Herbarium, collection of dried plant specimens mounted on sheets of paper. The plants are usually collected in situ (e.g., where they were growing in nature), identified by experts, pressed, and then carefully mounted to archival paper in such a way that all major morphological characteristics are visible (i.e., both sides of the leaves and the floral structures). The mounted plants are labeled with their proper scientific names, the name of the collector, and, usually, information about where they were collected and how they grew and general observations. The specimens are commonly filed in cases according to families and genera and are available for ready reference.

OR

“It is a collection of plant specimens that are pressed, preserved, dead and dried, also arranged in a sequence of classification for future purpose and study. The specimens\sample may be a complete plant or a part of the plant, specimens should be in dried form on a sheet paper. Almost 3000 herbarians available in the world, mostly used by mycologists, plant pathologists, taxonomists, and health scientists.

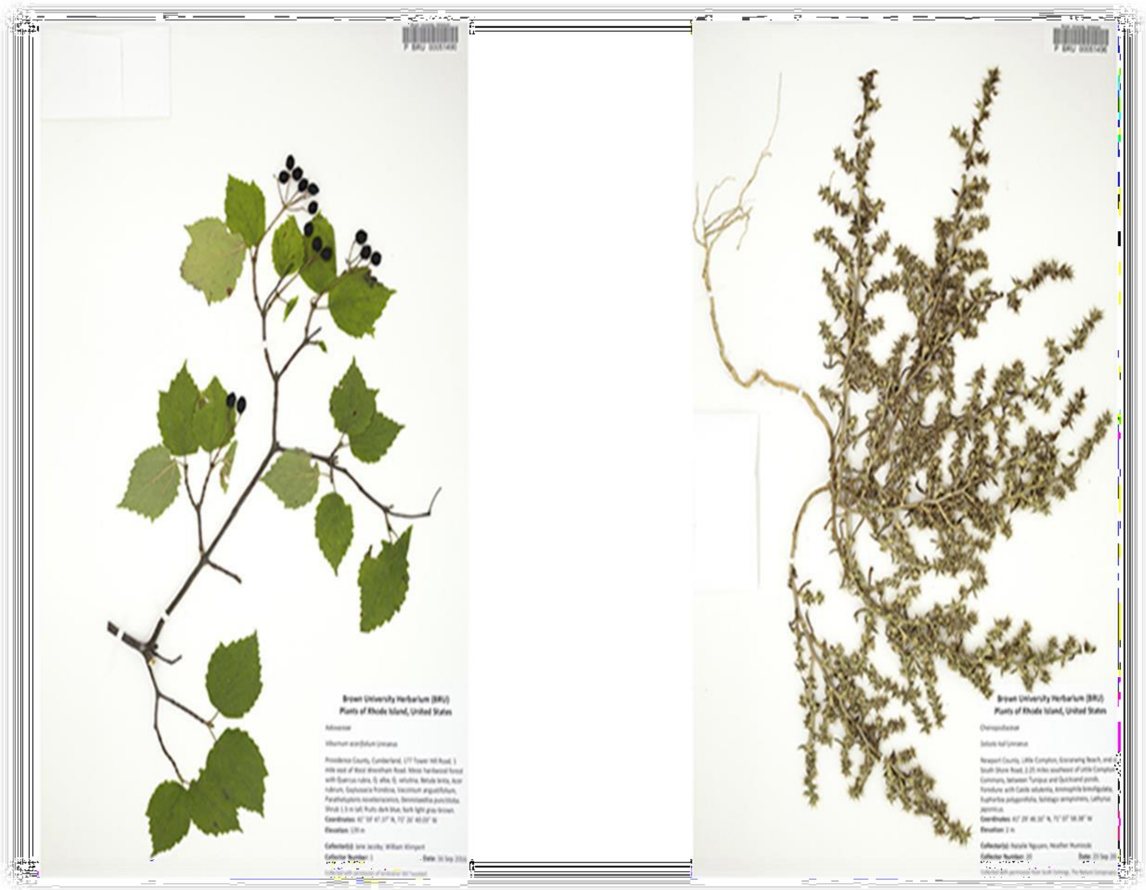
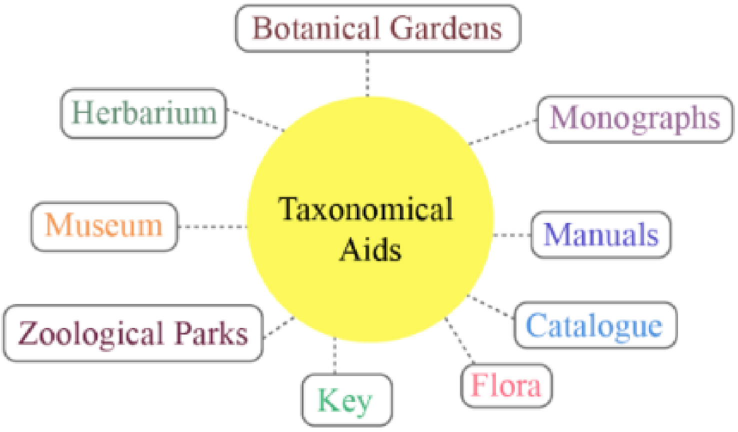


Fig: Herbarium sheets



Function of Herbarium

- ❖ Act as a source of information about plants.
- ❖ Help in research and teaching activities.
- ❖ Help in the accurate identification of plants.
- ❖ Also provide information about the plants that are collected worldwide, in one place.
- ❖ The specimens in the herbaria are used as a source of material for chemo-taxonomical and anatomical studies.

Importance of Herbarium:

1) It is a source of knowledge of flora of a region or a locality or a country.
2) It is a data store in which the information of plants is available.
3) The correct identification of plants is understood by the type specimen.
4) It provides materials for taxonomists and anatomists.
5) Pollen or microspore is preserved up to nearly 200 years without undergoing any changes in morphological features.
6) It is very useful to study cytology, structure of DNA, numerical taxonomy chemo-taxonomy etc.
7) It acts as a reservoir of gene pool studies.

Fig: Herbarium sheet

Use of Herbarium in Biodiversity and conservation:

Biodiversity means the variety and variability of all living organism from all sources including terrestrial, marine and other aquatic systems and the ecological complexes of which they are apart, this includes diversity within species, between species and of ecosystem. Authentic identification of species is pre-requisite for formulation and implementation of any research and management projects. Herbarium has invaluable role in correct identification of species and it is a databank for the biodiversity. Herbarium of the Forest Research Institute internationally known, as the Dehradun Herbarium (DD) is the only herbarium in the country engaged in survey, collection and identification of forestry species. The herbarium serves an important role as a ready reference for rare and threatened plant diversity of the country. This article briefly brings out the role and importance of herbarium, its digitization in biodiversity conservation. The Herbarium is a scientific collection composed by plants samples proceeding from several ecosystems. It provides a record and a reference about flora from a specific region. Herbarium serves as a tool for conserving the biodiversity in terms of scientific studies, applied research and activities, education and training. The use of herbarium will help conserve biodiversity are under the threat of extinction. It also preserves information on biodiversity data.

Herbarium Technique

To make a herbarium, there is a certain technique that is followed. This technique involves Collection, Drying, Poisoning, Stitching, Labelling, and Deposition.

1) **Collection of the specimen (plants).**

Rules for Collection of Specimen:

a) Every student of botany is required to collect plant specimens and prepare herbarium sheets.
b) All natural environments including sterile and dry must be searched.
c) One may carry some small bags or envelopes to carry the seeds and other small separate components.
d) Only native and naturalized plants should be collected.
e) Flowers and plants can be collected from grasslands, prairies, mountains, swamps, coast, woods, surviving in the different climate and the temperature conditions which are not too extreme for the survival of the plant.
f) When collecting samples from private property, or National parks, or private farms prior permission should be taken.
g) If some species of plants are protected by the law. So it is not wise to pick them up. Hence it is the responsibility of the collector to check the list of the plants protected under the law in the region of collection.
h) Collect only a small set of samples from a large population. Similarly, it is best to selectively trim a few pieces from different individuals so as not to damage the shrub or the tree.
i) Collect the flowers in a proper season by studying the blooming times of the plants.

j) Collect the samples which seem quite dry, and lacking any trace of surface moisture. But the sample plant should have the freshest appearance.
k) After returning from excursion the collected specimen should be pressed and their folder should be made and to be classified.

2) Pressing and drying of the specimen.

a) After the collection of specimens, the plants are pressed between the newspaper folder or blotting sheets.
b) Drying of specimens takes place by absorbing water through the blotting sheets.

3) Poisoning of specimens or protection of plants from insects or pests.

- a) The plants get protected from insects or pests by poisoning.
- b) The specimens are poisoned by dipping it into the chemicals like corrosive sublimate or mercuric chloride ($HgCl_2$).

4) Mounting and labelling of specimen

- a) After drying, the specimens are mounted on the herbarium sheets of size 41×29cm.
- b) Labelling should be done on the right hand side lower corner of the herbarium sheet. Generally the size of the label is 7×12 cm.
- c) The sheets are properly labelled and arranged accordingly with the accepted system of classification (Betham and Hooker's system).
- d) Labelling includes information like
  Date of collection
  Vernacular names (local names)
  Scientific name
  Family
  Habitat
  Collector's name.

5) Storing of herbarium sheets.

- a) The sheets are now stored in the almirahs (steel) to protect them from fire.
- b) For the protection from insects and pests they are treated with DDT (Dichloro diphenyl trichloroethane), naphthalene balls, carbon disulphide etc.

Equipment and Material Used:

Digger and pruning knife, a sickle with a long handle, vasculum, polythene bags, magazines or newspapers, bolting papers, plant press, field notebook, herbarium sheets, glue, labels, small transparent polythene bags.

Figure 14: Sampling material for the botanical survey: 1. Plant press for herbarium specimens; 2. 2 m folding ruler, 10 m and 50 m measuring tape; 3. Tent pegs; 4. Reel with 150 m string for delimiting the forest plots 5. Tablet with GIS Software for habitat mapping; 6. Digital camera for photo documentation; 7. Field book and pen; 8. Folding lens and field guide for identifying species in the field; 9. Magnets and small spade; 10. Handheld GPS; 11. Color spray can for marking corner points.

- **Cutters and Scissors:** used for cutting twigs.
- **Digger:** It is used for digging plants along with the roots.
- **Plant press:** It is used to press the plant for putting it on a paper sheet. Newspapers are used during pressing for support. Plant pressing can be done after returning home. But in summer time it is better to do it on the field.
- **Vasculum:** It is used for carrying collected specimen to avoid the loss of moisture and t avoid distortion due to drying.
- **Bag:** The collected specimens should be put into a strong bag made of cloth or polyethene. The bag protects the plants from damage during the outing. Care should be taken that the specimens are not getting folded. A bag of proper size should be used.
- **Field Notebook:** Name of plant, plant habit, the habitat, the ecology, the locality, the attitude, the season, the colour of flowers, observations of stem, leaves, fruits, seeds, scents, saps, latex, uses, and related information is noted in the field notebook.
- **Camera and Tripod:** A good photograph of the specimen its habitat can help in studies.

The Largest Herbaria in the World

This list includes those herbaria that fall within the top 100 in terms of number of specimens. The list includes all herbaria with more than 485,000 specimens.

Organization	Code	Country	Specimen Total	Date Founded
Royal Botanic Gardens	K	U.K.	8,125,000	1852
Muséum National d'Histoire Naturelle	P & PC	France	8,000,000	1635
The New York Botanical Garden	NY	U.S.A.	7,921,000	1891
Naturalis [1]	*L, Wag, U*	Netherlands	6,900,000	1829
Missouri Botanical Garden	MO	U.S.A.	6,850,000	1859
Conservatoire et Jardin botaniques de la Ville de Genève	G	Switzerland	6,000,000	1824
Komarov Botanical Institute of RAS	LE	Russia	6,000,000	1823
Naturhistorisches Museum Wien	W	Austria	5,500,000	1807
The Natural History Museum	BM	U.K.	5,200,000	1753

Smithsonian Institution	US	U.S.A.	5,100,000	1848
Harvard University [2]	*HUH*	U.S.A.	5,000,500	
Natural History Museum of Florence	FI	Italy	5,000,000	1842
Swedish Museum of Natural History	S	Sweden	4,570,000	1739
Université Claude Bernard Lyon	LY	France	4,400,000	1924
Meise Botanic Garden	BR	Belgium	4,000,000	1870
Botanischer Garten und Botanisches Museum Berlin, Zentraleinrichtung der Freien Universität Berlin	B	Germany	3,800,000	1815
Friedrich Schiller University Jena	JE	Germany	3,500,000	1896
Université de Montpellier	MPU	France	3,500,000	1809
University of Helsinki	H	Finland	3,393,629	1751
Botanische Staatssammlung München	M	Germany	3,200,000	1813
Museum of Evolution	UPS	Sweden	3,100,000	1785
Royal Botanic Garden Edinburgh	E	U.K.	3,000,000	1839
University of Copenhagen	C	Denmark	2,900,000	1759
Field Museum of Natural History	F	U.S.A.	2,7000,00	1893
Institute of Botany, Chinese Academy of Sciences	PE	People's Republic of China	2,650,000	1928
Lund University	LD	Sweden	2,500,000	1770
Eidgenössische Technische Hochschule Zürich	ZT	Switzerland	2,440,000	1859
California Academy of Sciences	CAS	U.S.A.	2,300,000	1853
M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine	KW	Ukraine	2,263,207	1921
Charles University, Prague	PRC	Czech Republic	2,240,000	1775
University of California	UC	U.S.A.	2,100,000	1872
Hungarian Natural History Museum	BP	Hungary	2,097,424	1870
Botanical Survey of India	CAL	India	2,086,650	1793
National Museum of Nature and Science	TNS	Japan	2,026,000	1877
Research Centre for Biology	BO	Indonesia	2,000,000	1841
National Museum in Prague	PR	Czech Republic	2,000,000	1818
University of Hamburg	HBG	Germany	1,800,000	1879
Botanical Museum, University of Oslo	O	Norway	1,800,000	1863
University of Michigan	MICH	U.S.A.	1,750,000	1837
University of Tokyo	TI	Japan	1,700,000	1877
Universidad Nacional Autónoma de México	MEXU	Mexico	1,600,000	1888
Agriculture and Agri-Food Canada	DAO	Canada	1,550,000	1886
Royal Botanic Gardens Victoria	MEL	Australia	1,500,000	1853
Academy of Science, Uzbekistan	TASH	Uzbekistan	1,500,000	1921

Universität Zürich	Z	Switzerland	1,500,000	1834
Senckenberg Gesellschaft für Naturforschung: Senckenberg Forschungsinstitut und Naturmuseum	FR	Germany	1,500,000	1817
Botanical Research Institute of Texas	BRIT	U.S.A.	1,482,000	1987
Academy of Natural Sciences	PH	U.S.A.	1,430,000	1812
Royal Botanic Gardens & Domain Trust	NSW	Australia	1,425,000	1896
Universität Wien	WU	Austria	1,400,000	1879
California Botanic Garden	RSA	U.S.A.	1,230,000	1927
W. Szafer Institute of Botany, Polish Academy of Sciences	KRAM	Poland	1,227,500	1867
Australian National Herbarium	CANB	Australia	1,204,426	1930
Hebrew University	HUJ	Israel	1,200,000	1928
Kyoto University	KYO	Japan	1,200,000	1921
South African National Biodiversity Institute	PRE	South Africa	1,2000,00	1903
Karl-Franzens-Universität Graz	GZU	Austria	1,200,000	1900
Real Jardín Botánico	MA	Spain	1,1581,16	1755
Università degli Studi di Roma La Sapienza	RO	Italy	1,120,000	1872
Kunming Institute of Botany, Chinese Academy of Sciences	KUN	People's Republic of China	1,114,000	1938
University of Gothenburg	GB	Sweden	1,100,000	1926
University of Cambridge	CGE	U.K.	1,100,000	1761
Upper Austrian State Museum	LI	Austria	1,100,000	1833
Moscow State University	MW	Russia	1,085,561	1765 or 1780
Instituto Politécnico Nacional	ENCB	Mexico	1,080,000	1943
University of Wisconsin	WIS	U.S.A.	1,078,000	1849
State Herbarium of South Australia	AD	Australia	1,040,000	1954
University of Texas at Austin	TEX	U.S.A.	1,006,000	1900
National Museums of Kenya	EA	Kenya	1,000,000	1902
South China Botanical Garden	IBSC	People's Republic of China	1,000,000	1928
Musée et Jardins Botaniques Cantonaux MJBC	LAU	Switzerland	1,000,000	1824
University of Manchester	MANCH	U.K.	1,000,000	1835
Staatliches Museum für Naturkunde Stuttgart	STU	Germany	1,000,000	1791
Institute of Botany, Ilia State University	TBI	Georgia	1,000,000	1894
University of Wyoming	RM	U.S.A.	983,000	1894
Hiroshima University	HIRO	Japan	970,000	1929

Introduction to Botanical Garden:

What is a botanical garden?

A botanical garden is a place for botanical research, conservation, education, and display, focusing on the region's native flora. Besides, a botanical garden is an establishment where plants are grown for scientific study and display to the public. A modern botanical garden comprises a herbarium, library, photographic studies, laboratory, lecture pavilion, and recreational facilities. On the other hand, it might also have specialist plant collections, such as those of cacti and other succulents, herb gardens, plants from particular parts of the world, and so on. Some others might comprise greenhouses and shade houses with special collections such as tropical plants, alpine plants, or other exotic species. Most are open to the public in some capacity and may provide guided tours, educational displays, art exhibitions, book rooms, open-air theatrical and musical performances, and other forms of entertainment.

Life forms and living processes are known as the science of biology. Growth, reproduction, capability to smell the terrain and mount a suitable response is unique features of living organisms. Diversity in the living world or biodiversity is the occurrence of a variety of life forms different in morphology, size, colour, anatomy, habitats and habits. Taxonomical aids are the collections of samples or preserved organisms which help in extensive research for the identification of various taxonomic ranking. These include Herbarium, Botanical Gardens, Museum, Zoological Parks and Keys. These are known as the tools for the study of Taxonomy. Taxonomy is the branch of study that deals with principles and procedures of identification, nomenclature and classification of organisms. Let's understand the detailed explanation of Botanical Gardens.

Botanical garden, is originally, a collection of living plants designed chiefly to illustrate relationships within plant groups. In modern times, most botanical gardens are concerned primarily with exhibiting ornamental plants, insofar as possible in a scheme that emphasizes natural relationships. Thus, the two functions are blended: eye appeal and taxonomic order. Plants that were once of medicinal value and extremely important in early botanical gardens are now chiefly of historical interest and are not particularly represented in contemporary collections. A display garden that concentrates on woody plants (shrubs and trees) is often referred to as an arboretum. It may be a collection in its own right or a part of a botanical garden.

Historical background

Botanical gardens have a long history that is intertwined with botany. The first botanic gardens were physic gardens built at European colleges for the study of medicinal plants. These early gardens were found near Pisa, Italy (1543) during the era of the Renaissance. The first botanical gardens were medical gardens in the 16th and 17th centuries, but as time went on, the idea of a botanical garden expanded to include displays of beautiful, exotic, unique, and occasionally economically valuable plant species brought back from European colonies and other far-off places. Later, in the 18th century, they took on a more instructional role, exhibiting the most recent plant categorization systems established by botanists working in the accompanying herbaria as they attempted to organize these new treasures. Then, in the 19th and 20th centuries, there was a movement toward a mix of specialized and eclectic collections displaying many areas of horticulture and botany (Hill, 1915).In the 19th and 20th centuries, a considerable number of civic or municipal botanical gardens were established. Although no scientific facilities or programs were developed, the horticultural features were strong, and the plants were frequently labeled. They were botanical gardens in the sense that they grew plant collections and exchanged seeds with other gardens across the world, but individuals in charge of them daily established their collection policies. They tended to devolve into little more than nicely maintained parks and were frequently overseen by general park administrations.

The garden is generally defined as a place for growing flowers, fruits or vegetables. But botanic or botanical garden is an educational institution for scientific workers and general public or layman to awake and enlightened interest in plant life.

1) Conserve the flora and fauna in natural habitat.
2) Botanical gardens act as out-door laboratories.
3) Initiate studies on the tropical and temperate ecosystems and their biota, before they are lost to science and preserve such systems.
4) Maintain less attractive and abandoned ornamental plants.
5) Train city arborists in the plantation of trees in urban areas.
6) Botanical gardens provide living plant materials for research.
7) Centers of conservation of endangered and rare species.
8) Garden therapy for eye-sight, mental-stress etc.

Importance of botanical Garden:

The main purpose that setting up the botanical gardens is to increase publics' knowledge and appreciation of plant based on the significance and conservation of plants through locally and globally and also for the ongoing benefit and enjoyment of the community. Botanical gardens also can provide visitors with an exceptional range of cultural, recreational, educational and scientific facilities which improve people's enjoyment and understanding of the plant world. Therefore, botanical gardens is used to demonstrate their relevance characteristics and values to our society.

Role of Botanical Gardens

1) **Taxonomic Studies:** Botanical gardens give precious information on various plants. Local flora, bonsai, rare plants etc. They act as "outdoor laboratories" for scholars and researchers. It helps us to know about our biodiversity, its features and various other information.
2) **Botanical Research-** For botanical research botanical gardens supply a wide range of plant species, seeds, flowers, and fruits. Research on plants enhance our intellectual life and adds to our knowledge about other life supporting processes.
3) **Conservation-**Botanical gardens conserve and generate rare species and genetic diversity. Conservating species may help diversity from fading which could help the upcoming generation with their knowledge about plant species.
4) **Education-**They supply facilities for courses in local flora, horticulture,

hybridization, plant propagation, etc. These educational programmes include workshops, and training sessions for teachers, students, naturalists, etc.

5) **Public Services-**They helps the public in identifying the local and exotic plant species; provide instructions for home gardening, and propagation of plants; supply plant resource; through sale or exchange.
6) **Aesthetics and Resources-**They attract people who have made gardening their hobby. These gardens also play a essential role in fulfilling human needs and providing well-being.
7) **Employment-**They create job opportunities for a large number of young botanists. It makes people employed by providing work at a different levels of jobs.

Use of Botanical Garden in Biodiversity and Conservation:

The first role of botanical gardens in plant conservation is the horticulture and cultivation functions towards the plants. This is because botanical gardens allow the better growth of the endangered plant species with the presence of these functions. With the better growth of plant, our environment also can become better because plants help to absorb the carbon dioxide when undergo photosynthesis process. This role of botanical gardens can also maintain the plant conservation of genetic diversity ex-situ but in the other way, they also allow plants to be used in restoration and rehabilitation of degraded habitats in-situ. Therefore, we can say that the powerful resources for plant conservation are the botanical gardens research expertise in plant science and horticulture.

Next, botanical gardens may implement the research and development (R&D) into plant taxonomy and genetics, useful plant properties, efficient seed banking methods, Phytochemisty, plant translocation and many more botanical areas that support plant utilization and plant conservation. Due to the increasing of human activity and the climatic change that causing the imbalance of ecosystem and biodiversity, research and development group of botanical gardens is important to carry out the projects that useful for the plant conservation. For example, R&D team can implement the experiments to investigate how plants can withstand the degraded and changing environments. After that, apply the best solution for the plant conservation to improve the sustainable development to our society.

In addition, botanical gardens possess the capability to store the seeds or germplasm of plants for future use, research and propagation. This role of botanical gardens is known as the seed banking which is another ex-situ plant conservation that helps to maintain the species of plant and reduce the chance of facing extinction. Seeds must be carefully collected and stored to ensure maximum genetic diversity is retained. To determine the best way of storing the different seeds, much more research and development activities and projects need to be carried out. Hence, we can state that botanical gardens are useful to promote plant conservation and recovery of endangered species of plant.

One of the most important roles that botanical gardens play in conservation is environmental education. Each year, more than 150 million people visit gardens all over the world and have the chance to get in touch with nature. Botanical gardens are a unique environment to raise public awareness and help people understand the importance of biodiversity, educate people about the threats it currently faces and make them realize that nature conservation is everyone’s job. This is why it is so important for gardens to maintain interpretation programs, host school groups and present exhibitions.

The obvious role of botanical gardens in biodiversity conservation is ***ex situ*** **conservation**. *Ex situ* conservation (growing wild plants outside their natural environment) has many advantages, but should not be seen as an objective in and of itself. It is one element of a comprehensive strategy to conserve species in their environment. *Ex situ* conservation helps to attain this objective by providing material to reintroduce plants into degraded areas or to reinforce existing populations.

One of a botanical garden’s primary conservation objectives can be working to **conserve local flora**, from scientific research to collaboration with towns, cities and local organizations to conserve or restore habitats. The collaboration of gardens with other organizations plays an important role in the implementation of natural or regional conservation plants. Gardens can provide the expert advice, practical assistance, databases and information needed to manage plants with a view to their conservation and sustainable use.

Herbarium collections are often housed in botanical gardens, arboretums, natural history museums, and universities. The largest herbaria, many of which are in Europe, contain several million specimens, some of which date back hundreds of years. Herbaria are the “dictionaries” of the plant kingdom and provide comparative material that is indispensable for studies in plant taxonomy and systematics. Given that nearly every plant species has a dried “type specimen” on which its description and Latin name are based, taxonomic disputes are commonly resolved by referencing type specimens in herbaria. The collections are also essential to the proper naming of unknown plants and to the identification of new species.

In addition to their taxonomic import, herbaria are commonly used in the fields of ecology, plant anatomy, and morphology, conservation biology, biogeography, Ethnobotany, and Palebotany. The sheets provide biogeographic information that can be used to document the historic ranges of plants, to locate rare or endangered species, or to trace the expeditions of explorers and plant collectors. Physically, the specimens are important sources, of genetic material for DNA analyses and of pollen for palynological studies. Herbarium sheets are often shared among researchers worldwide, and the specimens of many herbaria have been digitized to further facilitate their use.

Botanical gardens must find a compromise between the need for peace and seclusion, while at the same time satisfying the public need for information and visitor services that include restaurants, information centres and sales areas that bring with them rubbish, noise, and hyperactivity. Attractive landscaping and planting design sometimes compete with scientific interests — with science now often taking second place. Some gardens are now heritage landscapes that are subject to constant demand for new exhibits and exemplary environmental management.

TAXONOMY AND SYSTEMATICS

Taxonomy is defined as the branch of science dealing with the classification of organisms according to their similarities and differences. Systematics is often used synonymously with taxonomy, but sometimes interpreted more widely to include also identification, practice of classification and nomenclature. Andrew Sugden in (1986) defined taxonomy as "the science of classification and relationships of organisms" and systematics as "the part of classification that involves the arrangement of organisms into related groups". Some botanists treat taxonomy and systematics as two separate branches. According to these botanists systematics is "the study of diversity of plants and their identification, naming, classification and evolution" while taxonomy is "restricted to the study of classification". However the terms taxonomy and systematics have been so loosely and interchangeably used in the past to establish a proper delineation between the two is extremely difficult. In actual practice, the two terms are used synonymously and deal with the study of classification, its principles, procedures and rules. Basic components of taxonomy Classification, identification, nomenclature and description are the four basic components of taxonomy. Classification is an arrangement of organisms into groups on the basis of similarities. Identification is the determination of similarities or dissimilarities between the two elements. Description is the orderly recording of maximum possible characters of a taxon, individual plant, plant part or object. Nomenclature deals with scientific naming of plants.

CLASSIFICATION

Classification is an arrangement of organisms into groups on the basis of similarities. Taxonomic entities are classified in different fashions:

1. Artificial classification: These classifications are based on convenience. In these systems only one or a few external characters are taken into consideration for plant identification. These classifications are based on arbitrary, easily observable characters such as habit, colour, number, form or similar features. The first artificial system was proposed by Theophrastus in 300 BC and he classified plants on the basis of habit into Herbs, Under-shrubs, Shrubs and Trees. The sexual system of classification proposed by Linnaeus, is the best artificial system. This system of classification is based on the number of stamens, it is also called "numerical system of classification".

2. Natural classification: These systems of classifications used as many taxonomic characters as possible to group taxa. In these systems maximum external characters are taken in consideration. These systems use overall similarity in grouping taxa. Natural system of classification was initiated by M. Adanson and culminating in the extensively used classification of Bentham and Hooker. Natural systems of the eighteenth and nineteenth centuries used morphology in delimiting the overall similarity.

3. Phylogenetic classification: These systems of classification used as many taxonomic characters as possible in addition to the phylogenetic (evolutionary) history. Phylogenic systems are based on the evolutionary descent of a group of organisms, the relationship depicted either through a phylogram, phylogenetic tree or a cladogram. The first phylogenetic system was proposed by Eichler. Some other phylogenetic systems of classification were proposed by Englar and Prantl, Bessey, Hutchinson, Takhtajan.

The Type Method

The names of different taxonomic groups are based on the type method, by which a certain representative of the group is the source of the name for the group.

This representative is called the nomenclatural type or simply the type, and methodology as typification. The type need not be the most typical member of the group, it only fixes the name of a particular taxon and the two are permanently associated. Type may be correct name or even a synonym. Thus the tea family name (Theaceae) is derived from synonym Thea although the correct name for the genus is Camellia. Mimosa is the type for family Mimosaceae, but unlike most representatives of the family that have pentamerous flowers, the genus Mimosa has tetramerous flowers. The family Urticaceae, similarly, has Urtica as its type. When the originally large family was split into a number of smaller natural families, the name Urticaceae was retained for the group containing the genus Urtica, since the two cannot be separated. The other splitter groups with family rank got the names Moraceae, Ulmaceae and Cannabaceae with type genera Morus, Ulmus and Cannabis, respectively. The type of a family and the higher groups is ultimately a genus, as indicated above. A type of a particular genus is a species, e.g. Poa pratensis for Poa. The type of name of a species or infraspecific taxon, where it exists, is a single type specimen, preserved in a known herbarium and identified by the place of collection, name of the collector and his collection number. It may also be an illustration of the plant. The Code recognizes several kinds of type, depending upon the way in which a type specimen is selected. These include:

1. Holotype: A particular specimen or illustration designated by the author of the species to represent type of a species. For the purpose of typification, a specimen is a gathering, or part of a gathering, of a single species or infraspecific taxon made at one time. It may consist of a single plant, parts of one or several plants, or of multiple small plants.

2. Isotype: A specimen which is a duplicate of the holotype, collected from the same place, at the same time and by the same person. Often the collection number is also the same, differentiated as a, b, c, etc.

3. Syntype: Any one of the two or more specimens cited by the author when no holotype was designated, or any one of the two or more specimens simultaneously designated as types. Duplicate of a syntype is an isosyntype.

4. Paratype: A paratype is a specimen cited in the protologue that is neither the holotype nor an isotype, nor one of the syntypes if two or more specimens were simultaneously designated as types.

5. Lectotype: A specimen or any other element selected from the original material cited by the author when no holotype was originally selected or when it no longer exists. A lectotype is selected from isotypes or syntypes.

6. Neotype: A specimen or illustration selected to serve as nomenclatural type as long as all of the material on which the name of the taxon was based is missing; a specimen or an illustration selected when no holotype, isotype, paratype or syntype exists.

7. Epitype: A specimen or illustration selected to serve as an interpretative type when the holotype, lectotype or previously designated neotype, or all original material associated with a validly published name, is demonstrably ambiguous and cannot be critically identified for purposes of the precise application of the name of a taxon. Topotype is often the name given to a specimen collected from the same locality from which the holotype was originally collected.