

THE MODERN ARBORETUM

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We can get the best perspective of a modern arboretum and its organization and function by considering how arboreta and botanical gardens came into being, evolved and changed through function.

Gardens developed as soon as man emerged from nomadism to an agricultural existence. The first gardens were purely utilitarian, where a few herbs, vegetables and fruit trees, were grown near the dwelling. This can still be seen among the agriculturally primitive peoples. The Arabs in the Sahara, living in oases, depend for food almost exclusively on dates, but between the dates they have small kitchen gardens with tomatoes, eggplant, squash, horse beans, chili pepper, corn, all in small numbers, and a few fruit trees such as fig, peach, apricot, lemon, pomegranate and grape, and as herbs mint, absinthe, marijuana. Apart from the wild oleanders there are no flowers.

Not until a considerably higher level of economic development has been reached, does the garden become less purely utilitarian, and starts to contain ornamental and flowering plants.

With the collapse of the Roman Empire the pleasure gardens, which were so highly developed in Rome, seem to have disappeared completely. Since the transport system also was defunct, which made exchange of herbs and medicines extremely difficult, the need for the cultivation of medicinal plants in many localities became much greater, and the monastery gardens grew into real collections of medicinal plants. If the brother in charge of the garden was very active, he increased the collection of herbs and vegetables, and he may have slipped in a rose or other beautiful flower for the image of the Holy Mother, or to be used in church ceremonies. Many of the introductions into the monastery gardens came from Italy, brought by returning pilgrims.

In a description of such a monastery garden at St. Gall, Switzerland, in 820 A.D., it was said that "lilies, roses, mints, and fenu-greek grew in one bed; in the 'Herbularius' there were sage, rue, gladiolus and cumin; in the vegetable garden (Hortus) there were onions and garlic, dill and beets, parsnips and cabbages." (Reed 1942, p. 116).

The Renaissance, which marked the beginning of so many intellectual developments, also was the beginning of the Botanical garden as we know it at present. It was a necessary adjunct to the teaching at the Universities which were then just starting. Usually there was one professor of Medicine, whose main task was to teach the future physicians to know the drugs and their uses. For this reason the first botanical gardens, such as the papal one in Rome, which existed even in the 13th century, were really medicinal herb gardens, where the professor took his students to teach them the names of the

herbs and their uses. The plants commonly encountered in these first botanical gardens can be found in the so-called herbals, sort of textbooks of Botany, which prior to the invention of printing were present as manuscripts in the libraries of Universities and monasteries.

The first printed herbals were exclusively catalogues of medicinal plants and their uses, and were very poor both as far as plant descriptions and illustrations were concerned. It requires a vivid imagination to recognize most of the plants in these herbals. One herbal, the Pseudo-Apuleius, was printed in 1472 by de Lignamine in Rome. It was not an original work, but a reproduction of a fourth-century manuscript, copied and modified over and over again until little of the original information was left. Fortunately within the following 20 years the mere possibility of purchasing a printed herbal created a demand for a technically better product. This was fulfilled by the Ortus Sanitatis, printed in 1484 in Mainz, and translated soon after into German. The following 60 years saw more original herbals being printed, and culminated in the magnificent herbal of Fuchs of 1543.

The evolution of the herbals also reflected the growth of the Botanical Garden. Many trends can be recognized:

- 1) The arrangement of the plants became more and more systematic, with the Compositae, Umbelliferae, Labiatae, grasses, and other natural families being planted together, reflecting the development of a system of classification.
- 2) The garden collection was no longer restricted to medicinal and culinary herbs, but also included wild plants without economic importance, reflecting the trend towards a general taxonomy.
- 3) Although the main focus of the botanical garden remained the herb and annual garden, usually located in the center, trees and shrubs became more and more a part of the garden, being planted around the sides. This can still be seen in the oldest Botanical Garden now in existence, the one in Padua, begun in 1515. This marks the beginning of the Arboretum.
- 4) More and more, exchange of plants between botanical gardens in different countries occurred. Travelers were urged to bring plants and seeds from far countries. In this way for instance Clusius, who founded the Botanical Garden at the University of Leiden in 1594, gathered there a very complete collection of bulbous plants, which led to the Dutch bulb industry. He was in regular correspondence with 300 collectors all over the world, who sent him new plants.
- 5) In northern climates in connection with the importation of plants from lands with different weather, it became necessary to build structures to protect subtropical plants from frost. Thus the orangery or conservatory developed, in which oranges, olives, myrths and other mediterranean plants could be kept alive over winter. Then, when sea captains started to bring tropical plants with amazing flowers, such as orchids, or sensitive plants, to their kings or patrons, greenhouses became necessary, and were developed in the 17th and 18th centuries.

While in the 16th century a Botanical Garden still could contain most of the plants known to botanists of those days, the rapid development of botanical knowledge of plants from other parts of the world, made it impossible to have an inventory of all plants in one living garden. It is interesting to see how, for example, the collection of plants in the Leiden Botanical Garden increased from 1000 in 1600 to 4000 at the end of the century. In the 18th Century however its collections began to lag more and more. This was accelerated especially after 1735 when Linnaeus started to describe more and still more tropical plants. The impossibility of a Botanical Garden containing a complete collection of all known plants led to a shift in emphasis from living specimens to dried herbarium sheets. The herbarium, which could hold a complete plant inventory, now became the principal tool of the taxonomic botanist. At the same time a shift in botanical interests occurred.

Towards the end of the 17th Century Plant Anatomy, and in the 18th Century, Plant Physiology, became branches of Botany, and thus the importance of the Taxonomic Garden as the main tool in the teaching of Botany also waned. In the beginning of the 18th Century, Boerhaave still gave in his text book the following definition of Botany: "It is that branch of science, through whose happy pursuit one learns with the least difficulty the largest number of plants". Starting with the 17th Century there were usually already two professors of medicine, one for clinical medicine, the other for pharmacology, who taught also Botany and Chemistry. The latter would teach Botany during the summer semester. He would take his class in the garden, often starting at 5 a.m., and, walking from plant to plant, named all the names he knew of each plant, with its medicinal uses. This was all done in Latin, and thus students, like Linnaeus, could travel from country to country whether he knew the local language or not and attend the classes in Botany.

Instead of growing with the development of Botany, most European University Botanical Gardens remained static, and lagged further and further behind. Out of sheer inertia, they hung on as less and less important adjuncts to the Botany department, but students were seldom seen in the gardens any more. In old University towns without parks, they gradually degenerated into public parks, and nurses with perambulators replaced the students.

This development explains why in the new world usually no Botanical Garden was created when a Botany department was begun in contrast with old world Botany departments. Today many examples can be given of European Universities, where more than half of the Botany Department funds go to the ineffective garden, with a small and poor Botanical Laboratory maintained with the remainder of the budget.

The developments in the Leiden Botanical Gardens illustrate the changes in botanical gardens which occurred with changes in methods of teaching botany. As mentioned earlier, in the beginning there was only one professor of medicine, but by 1681 a resolution was passed by the trustees of Leiden University that "there shall be four medical professors, which have to give instruction in Professio Anatomica, in Praxim Medicam, in Artem Chemicam and in Artem Botanicam." The botanical teaching was further specified: in summer the Institutio Botanica

is given, while in winter the students receive instruction in what we would now call pharmacognosy and pharmacology. Hence even at that time there already was a full professor of botany. (Veendorp and Baas Becking: Hortus Lugduno-Batavorum).

While originally the botanical garden was all the professor needed for his teaching, botany developed rapidly to such an extent that it would have been exceedingly expensive to have kept pace with the botanical garden. About that time the garden started a growth by itself, centered around the supervisor or "Hortulanus". It became more of a show-place, or a collector's place. One botanic garden for instance became famous for its Bromeliads, another for its Cacti and so on. The botanic garden became the public showplace of the university and as such the Hortulanus became so important and powerful that the professor of botany was the Director in name, but was only allowed a small voice in what was to be grown.

The twilight of the University Botanical Garden did not mean that the Botanical Garden no longer had any legitimate functions in the 19th and 20th Century society. Its functions, however, were taken over by new institutions: the Experiment Station field plots, special plant introduction gardens, experimental greenhouses, private gardens, and a new type of super-garden, of which Kew, Buitenzorg, New York, Brooklyn and St. Louis Botanical Gardens are the prototypes. They developed without connection with a University, but were usually government supported. They are not narrowly limited to taxonomic gardens, but serve the public, Botany, and Horticulture equally. They combine: information to the government and public; education and training of gardeners and the public; demonstration of desirable plant materials; introduction, testing and distribution of new plants; development of new horticultural materials; they provide a center for horticultural interests, supply facilities for testing of plants and they perform research on plants in general. In addition to all these functions these gardens are beautifully landscaped, and are an important link in the park system of the city in which they are located.

These new Botanical Gardens I would like to call functional Botanical Gardens. They perform a really important function in present-day society, as their growth and support by the public testifies. There are a number of smaller or fractional Botanical Gardens, which perform only some of the functions mentioned above. But all the successful ones grow and evolve together with the growth and development of Botany and of Society.

A very instructive case history can be given for the Buitenzorg (now Bogor) Botanical Garden in Java, Indonesia. This garden was founded in 1817. For the next 30 years it was important in connection with the development of knowledge of the flora of the Indo-Malaya region. It became more and more the center for introduction of plants from other parts of the tropics: Cinchona, Hevea and many other plants were first brought into the Archipelago through the efforts of The Gardens. With the appointment of M. Treub as director in 1880 the development of the Buitenzorg Botanical Gardens became almost explosive.

It became the scientific center of the Dutch East Indies and the Mecca for botanists all over the world because Treub organized the publication of flora's of the areas of Buitenzorg. These included not only the higher plants, but also mosses, ferns, myxomycetes, algae and other plant groups. The Gardens organized phytopathological and other research on cultivated plants. When a Department of Agriculture was created in the Dutch East Indies in 1905, the organization of the Buitenzorg Botanical Garden was taken over lock, stock and barrel. With Treub's retirement as Director of Agriculture in 1909 the purely botanical and strictly scientific work of the Department was detached and the garden was reconstituted exclusively as a Botanical Garden. Unfortunately, with the removal of all applied work, the Gardens were emasculated, and never again rose to the important stature they had when they were complete and functional under Treub. In 1939 Baas Becking instituted a major reorganization of the Buitenzorg Gardens, but due to the war and the transfer of sovereignty to the Indonesian Government, the hoped-for rejuvenation has not materialized.

We have seen that in the narrowest sense a botanical garden or arboretum is a living collection of plants. However, as such it is hardly necessary any longer from a purely botanical point of view. Only for the study of palms, gingers, cacti, and certain other plants which cannot be properly studied in the form of herbarium material are such collections important, and thus the cactus collection of the Huntington Botanical Gardens in California, or the palm collections at the botanical gardens in Java are very significant.

The current expansion and growth of horticulture, floriculture, and botany should be considered and should be reflected in the arboretum or botanical garden. Although it may not be necessary to have all aspects of this growth represented, because other institutions may have taken over certain of these functions, yet the following points seem to be entirely essential in an effective arboretum.

In our Southern California area especially, plant introduction is of major importance. Until now, no systematic introduction of plant materials from regions with comparable climates has been carried out here, in contrast with the introduction of plants from all over the world in the eastern United States and in the northern European countries with their very different climate. There are still many, many spectacular plants which should be introduced here and can be expected to become excellent materials for gardens or street plantings.

In connection with introductions, acclimatization has to be considered. We know remarkably little about what acclimatization of plants actually means, but it remains a fact that plant materials, as introduced, very often do poorly until they have been grown for one or several generations in the new climate. This may be partly a question of selection of the best types from a population of plants which is introduced as seed material. In this connection it should be mentioned that selection and hybridization of the most desirable plants are important functions of a modern arboretum.

By having complete records of the behavior of the plants from the

seed stage, and by testing the material under different conditions, an effective study of the best cultural conditions is possible and will lead to a better appreciation of where and how to grow these plants. In this connection the plantings themselves will be demonstrations of the possibilities of the new introductions under the new conditions.

The educational function of a modern arboretum is of prime importance. This includes education of the gardening public. For instance this is carried out very effectively at the Brooklyn Botanical Garden. Education of maintenance gardeners, which particularly in southern California have no place to get much information and training, is another important and essential function. These functions are different from those of regular schools and colleges and are related more to education in a trade school.

With the remarkable growth in recent years of horticultural and plant culture societies, an arboretum can also be a center of activity and coordination of horticultural societies. Therefore at the Los Angeles State and County Arboretum the different groups, such as the herb society, the rose society, Begonia society, and others who are interested in some of the plantings at the arboretum are welcomed. It is hoped office space for administrative functions of these societies can be offered.

Probably the most important function of a modern arboretum is research, without which no future developments are possible. Without research an arboretum or botanical garden is a static body but through research it is possible to contribute to the further developments of horticulture and other branches of botanical science. It is hoped that not only much research will be carried out by the staff of the Los Angeles State and County Arboretum, but also that it will be possible to accommodate research workers from neighboring, or foreign institutions whenever the facilities here will make them useful for their research.

Here the research on fire resistant plants, on turf grasses, and other subjects are good examples of valuable research conducted by an arboretum.

In conclusion it is seen how the Los Angeles State and County Arboretum has already gone a long ways in the direction of a really modern and functional arboretum and it is hoped that it will be able to keep pace or actually lead in future developments in the fields of botany and horticulture and also that it will be able to keep pace with the rapid development of southern California. The nursery industry has boomed like never before, and gardening magazines have larger circulations than ever, tell us that the aesthetic beauty of plants is very important. New homes are being beautifully planted and old homes are being improved through improved landscaping. Garden clubs are growing in size and number, plant societies likewise, and even the men's garden clubs have reached powerful status in this country.

All of these facts have taken ornamental plants out of the realm of unessential and into the broad picture of our local and national



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