

A EUROPEAN COMMUNITY ARBORETUM IN MADEIRA ?

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With 1 figure

ABSTRACT. In arboreta throughout northern Europe low temperatures limit the number of species that can be successfully grown without protection, whereas the islands of the Macaronesian Archipelago have higher temperatures and a choice of elevations, which sustains a remarkable range of temperate and subtropical species.

Of all the islands within the Macaronesian Archipelago Madeira is perhaps the best endowed in terms of rainfall, temperature and existing infrastructure with regard to establishing an arboretum. There already is in Madeira areas which could, at little cost, be developed into a series of small arboreta, which would effectively exploit specific climatological niches. Such development would not only be of interest to foresters, horticulturists and botanists but also provide facilities for research and teaching.

This paper identifies some areas which could be developed as arboreta, outlines the procedure/alternatives to be followed during their establishment and addresses financial and sustainability issues.

Key words: Macaronesia, Madeira, arboretum, woody plants.

INTRODUCTION

Madeira has got a long tradition for introduction and cultivation of exotic plants, and a wide range of species from all continents are now being grown (VIEIRA 1974 and FRANQUINHO & DA COSTA 1990) or are more or less naturalized in the island (HANSEN & SUNDING 1985). As a matter of fact, the exotics have been so successful in Madeira that some are becoming a threat to the island's native flora, e.g. species of *Acacia* and *Eucalyptus*.

This abundance of species is possible because of Madeira's mild climate and the great variation in topography and rainfall (from 500 mm/year in the Ponta de São Lourenço area, 600 mm/year in the lowlands on the south side of Madeira to 2300 mm on the northern side and up to 2700 mm/year in the high mountains (MACHADO 1984).

Relatively little of the islands original vegetation is still intact. However, an effort is being made to protect what is left i.a. by the creation of the "Parque Natural da Madeira" in

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1982 (COSTA NEVES & VALENTE 1992). Certain areas are delimited in which the native vegetation, mainly the Laurisilva, has been protected and it is planned to re-establish the native forests over quite extensive areas in the northern half of the island. About one third of Madeira will be included in this zone, when the project eventually is realized.

The remaining parts of the island are either cultivated land or have been so strongly influenced by other kinds of human activity, that they are kept completely out of the park, or planned as buffer zones for this.

What is an arboretum?

The word arboretum is used to designate an outdoor collection of trees and shrubs, which are cultivated for scientific research, for education and extension and for ornamental purposes. An arboretum normally attempts to obtain a more or less complete and worldwide representation of woody species, which can be grown under the local climatic-and edafic conditions.

Why make an arboretum in Madeira?

There is an ever growing interest in the cultivation of trees and shrubs both in Europe and world-wide. In the author's opinion there is also an obvious need to develop close cooperation between institutions and people working with woody plants in Europe. For instance the conservation of threatened woody species is one of the urgent tasks that could be entrusted to a Madeiran Arboretum. Finally and not least, Madeiran forestry and arboriculture could be greatly enriched by the outputs from a well functioning arboretum.

Madeira has got important plant collections both private and public, and many of these collections contain a considerable number of woody species, e.g. the Funchal Botanical Garden, the Quinta do Palheiro Gardens, the recently restored Monte Palace Garden and many of the parks and private gardens in Funchal and other parts of Madeira. However, only a fraction of the potential number of species is available to the general public and for general and scientific studies.

The most favourable conditions for plant growth within the European Community (with regard to diversity) are found in Macaronesia, and the variation in natural conditions in the Madeiran Archipelago makes this a particularly good choice for an extensive collection of woody plants. Similar opinions were expressed in connexion with the establishment of the Funchal Botanical Garden, e.g. by PIERRE DANSEREAU in 1966: "A Madeira é uma região ideal para a obtenção de vários tipos de experiências botânicas" (PEREIRA 1989).

Where in Madeira could the Arboretum be located?

An arboretum can be composed of several units. In the case of Madeira it would be obvious to develop a multi-site arboretum. A main collection should be established in the proximity of Funchal, where most of the island's arboricultural expertise is found and where

population density is highest and tourism concentrated.

No particular area has been identified, but it would be desirable to connect the arboretum network to the Funchal Botanical Garden, i. a. for the establishment of a main propagation centre (elevation 150 m, yearly rainfall about 700 mm and yearly mean temperature about 18 C°).

As a representative for semi-arid conditions Porto Santo would be an obvious choice. A forest diversification project has been run on Porto Santo since 1990. Three trial plots, varying in size from 0,5 to 1,2 ha and located from 100 to 350 m. a.s.l., have been planted with a number of exotic woody species. It should be easy to develop these plantings into small arboreta with a good representation of subtropical and tropical dry zone species (average yearly precipitation 380 mm).

Santo da Serra (about 650 m elevation) could be a good location for a third satellite. There are many fine trees in the city park and the forest nursery at Casa Velha holds a small but interesting collection of trees and shrubs (i.a. species of *Camellia*, *Cyathea* and *Rhododendron*). The yearly rainfall is about three times that of Funchal (1700 mm), while mean temperatures are about 4 degrees below those of Funchal and Porto Santo; a mild temperate type of climate, in which a wide range of species can be grown.

A fourth satellite could be located at the Paul da Serra plateau in connection with the Estanquinhos afforestation (about 1600 m elevation). The annual rainfall is 1700 mm and yearly mean temperature about 9 C° (comparable to adjacent Bica da Cana). Boreal species, such as *Picea abies*, *Abies alba* and *Pseudotsuga menziesii* are cultivated in this area.

The Quemadas recreation area at 850 m elevation has a superb collection of trees and shrubs (i.a. *Cedrus*, *Pseudotsuga* and *Rhododendron*), which could serve as nucleus in a fifth arboretum satellite. Average yearly precipitation is 2.270 mm and yearly mean temperature 12,4 C°.

If compatible with the natural park's concept a sixth satellite could be established at the highest elevations (about 1800 m) in the Pico do Arieiro region, where yearly precipitations exceed 2700 mm and yearly mean temperature is 9,5 C°.

Other areas might of course be considered. The above suggestions are based on the author's knowledge of Madeira.

Aims of the Arboretum

The aims of the arboretum can be summarized in the following five points:

1. To further the cultivation of trees and shrubs in Madeira and in Europe (indigenous as well as exotic species).
2. To enrich the assortment of trees and shrubs in Madeira and to become a substantial addition to the scientific plant-collections in Madeira and in Europe.

3. To function as a laboratory for dendrologists and arboricultural tourists, both from Madeira and abroad.

4. To assist in the world-wide ex-situ conservation of threatened woody species.

5. To add - through its presentation - to the attractions of the Madeiran Archipelago, and to contribute to public education and recreation.

Composition of the collections

Different principles can be applied in the lay out of an arboretum. Ecology must always be taken into consideration, and particularly for plants which require specific growing conditions.

Collections arranged according to taxonomical principles can be very practical for the study of families and genera. A geographical arrangement, where plants from the same region are grouped together, can also have advantages from a pedagogical point of view. Sometimes a geographical arrangement gives better stimulus to the imagination, than taxonomically arranged collections.

A combination of the three mentioned principles have been applied with success in many collections, and could also be recommended in the present case.

A geographical split-up could be applied between the different satellites. The Santo da Serra station could for instance be reserved for a south hemisphere collection with emphasis on southern South America and the Pacific side of the Andes, and with substantial contributions from New Zealand and Southeast Australia.

A taxonomically arranged collection might be the best solution for families or genera with many species, e.g. *Eucalyptus* and *Acacia*. This is also the case for *Rhododendron*, which is a most interesting genera for high rainfall areas in Madeira.

Well documented material

One of the most important principles in the establishment of modern plant collections is to use material with a well documented origin, and preferably collected in the wild. This should also be a guiding principle in the establishment of a Madeiran Arboretum.

Risks for introducing invasive species via an arboretum

It has been argued that potential dangerous plants, i.e. invasive species, might be introduced via an arboretum. On the contrary, an arboretum can contribute to a better control in connexion with plant-introduction. And it must of course be one of the most important tasks for an arboretum to test and monitor new introductions, and to avoid that potential weedy - species go out in general cultivation.

Attempt to re-establish a dry zone Macaronesian forest

As part of the arboretum project it would be both interesting and relevant to establish

a dry zone Macaronesian forest type corresponding to the OLEO-RHAMNETEA CRENULATAE community (SANTOS 1983). In Madeira (and Porto Santo) this forest is characterized by: *Olea europaea* ssp. *maderensis*, *Juniperus phoenicea*, *Dracaena draco*, *Sideroxylon marmulano*, *Apollonias barbujana*, *Visnea mocanera* and *Maytenus dryandri*. Only insignificant remnants are left in Macaronesia of this lowland forest type.

Ilheu de Cima to the North East of Porto Santo, was called Ilheu dos Dragoeiros, when the dragon trees were still part of the natural flora of Porto Santo. Why not try to re-establish a Macaronesian dry forest on this islet, which is only 30 ha? It is full of rabbits, but no trees and hardly any shrubs. If only the rabbits could be eliminated, then it should be both possible, and feasible to bring the island back to merit its former name.

CONCLUSIONS

The natural conditions of the Madeiran Archipelago are very favourable for the establishment of a collection of trees and shrubs with an exceptional range of species.

A Madeiran arboretum could become a focal point for dendrology and arboriculture in Europe and Macaronesia and could give substantial contributions to international research in these fields.

The development of an arboretum is a long-term project and needs long-term and sustained financing. A good way of obtaining this is normally by a governmental or intergovernmental affiliation. Financial support from the European Community might be a way to secure the development and future life of a Madeiran arboretum. However, the initiative must be taken in Madeira.

Consequently, the most important prerequisite is genuine and sustained commitment by individuals and institutions in Madeira, who feel convinced that Madeira is the obvious place for an outstanding collection of trees and shrubs from all over the world.

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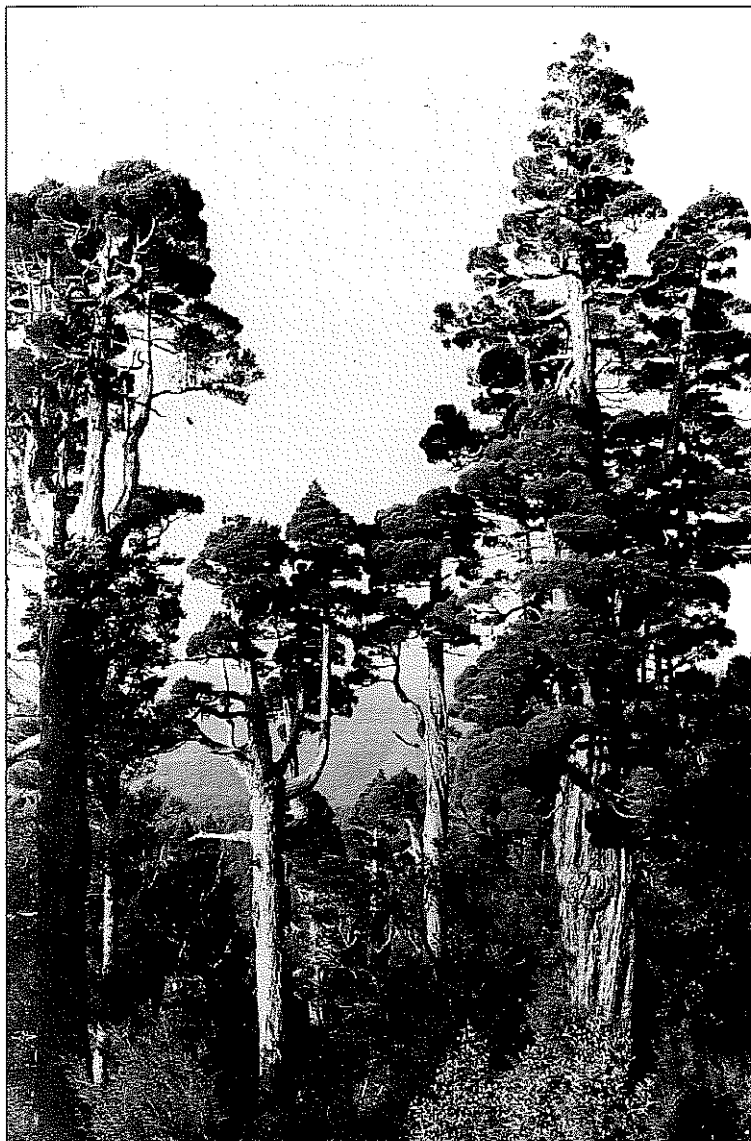


Figure 1 - The southern hemisphere could provide an abundance of species to an arboretum in Madeira, such as *Libocedrus bidwillii*, HOOK f.. Here at 1200 m elevation in the Ruahine Range, North Island, New Zealand. (Photo POUL SØNDERGAARD 1975).