to use names when recognising a plant. Identification differs from plant nomenclature or naming.

6.1.2. Characters Considered During Plant Identification

When identifying a plant, the following characteristics are taken into account:

1) The annual or perennial status of a plant, as well as whether it is herbaceous or woody.
2) Whether or not the leaf, stem, or other plant parts have milky or coloured sap.
3) Phyllotaxy, venation, and leaf type.
4) The type of stipule and its presence or absence on immature shoots.
5) The amount and varieties of surface coverings (hairs, trichomes, spines, etc.).
6) The components of flower, including the quantity of separate or united sepals and petals, as well as their arrangement, or aestivation.

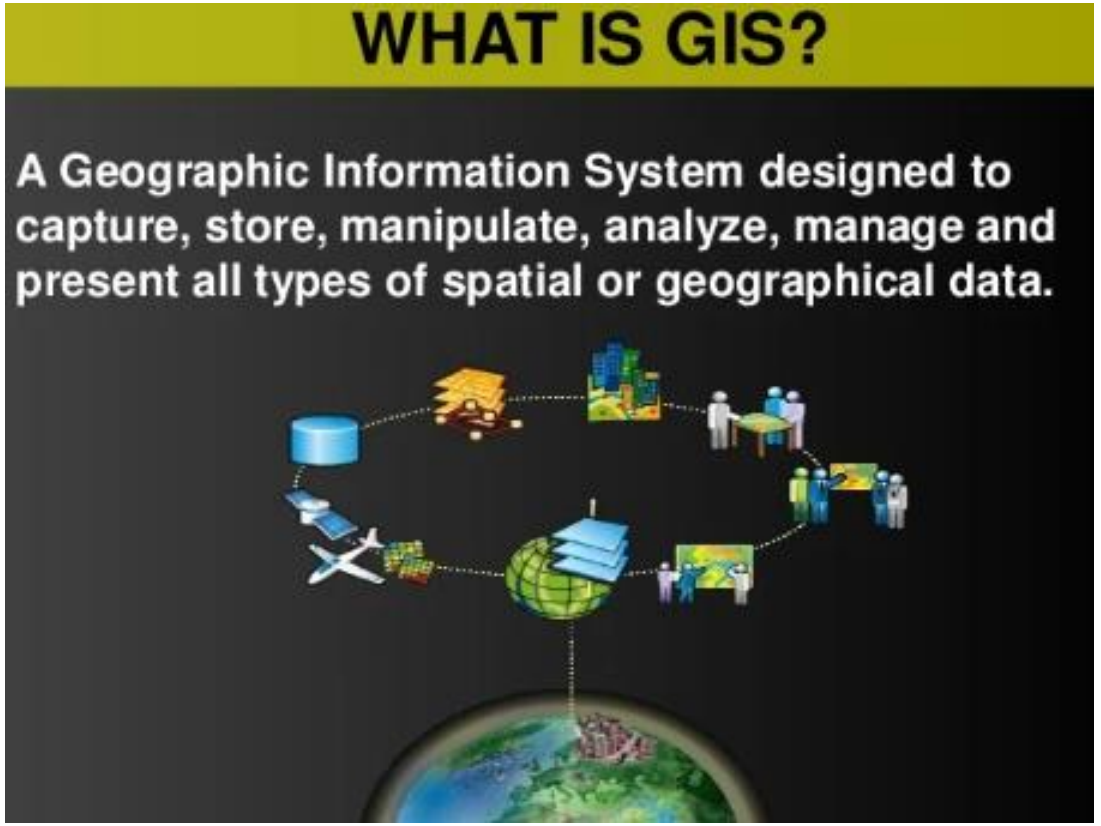
7) Whether or not perianth is present in one or more series.
8) Presence of pappus, epicalyx, or other comparable structures, such as those seen in Asteraceae or Malvaceae, respectively.
9) Whether the flowers have a nectar-secreting disc as seen in Rutaceae.
10) The actinomorphism or zygomorphism of flowers.
11) The quantity and placement of stamens, as well as any anther or filament fusion.
12) The number of gynoecium pistils, styles, and stigmas; observation of a transverse ovarian section; number of ovarian locules; number of ovules per locule; and placentation
13) The location of ovary and the fusion of perianth by looking through the centre of a longitudinally cut portion of complete flower.

6.2. GIS (GEOGRAPHICAL INFORMATION SYSTEM)

6.2.1. Introduction

An area's information is provided by a Geographic Information System (GIS). Interpretation of results requires the use of computer and software.

GIS gathers, organises, maintains, and displays data that is geographically related. It comprises of mapping software and how remote sensing, land surveying, aerial photography, math, photogrammetry, geography, and tools that can be used with GIS software can be applied to it.



6.2.2. Components of GIS

Using a computerised system, GIS allows users to input, manage, alter, analyse, and display spatially related data. To accomplish various activities with GIS, the elements of GIS, such as software, hardware, data, people and methodologies are necessary.

6.2.2.1. Software

The features and resources required to store, analyse, and present geographic information are provided by GIS software. Important software parts include:

1) A Database Management System (DBMS).
2) Tools for entering and manipulating geographic data.
3) Tools for geographic querying, analysis, and visualisation.
4) A Graphical User Interface (GUI) for quick tool access.

GIS software can either be purchased or can be downloaded for free if it was created using open source software. Commercial software, on the other hand, is copyright protected, can be expensive, and has a limited number of licensees.

Commercial GIS software options at the moment include Arc/Info, Intergraph, MapInfo, Gram++, etc. Arc/Info is the most well-known software solution, and AMS/MARS, among other programs, are open source.

6.2.2.2. Hardware

A GIS runs on hardware, which is the computer. Today, GIS functions on a variety of hardware platforms, including standalone or networked desktop PCs as well as centralised computer servers.

Hardware Requirements

1) **CPU Speed:** 800 MHz minimum, 1.0 GHz recommended or higher
2) **Processor:** Pentium or higher
3) **Memory/RAM:** 256 MB minimum, 512 MB recommended or higher
4) **Display Properties:** Greater than 256 colour depth
5) **Swap Space:** 300 MB minimum
6) **Disk Space:** Typical 605 MB NTFS, Complete 695 MB FAT32 + 50 MB for installation
7) **Browser:** Internet Explorer 6.0 Requirement

   (Some features of ArcInfo Desktop 9.0 require a minimum installation of Microsoft Internet Explorer Version 6.0.)

6.2.2.3. Data

Data is the GIS's most crucial component. One can either collect geographic or spatial data or purchase it from a commercial data source, together with supporting tabular data. Maps and remotely sensed data, such as satellite imaging and aerial photography, are both **examples** of spatial data. Latitude and longitude coordinates must be correctly geo-referenced on these data types.

Tabular data may take the form of attribute data that is connected to geographical data in some way. Majority of GIS software has a built-in database management system (DBMS) that allows users to build and maintain databases to assist manage and organise data.

6.2.2.4. Users

Without the users who maintain the system and create strategies for its use, GIS technology is of limited value. Users of GIS range from technical experts who develop and support the system to people who utilise it to facilitate their daily activities.

6.2.2.5. Methods

A well-designed plan and business rules, which are the operational models and procedures particular to each organisation, are the foundation of a successful GIS.

6.2.3. Uses of GIS

These purposes could all make use of GIS:

1) Locating objects on a map, which enables one to locate areas with the features desired and to choose where to take appropriate action. Locating items on a map enables to:
   i) **Locate a Feature:** One utilises maps to determine the location or nature of a specific feature.
   ii) **Discovering Patterns:** Patterns can be discovered by examining the distribution of features on the map rather than simply a single feature.
2) **Mapping Quantities:** One can use mapping quantities to determine a feature's dominance in a given area, i.e., where the most and least are, which enables to find locations that satisfy the necessary requirements and take action, or to see the relationships between locations. Quantity mapping provides a higher level of information than merely mapping the positions of features.
3) **Finding what's inside:** GIS can be used to monitor what is happening and to take specific action by mapping what is inside a specific area.
4) **Discovering what's Within:** By mapping what is inside a certain location, GIS may be used to monitor what is happening and to take targeted action.
5) **Locating what's Close by:** By mapping what is close by, GIS can be used to determine what is happening within a specific range of a feature.
6) **Mapping Changes:** Future conditions can be foreseen by mapping the change in a region, allowing one to choose a course of action or assess the outcomes of a course of action.

6.2.4. GIS Mapping

Today, it is not possible to monitor change, make educated decisions, and identify geospatial patterns without using GIS map data. When it comes to dynamically and interactively displaying geophysical data about the planet on the screen, a GIS map is an essential tool.

GIS stands for **Geographic Information System** and the map is **a visual representation of quantifiable data**.

A GIS map differs from conventional table maps in that it is dynamic and interactive. Based on the provided qualities, it can demonstrate change in these aspects over time and expose previously hidden elements by highlighting them. A GIS map converts actual geospatial data into coloured patterns or shapes, since human eyes are designed to respond to various colours and shapes. Decisions are made more quickly and with greater knowledge because of the accelerated information processing.

GIS Map Layer

The beauty of GIS map layers is that they make it possible to overlay different map types on top of one another on the same screen. In this manner, various layers can interact and work together to provide considerably more information.

The user can quickly switch between many layers without being confused. The **GIS base map** is the most fundamental layer. The standard base map in satellite view is widely known. However, any type of data can be used as a basic map to add additional layers to, depending on the individual goal.

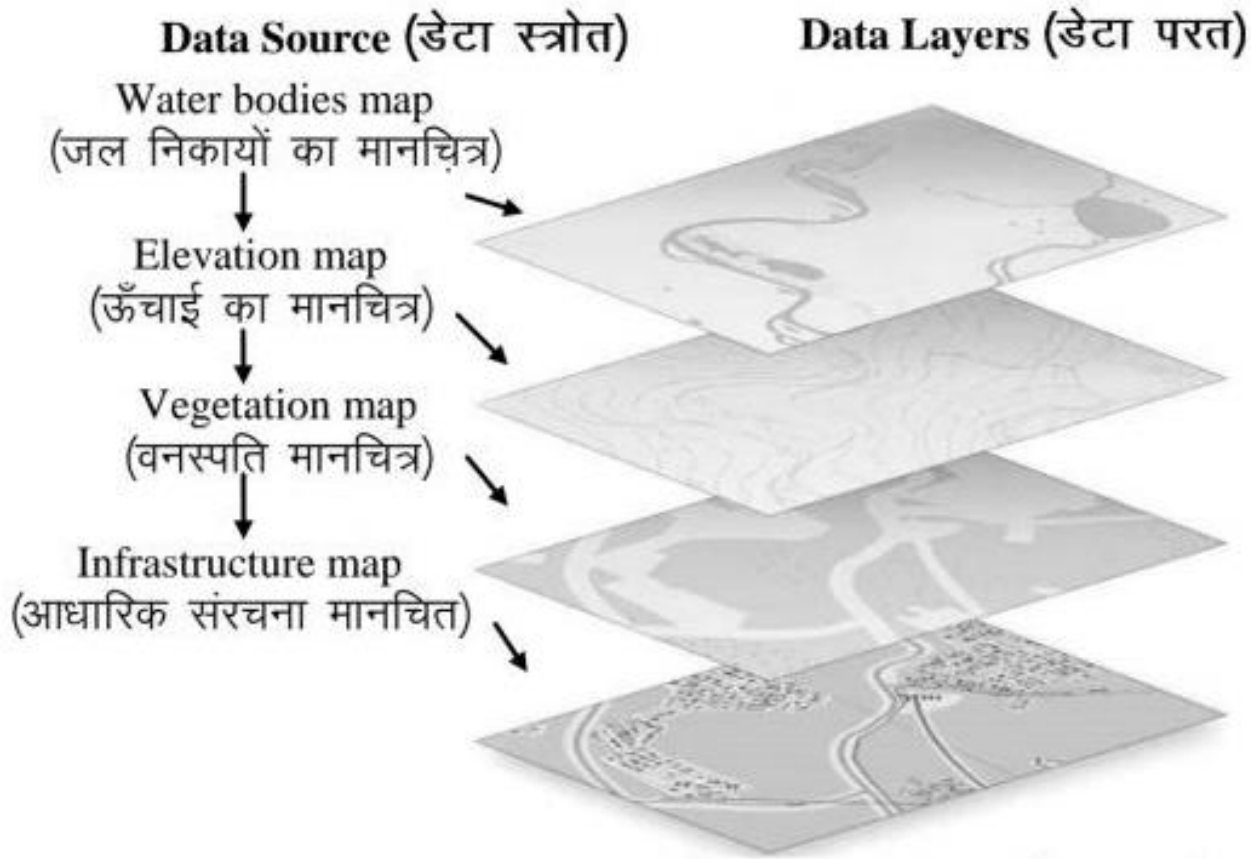


Figure 6.1: GIS Map Layers (चित्र 6.1– GIS मानचित्र परत)

6.2.5. Types of Mapping in GIS

There are numerous types of mapping in GIS, depending on precisely what has to be visualised. Anything from agricultural classification to population density can be viewed. Category, heat, cluster, bubble, and amount maps are some of the most popular GIS map kinds.

Category map
Heat map
Cluster map
Bubble map
Quantity map

6.3. 0P02.010H11YLIP - FREE PHYLOGENETIC SOFTWARE (PHYLIP SOFTWARE)

6.3.1. Introduction

Joseph Felsenstein (of the University of Washington) has been developing Phylip as a free collection of tools for phylogeny inference since October 1980. That month perceived the initial release of Phylip, which has since undergone significant improvements.

Later versions have significantly improved by including more tools and techniques for designing trees and accepting various data sources. Incorporated into other biological knowledge bases, like BioBIKE, Phylip is today one of the most commonly used phylogenetic analysis software programs since 1980.

6.3.2. Different Useful Programs

Five groups (**table 6.1**) could be used to classify the PHYLIP programs:

1) Programs for molecular sequence data (such as DNAPARS, PROTPARS, etc.).
2) Programs for distance matrix data (such as FITCH, KITSCH and NEIGHBOR).
3) Programs for gene frequencies and continuous characters (such as CONTML, GENDIST and CONTRAST).
4) Programs for 0-1 discrete state data (such as MIX, MOVE, CLIQUE, etc.).
5) Programs for plotting trees and consensus trees (such as DRAWTREE, CONSENSE, etc.).

(चित्र 6.2– PHYLIP पैकेज में शामिल मॉड्यूल का प्रतिनिधित्व करने वाले कुछ चिह्न जो विभिन्न कार्य करते हैं)

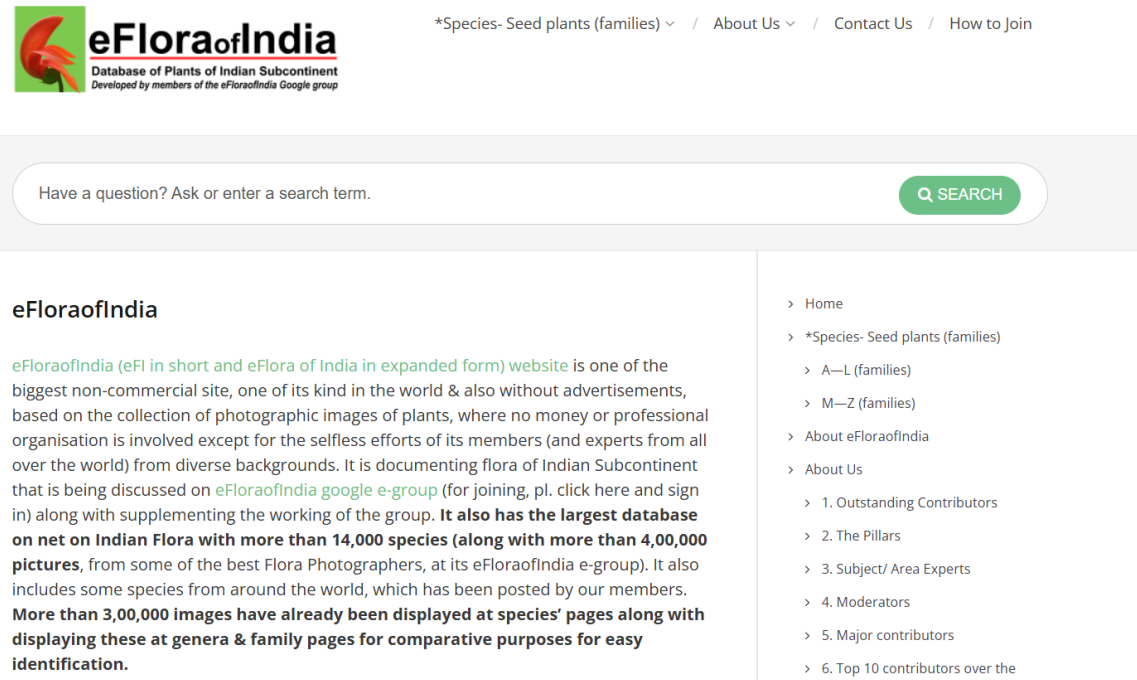
Figure 6.2: Some Icons Representing the Modules Included in PHYLIP Package which Carry out Different Tasks
(चित्र 6.2– PHYLIP पैकेज में शामिल मॉड्यूल का प्रतिनिधित्व करने वाले कुछ चिह्न जो विभिन्न कार्य करते हैं)

6.4. DIGITAL TAXONOMY (E-FLORA)

An **electronic flora** is a website that offers descriptions of the related plants along with identification keys, or at least partial identification keys, for the listed plants.

The **e-flora of India (eFI)** website is one of the largest non-commercial sites of its kind in the world and is also free of advertisements. It is based on a collection of plant photographs, and neither money nor a professional organisation is involved; instead, its members from a variety of backgrounds give their time and energy freely to the project. The efloraofindia google e-group is used to discuss and augment the group's work while documenting the flora of Indian Subcontinent.

With **more than 14,000 species**, along with more than 3,00,000 pictures as on 31st March, 2018 from some of the best Flora Photographers, at its efloraofindia e-group, it also offers the **largest online database dedicated to Indian Flora**. Additionally, several international species that have been posted by our members are included. As on 31st January, 2020, more than 2,50,000 photos have been shown at species' pages, and also at genus and family pages for comparison and simple identification.



THANK YOU