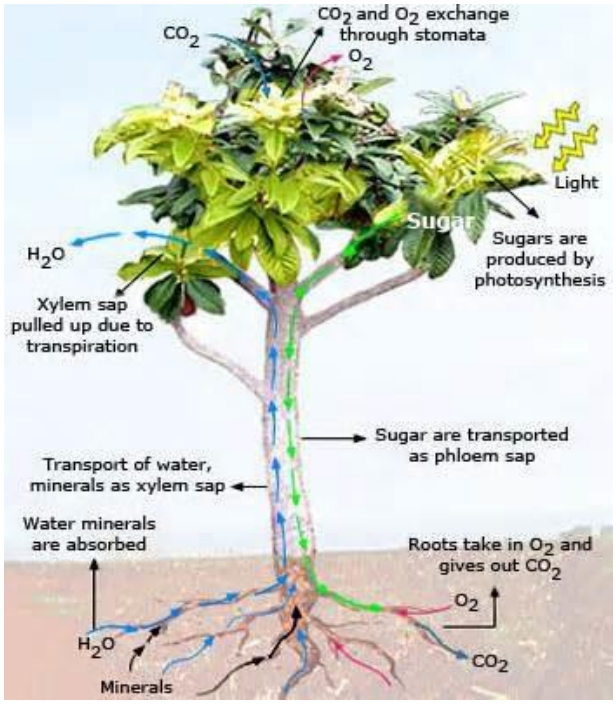
PLANT:

Plants included those organisms that possess photosynthesis, cell walls, spores, and a more or less sedentary behavior. This contained a variety of microscopic organisms, all of the algae, and the more familiar plants that live on land.



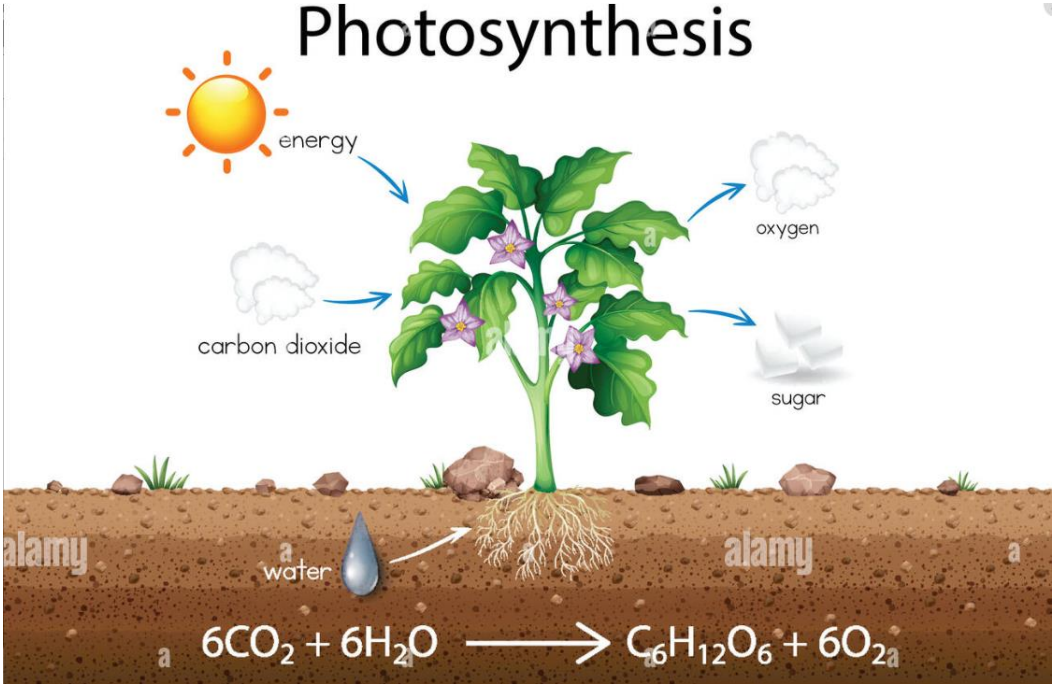
WHY STUDY PLANTS?

The tremendous importance of plants cannot be overstated زیادەڕۆیی. Without them, we and most other species of animals (and many other groups of organisms) would not be here.

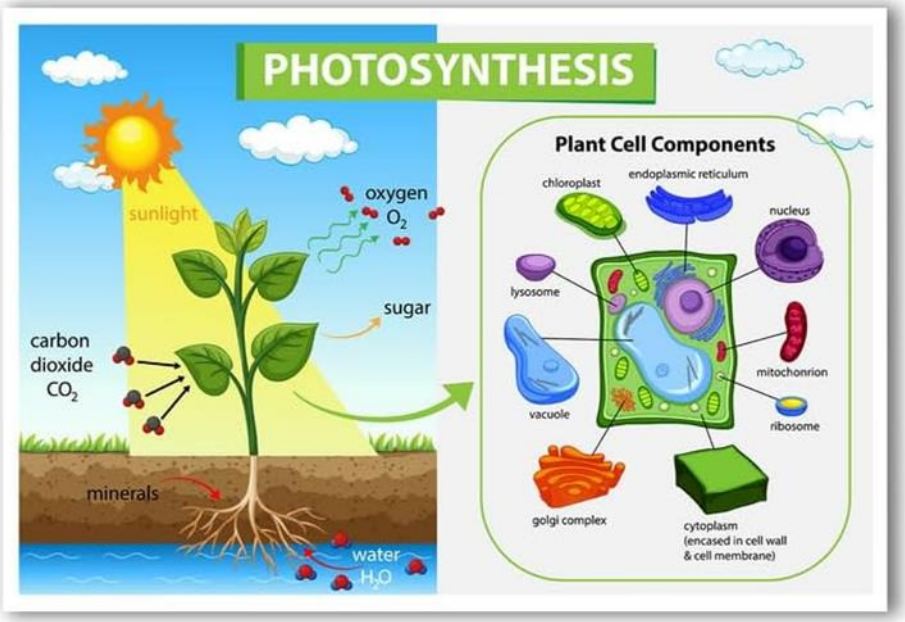
Photosynthesis in plants and the other photosynthetic organisms changed the earth in two major ways. First, the fixation of carbon dioxide and the release of molecular oxygen in photosynthesis directly altered the earth's atmosphere over billions of years. As a critical mass of oxygen accumulated in the atmosphere, selection for oxygen dependent respiration occurred, which may have been a necessary precursor in the evolution of many multicellular organisms, including all animals.

In addition, an oxygen-rich atmosphere permitted the establishment of an upper atmosphere ozone layer, which shielded life from excess UV radiation. This allowed organisms to inhabit more exposed niches that were previously inaccessible. Second,

the compounds that photosynthetic species produce are utilized, directly or indirectly, by non-photosynthetic, heterotrophic organisms.



For virtually all land creatures and many aquatic ones as well, land plants make up the so-called primary producers in the food chain, the source of high-energy compounds such as carbohydrates, structural compounds such as certain amino acids, and other compounds essential to metabolism in some heterotrophs. Thus, most species on land today, including millions of species of animals, are absolutely dependent on plants for their survival. As primary producers, plants are the major components of many communities and ecosystems. The survival of plants is essential to maintaining the health of those ecosystems.

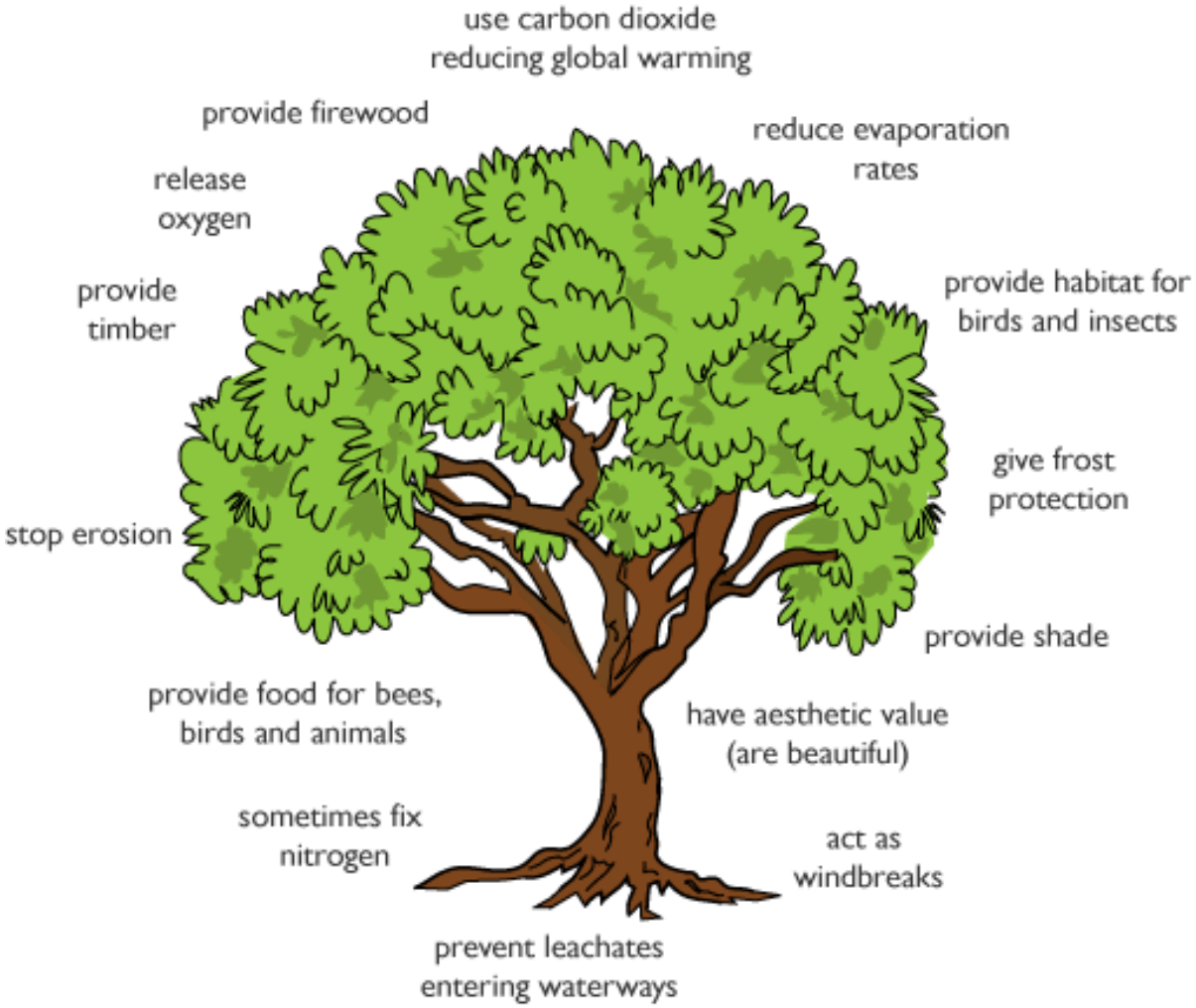


To humans, plants are also monumentally important in numerous, direct ways. Agricultural plants, most of which are flowering plants, are our major source of food. We utilize all plant parts as food products: roots (e.g., carrots; stems (e.g., potatoes; leaves (e.g., cabbage, celery, lettuce; flowers (e.g., broccoli; and fruits and seeds, including grains such as rice, wheat, corn, barley, and oats, legumes such as beans and peas, and a plethora of fruits such as bananas, tomatoes, peppers, pineapples, apples, cherries, peaches, melons, citrus, olives, and others too numerous to mention.

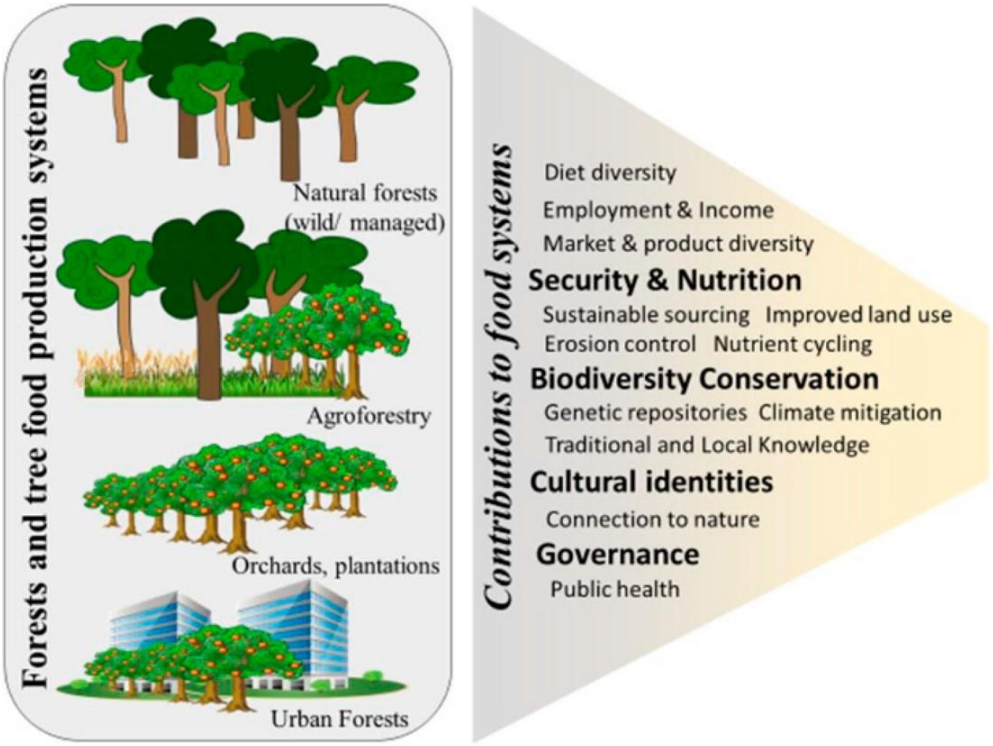
Tall conventional plant | **Improved high-yielding plant** | **Low-tillering ideotype (new plant type)**

Other plants are used as flavoring agents, such as herbs and spices, as stimulating beverages, such as chocolate, coffee, and tea. Woody trees of both conifers

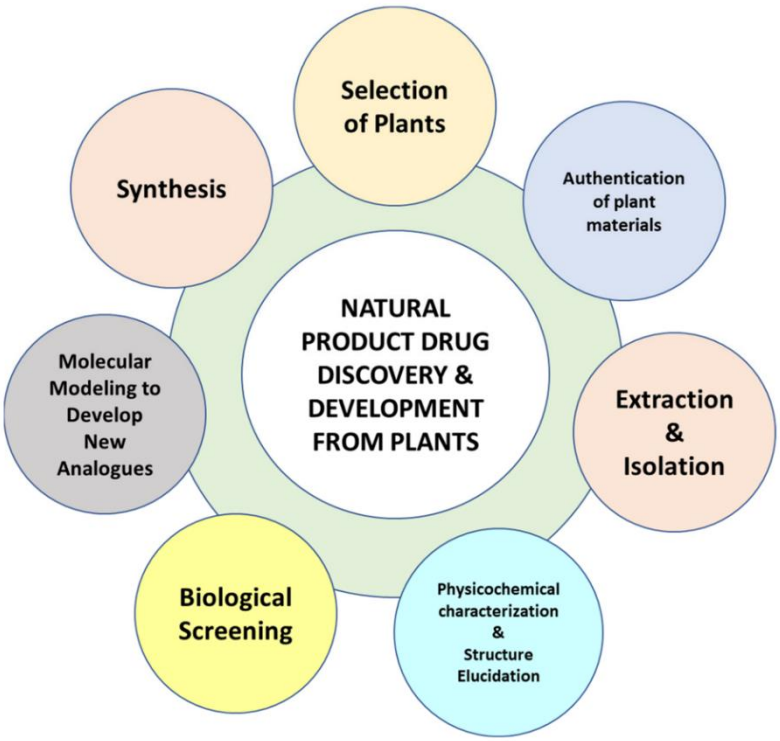
and flowering plants are used structurally for lumber and for pulp products such as paper. In tropical regions, bamboos, palms, and a variety of other species serve in the construction of human dwellings. Plants are important for their aesthetic beauty, and the cultivation of plants as ornamentals is an important industry. Finally, plants have great medicinal significance, to treat a variety of illnesses or to maintain good health. Plant products are very important in the pharmaceutical industry; their compounds are extracted, use to synthesize new drugs.



Some of the fields in the plant sciences are very practically oriented. **Agriculture** and horticulture deal with improving the yield or disease resistance of food crops or cultivated ornamental plants, e.g., through breeding studies and identifying new cultivars. **Forestry** is concerned with the cultivation and harvesting of trees used for lumber and pulp.



Pharmacognosy deals with crude natural drugs, often of plant origin. But many aspects of the pure sciences also have important practical applications, either directly by applicable discovery or indirectly by providing the foundation of knowledge used in the more practical sciences.



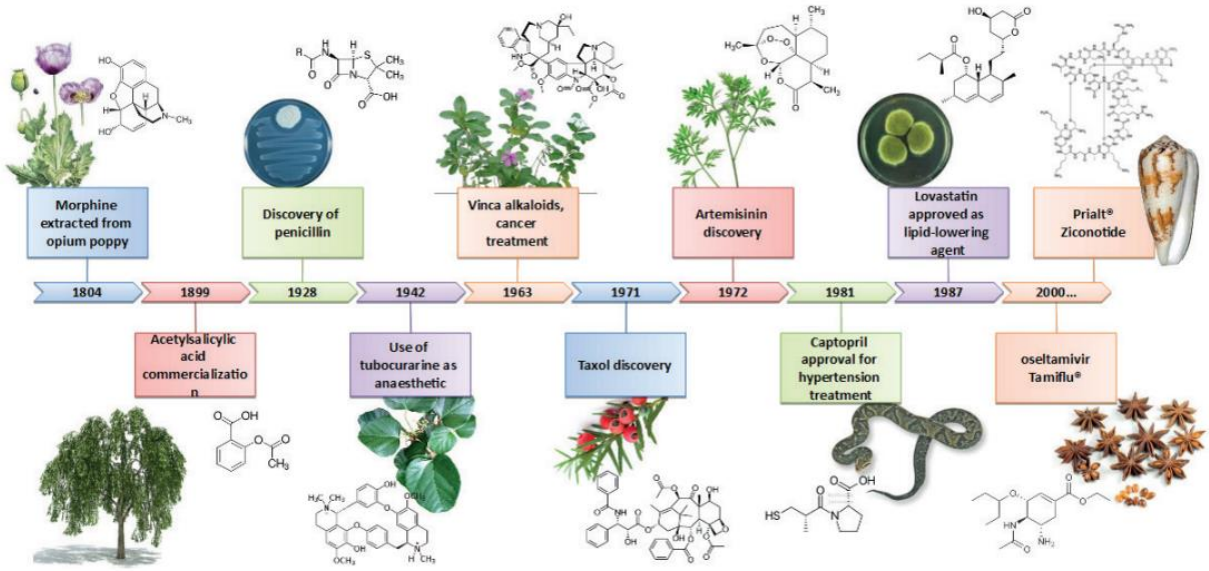
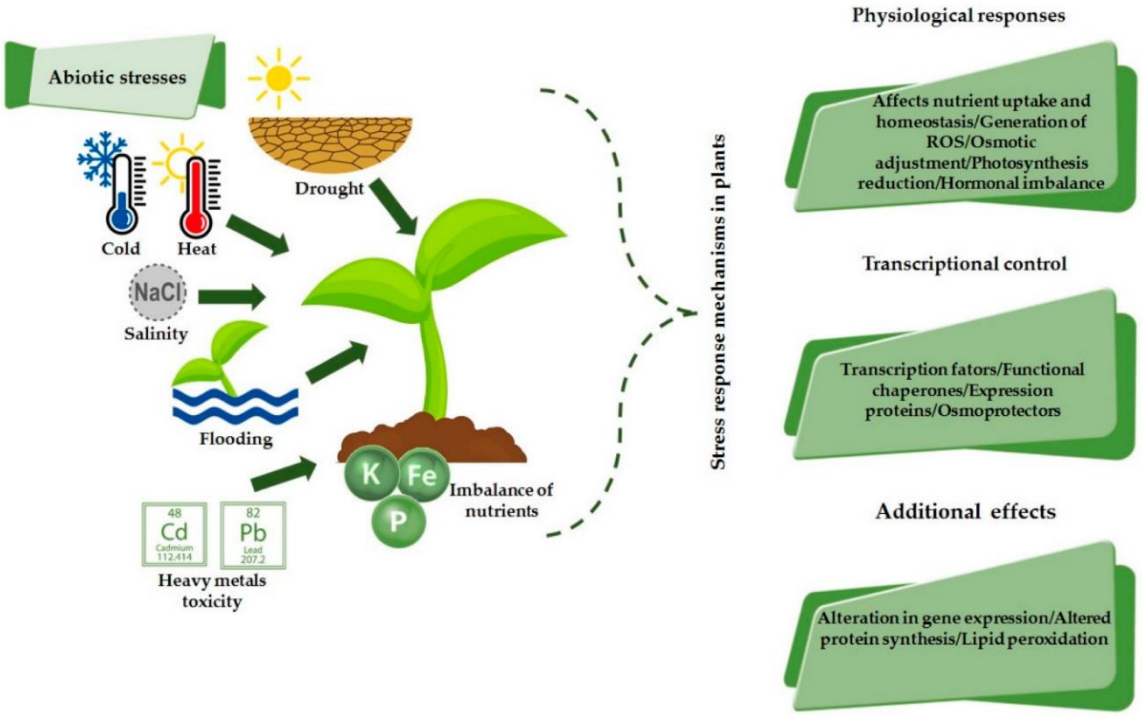


Figure 1 - A few natural products used as medicines identified in the last century.

Among these are plant anatomy, dealing with cell and tissue structure and development; **Plant chemistry and Physiology**, dealing with biochemical and biophysical processes and products; plant molecular biology, dealing with the structure and function of genetic material; plant ecology, dealing with interactions of plants with their environment; and, of course, plant systematics. A distinction should be made between botany and plant sciences.



Plant science is the study of plants, treated as equivalent to land plants here. **Botany** is the study of most organisms traditionally treated as plants, including virtually all eukaryotic photosynthetic organisms (land plants and the several groups

of algae) plus other eukaryotic organisms with cell walls and spores (fungi). Thus, in this sense, botany is inclusive of but broader than the plant sciences.

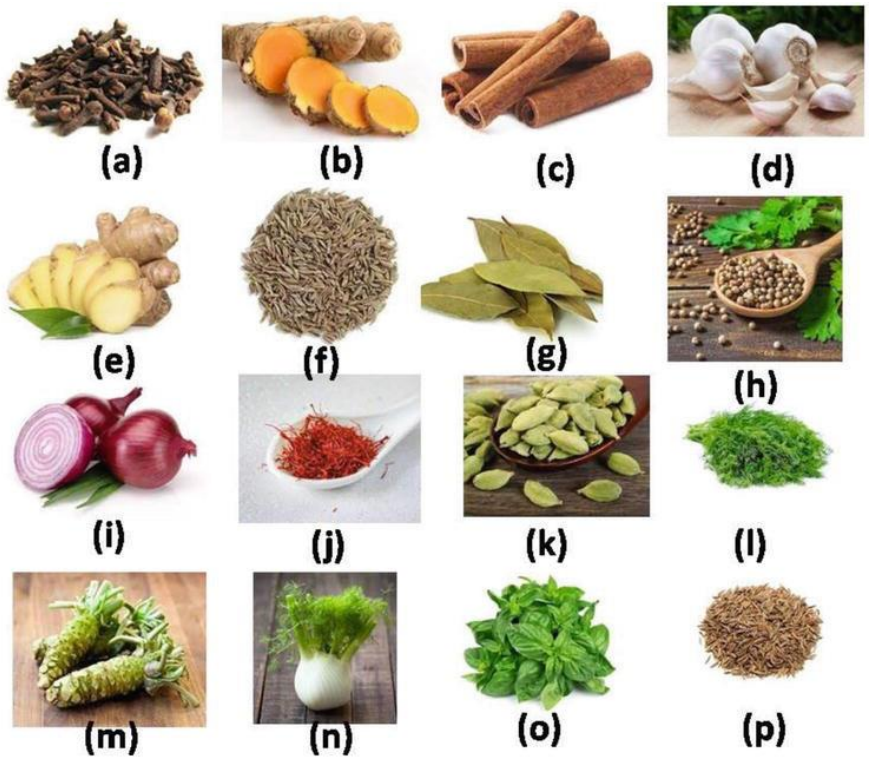


Figure 1. Some common spices in use; (a) clove (b) turmeric (c) cinnamon (d) garlic (e) ginger (f) cumin (g) bay leaf (h) coriander (i) onion (j) saffron (k) cardamom (l) dill (m) wasabi (n) fennel (o) basil (p) caraway.

Fundamental Components of Taxonomy

For scientific study of an organism, it is necessary to identify it, have a name for its communication and assign it to a group to which it fits well-the three main functions of taxonomy. The literal meaning of taxonomy (Greek, **taxus** = arrangement; nomos = law or rule) is the "lawful arrangement" or "arrangement by rules" of things. Plant taxonomy refers to classification of plants following certain rules of principles, after to introduce the term plant taxonomy which has its synonymous names as systematic botany and plant systematic in general.

Basic Botany Areas

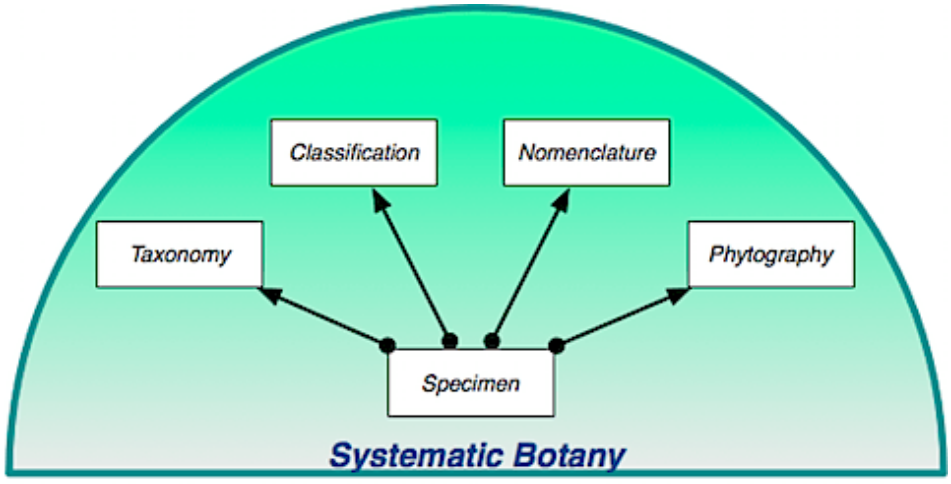
1. Plant Taxonomy.
Identification, Naming and Classification.

2. Plant Morphology.
Plant Form and Anatomy.

3. Plant Physiology.

What is Systematics?

Systematics is defined as a science that includes and encompasses traditional taxonomy, the description, identification, nomenclature, and classification of organisms and that has as its primary goal the reconstruction of phylogeny, or evolutionary history of life. Systematics is founded in the principles of evolution, its major premise being that there is one phylogeny of life. The goal of systematists is, to discover that phylogeny.



TAXONOMY

Taxonomy is a major part of systematics that includes four components:

Description, **I**dentification, **N**omenclature, and **C**lassification (**DINC**). The general subjects of study are **taxa** (singular, **taxon**), which are defined as groups of organisms. Ideally, taxa should have a property known as **monophyly** and are traditionally treated at a particular rank. It should be pointed out that the four components of taxonomy are not limited to formal systematic studies but are the foundation of all intellectual endeavors of all fields, in which conceptual entities are described, identified, named, and classified.

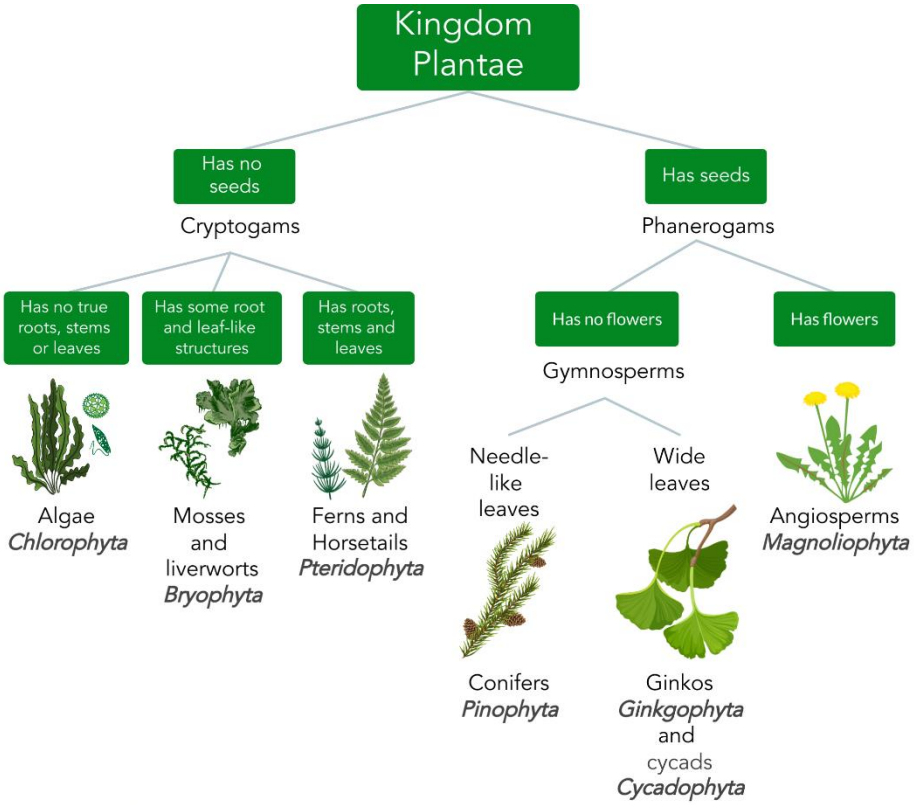
1. Description is the assignment of features or attributes to a taxon. The features are called **characters**. Two or more forms of a character are **character states**. One example of a character is petal color, for which two-character states are yellow and blue. Another character is leaf shape, for which possible character states are elliptic, lanceolate, and ovate. Numerous character and character state terms are used in plant systematics, both for general plant morphology. The purpose of these descriptive

character and character state terms is to use them as tools of communication, for concisely categorizing and delimiting the attributes of a taxon, an organism, or some part of the organism. An accurate and complete listing of these features is one of the major objectives and contributions of taxonomy.

2. Identification is the process of associating an unknown taxon with a known one, or recognizing that the unknown is new to science and warrants formal description and naming. One generally identifies an unknown by first noting its characteristics, that is, by describing it. Then, these features are compared with those of other taxa to see if they conform. Plant taxa can be identified in many ways. A taxonomic key is perhaps the most utilized of identification devices. Of the different types of taxonomic keys, the most common, used in all Floras, is a dichotomous key. A **dichotomous key** consists of a series of two contrasting statements. Each statement is a **lead**; the pair of leads constitutes a **couplet**.

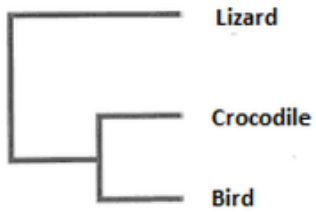
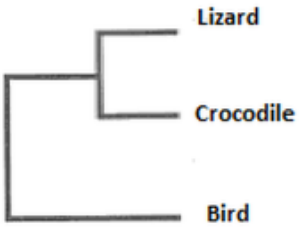
3. Nomenclature is the formal naming of taxa according to some standardized system. For plants, algae, and fungi, the rules and regulations for the naming of taxa are provided by the International Code of Botanical Nomenclature. These formal names are known as **scientific names**, which by convention are translated into the Latin language. The fundamental principle of nomenclature is that all taxa may bear *only one scientific name*. Although they may seem difficult to learn at first, scientific names are much preferable to common (vernacular) names. The scientific name of a species traditionally consists of two parts (which are underlined or italicized): the genus name, which is always capitalized, e.g., *Quercus*, plus the specific pithet, which by recent consensus is not capitalized, e.g. *agrifolia*. Thus, the species name for what is commonly called California live oak is *Quercus agrifolia*. Species names are known as **binomials** (literally meaning two names) and this type of nomenclature is called binomial nomenclature, first formalized in the mid-18th century by Carolus Linnaeus.

4. Classification: is the arrangement of entities (in this case, taxa) into some type of order. The purpose of classification is to provide a system for cataloguing and expressing relationships between these entities. Taxonomists have traditionally agreed upon a method for classifying organisms that utilizes categories called **ranks**. These taxonomic ranks are hierarchical, meaning that each rank is inclusive of all other ranks beneath it. As defined earlier, a **taxon** is a group of organisms typically treated at a given rank.



Magnoliophyta is a taxon placed at the rank of phylum; **Liliopsida** is a taxon placed at the rank of class; **Arecaceae** is a taxon placed at the rank of family; etc. Note / that taxa of a particular rank generally end in a particular suffix.

There are two major means of arriving at a classification of life: **Phenetic** and phylogenetic. **Phenetic** classification is that based on overall similarities. Most of our everyday classifications are Phenetic. For efficiency of organization (e.g., storing and retrieving objects, like nuts and bolts in a hardware store) we group similar objects together and dissimilar objects apart. Many traditional classifications in plant systematics are **Phenetic**, based on noted similarities between and among taxa.

	Phylogenetic system of classification	Phenetic system of classification
1.	It classifies organism on the basis of ancestral relations.	It classifies organism on the basis of morphological similarity.
2.	Example of phylogenetic system 	Example of phenetic system 

Phylogenetic classification is that which is based on evolutionary history, or pattern of descent, which may or may not correspond to overall similarity.

The primary taxonomic ranks accepted by the International Code of Botanical Nomenclature.

Major Taxonomic Ranks	**Taxa.**
Kingdom:	Plantae
Division:	Magnoliophyta
Class:	Liliopsida (Monocots)
Order:	Arecales
Family:	Arecaceae
Genus: (plural: genera)	*Cocos*
Species: (plural: species)	*Cocos nucifera*

International Code of Botanical Nomenclature. (I.C.B.N.):

The publication of Cod is based on the realization that botany requires a precise and simple system of nomenclature used by botanists in all countries and aims at providing a stable method of naming plants and taxonomic groups, avoiding and rejecting the use of names which may cause error or ambiguity or throw science into confusion.

Rules and Recommendation of ICBN:

Some important ones are discussed below;

A- The rank of taxa:

The term **taxon** (pl. **taxa**), a taxonomic group of any rank, has been introduced for the first time in 1956 edition of the Code. The system of nomenclature provides a hierarchical arrangement of ranks and every plant is treated as belonging to number of successively higher taxa, each assigned a particular rank with species as a basic unit. The seven principal-obligatory ranks in descending sequence are: Kingdom (regnum), Division (divisio or phylum), Class (klass, classis), Order (ordo), Family (familia), Genus (genus) and Species (species).

The ending of the names:

The ending of the name indicates its rank, as below:

- **Kingdom, ---- (various) e.g. Plantae**
- **Division, ---- phyta e.g. Magnoliophyta (Tracheophyta)**
- **Subdivision, ---- phytina e.g. Magnoliophytina (Spermatophytina)**
- **Class, ---- opsida e.g. Magnoliopsida (Angiospermopsida)**
- **Subclass, ---- idae e.g. Magnoliidae (Monocotyledonidae)**
- **Order, ---- ales e.g. Liliales**
- **Suborder, ---- ineae e.g. Lilineae**
- **Family, ---- aceae e.g. Liliaceae**
- **Genus, ---- (various) us, as, a, um, es, on, ii… *Lilium* L.**
- **Species, ---- (various) *Lilium candidum***

The rank of species is basic, on or more species make up a genus, one or more genera make up a family and so on.

B- Special exception is made for the following eight families. These names because of long usage are treated as validly published. For these families alternative names are also permitted ending in-*aceae*.

Old name	New name
i. Palmae	(Arecaceae)
ii. Gramineae	(Poaceae)
iii. Cruciferae	(Brassicaceae)
iv. Leguminosae	(Fabaceae)
v. Guttiferae	(Clusiaceae)
vi. Umbelliferae	(Apiaceae)
vii. Labiatae	(Lamiaceae)
viii. Compositae	(Asteraceae)