

CONSERVATION OF NATURAL VEGETATION IN AZORES ISLANDS

By PEREIRA, M^a.J. *, MOURA M. *, MACIEL G.B. *, OLIVEIRA J.B. *

ABSTRACT. Since the arrival of the first settlers to the Azores, the island's flora has suffered deep and irreversible modifications. So far, Faial Island Botanical Garden, is the best achievement in the field of conservation intervention strategies. This well-developed garden, possesses almost all the endemic *taxa*, collected from several islands.

The Biology Department at the University of Azores is now, studying the *status* and phenology; ecophysiology of seed germination; seed dormancy breakdown and *in vitro* culture techniques of these endemic *taxa*.

Some of the produced plants will become part of a LIFE financed project and placed in sites of no economic value, where traces of the heavily depleted natural community can still be found. These sites are at the same time feeding areas for the Azorean bullfinch (*Pyrrhula murina*), a bird confined to the native cloud forest zone in eastern S. Miguel.

INTRODUCTION

Man's occupation and intervention in the habitat, together with the introduction of exotic plants and animal species, resulted in reduction, fragmentation and modification of areas occupied by the Azorean natural plant communities (HAGGAR, 1988; SJÖGREN, 1973). The efforts of in the last decades for the conservation of these communities have resulted in the creation of Faial Botanical Garden (GOMES, 1994), and several protected areas.

However the creation of protected areas does not represent a guarantee of conservation of these communities. First, due to lack of understanding about the minimal area required to maintain the biodiversity and dynamic of these communities (BRAMWELL, 1991) and second, due to lack of personal, material conditions and knowledge to manage those protected areas. The absence of management in the protected areas, allows several inappropriate human activities (FERNANDES, 1991; RAPOSO, 1991), the invasion by exotic plant species and the

* Departamento de Biologia. Universidade dos Açores. R. da Mãe de Deus 58. Apartado 1422. P-9502 Ponta Delgada Codex.

soil erosion resulting in a continuous impoverishment of the vegetal cover (FERNANDES, 1991).

On S. Miguel island, the reduction and degradation of the high altitude forest threaten the bullfinch (*Pyrrhula murina*) with extinction, since this bird, also endemic of the Azorean islands, feeds on several endangered endemic vascular *taxa* (e.g., *Prunus lusitanica* ssp. *azorica* (Mouillef) Franco, *Rubus hochstetterorum* Seub., *Vaccinium cylindraceum* Sm., *Ilex perado* ssp. *azorica* Tutin) (RAMOS, 1995). Some of the introduced species can, however, supply alternative food for the bullfinch. But this, doesn't represent a solution, because throughout the year these birds are unable to find any food in large areas of the landscape, mainly pastures and *Cryptomeria japonica* (L. fil.) D. Don plantations. For these reasons this rare bird is confined to a few areas of the native cloud forest, already relatively altered, in eastern S. Miguel (RAMOS, 1995).

With the aim of preserving both the bullfinch and its natural habitat, the Regional Office for Forestry Resources and the University of Azores have started a project co-financed by the LIFE program. This project intend to control exotic plants, reintroduce the *taxa* that are used by this bird as a food resource, and the location of temporary artificial feeding stations, in the bullfinch feeding areas (RAMOS, *in press*).

Conservation strategy for the natural forest

The high altitude forests are one of the threatened Azorean natural ecosystem types.

An active recuperation of these forests requires: the study of natural reproduction in the community *taxa*; the development of propagation techniques, primarily aimed at the endangered endemic *taxa*; the identification of the several successional and climax communities that appear in a certain area and the development of techniques to control the invasive exotic flora.

Knowledge of natural propagation

Study of the natural propagation started with the populations study *in situ*, in several expeditions performed in different islands (PEREIRA, 1991; OLIVEIRA *et al.*, 1993). The aim of these expeditions was the study of *taxa* biology and ecology, and the determination of the real population *status* and size, their number and distribution.

Seed germination and ecophysiology experiments were undertaken on 21 Azores endemic *taxa* and on two *taxa* endemic to Azores, Madeira and Canary islands (MACIEL, 1994).

These studies, showed: differences in the germination capacity according to geographic origin (MACIEL, 1994); absence or presence of dormancy (MACIEL, 1994) and seedling viability.

Techniques for plant production

The techniques used for plant production comprised: seed germination; micropropagation and classic vegetative propagation.

The *taxa* seeds that do not present dormancy, for example *Ammi huntii* WATSON, *Bellis azorica* HOCHST., *Chaerophyllum azoricum* Trelease, *Hypericum foliosum* Aiton, *Leontodon filii* (HOCHST.) Paiva & Ormonde, *Rumex azoricus* Rech.fil., *Senecio malvifolius* (L'Hér.) DC., *Tolpis azorica* (NUTT.) Silva and *Vaccinium cylindraceum* Sm. can be propagated by seed germination (MACIEL, 1994).

For the following species: *Daboecia azorica* Tutin & Warburg, *Euphorbia stygiana* Watson, *Juniperus brevifolia* (Seub.) ANTOINE, *Lactuca watsoniana* Trelease, *Picconia azorica* (Tutin) KNOBL., *Prunus lusitanica* ssp. *azorica* (Mouillef) Franco, *Viburnum tinus* ssp. *subcordatum* (Trelease) Silva, *Ilex perado* ssp. *azorica* Tutin and *Laurus azorica*. (Seub.) Franco, we are testing several techniques recommended by the 'International Seed Testing Association' in order to breakdown the dormancy of their seeds .

At present, research on micropropagation techniques, are being carried out on 14 endemic vascular *taxa*: *Daboecia azorica* Tutin & Warburg (MOURA, 1996), *Euphorbia azorica* Seubert (MOURA, 1996), *Lactuca watsoniana*, *Lotus azoricus* Ball (MOURA, 1996), *Picconia azorica*, *Prunus lusitanica* ssp. *azorica* (Mouillef) Franco, *Vaccinium cylindraceum* Sm., *Viburnum tinus* ssp. *subcordatum* (Trelease) Silva, *Ilex perado* ssp. *azorica* Tutin, *Laurus azorica* (Seub.) Franco, *Hypericum foliosum* Aiton (MOURA, 1996), *Leontodon filii* (Hochst.) Paiva & Ormonde (MOURA, 1996), *Rumex azoricus* Rech.fil. (TOSTE, 1995), *Tolpis azorica* (Nutt.) Silva (MOURA, 1996). Production protocols have already been accomplished for the ultimate 4 species.

For *Juniperus brevifolia* (Seub.) Antoine, *Ilex perado* ssp. *azorica* Tutin, *Prunus lusitanica* ssp. *azorica* (Mouillef) Franco, *Vaccinium cylindraceum* Sm., *Viburnum tinus* ssp. *subcordatum* (Trelease) Silva, and *Laurus azorica* (Seub.) Franco, trials of vegetative propagation by stem cuttings have begun.

Characterization of the recuperation areas

The selected working areas are located between 500m and 800m of altitude, in the "Pico da Vara" natural reserve.

Each area presents different characteristics of wind exposure, humidity, slope, cover and strata composition; nevertheless we can distinguish three quite different zones:

A - sheltered areas, located in the slopes of "Ribeira do Guilherme", at nearly 500 m of altitude. These areas have altered natural communities, but are still similar to the

descriptions of laurifolia forests (DIAS, 1991). The principal exotic plants present are: *Clethra arborea* Aiton, *Hedychium gardneranum* Roscoe and *Pittosporum undulatum* Vent.

B - plantation areas of *Cryptomeria japonica* (L. fil.) D. Don, located in exposed zones, steep slopes at approximately 600m of altitude; in these areas the dominant *strata*, in spite of the presence of some ferns, are almost exclusively formed by *Hedychium gardneranum* Roscoe.

C - exposed areas, less steep, of seminatural pastures, located at nearly 700 m of altitude, with soils subjected to flooding. On the margins of these pastures we can find remains of the native community, including some individuals of *Juniperus brevifolia* (Seub.) Antoine.

Control of the exotic flora in the recuperation areas

The control of exotic flora poses different problems to solve:

- the elimination of exotic plants in large areas without reposition of the endemic *taxa*, subjects the soil to the torrential erosion phenomenon and does not stop it's rapid reoccupation by the invasive plants;

- the control of *Clethra arborea* Aiton is controversial since this is the best food option available to the bullfinches between December and March (RAMOS, 1995); however, it is outcompeting native species, and many areas may turn into monospecific stands (RAMOS, *in press*);

- elimination of invasive exotic plants's does not depend only on human control actions, but also of the competitive success of the endemic *taxa*. Control will therefore be carried out progressively as areas of native vegetation are restored and expanded.

The selected areas present long term recuperation potentialities into two types of climax communities: the laurifolia forest in the more sheltered lower altitude areas, and the cedar woods in the higher altitude and more exposed areas.

The recolonization with hardwood plant species, characteristic of these climax communities, more demanding and of slow growth, (DIAS, 1991), can not be done on bare soil. It is necessary, in the first place, to regenerate a competitive successional community of several colonizing species that will be able to protect the soil, compete with the invasive plants and provide shelter for the young hardwood plants on whose growth will depend the climax community.

According to the places to recolonize we will make use of the following *taxa* with a pioneer character: *Hypericum foliosum* Aiton, *Leontodon filii* (Hochst.) Paiva & Ormonde, *Tolpis azorica* (Nutt.) Silva, *Holcus rigidus* Hochst. ex Seub., *Festuca jubata* Lowe, *Calluna vulgaris* (L.) Hull and *Erica scoparia* ssp. *azorica*. (Hochst.) Webb. Regarding the hardwoods the following *taxa* will also be planted: *Juniperus brevifolia* (Seub.) Antoine, *Ilex perado* ssp. *azorica* Tutin, *Prunus lusitanica* ssp. *azorica* (Mouillef) Franco *Vaccinium cylindraceum*

Sm., *Viburnum tinus* ssp. *subcordatum* (Trelease) Silva and *Laurus azorica*. (Seub.) Franco.

General conclusions

The knowledge of the endemic vascular *taxa* natural multiplication strategies and the development of multiplication techniques possesses two immediate advantages: the capacity of producing a high number of individuals in a reduced time and the capacity of maintaining viable vegetative or seminal material in seeds or tissues banks.

The production of new plants and their reintroduction in protected areas allows the maintenance and development of natural populations, as well the maintenance of the genetic variability within each *taxon*.

The conservation of natural communities, permits the obtention of quality material in quantity, and consequently, allows their integration in seed and tissue banks, research laboratories and botanical gardens.

The knowledge of multiplication techniques will also allow commercial exploitation of the economically viable *taxa*.

Finally, the maintenance of the vegetation cover in a protected area permits the survival of other related life forms.

ACKNOWLEDGEMENTS

We wish to thank all staff members at Ponta Delgada and Vila do Nordeste Regional Office for Forestry Resources, for the initiative of this project and the invitation made to the University of Azores, which permitted this rich cooperation.

We also wish to thank the opportunity given by the LIFE program (U.E.) União Europeia, who's financing made these studies possible.

REFERENCES

BRAMWELL, D.:

1991. "Plantas y Futuro" An experiment in the conservation of endangered insular, endemic plants. *In*: Dias, E., J. Carretas & P. Cordeiro (Eds.) *Comunicações das 1^{as} Jornadas Atlânticas de Protecção do Meio Ambiente*, pp 212-214. Angra do Heroísmo.

DIAS, E.:

1991. Carta da vegetação da ilha Terceira. *In*: Dias, E., J. Carretas & P. Cordeiro (Eds.) *Comunicações das 1^{as} Jornadas Atlânticas de Protecção do Meio Ambiente*, pp 212-214. Angra do Heroísmo.

FERNANDES, J.:

1991. Génese e evolução de algumas formas de erosão torrencial na ilha de S. Miguel do arquipélago dos Açores. *In*: Dias, E., J. Carretas & P. Cordeiro (Eds.) *Comunicações das 1^{as} Jornadas Atlânticas de Protecção do Meio Ambiente*, pp 432-438. Angra do Heroísmo.

GOMES, M.:

1994. Jardim Botânico do Faial. Resumo da comunicação oral apresentada no "III Simpósio da Associação Ibérico-Macaronésica de Jardins Botânicos". Horta.

HAGGAR, J.:

1988. The structure, composition and status of the cloud forests of Pico island in the Azores. *Biol. Conserv.*, **46**: 7-22.

MACIEL, G.B.:

1994. *Ecofisiologia da Germinação de Sementes de Plantas Vasculares Endémicas dos Açores*. Trabalho de síntese apresentado para prestação de Provas de Aptidão Pedagógica e Capacidade Científica, Departamento de Biologia, Universidade dos Açores, Ponta Delgada.

MOURA, M.:

1996. *Cultura in vitro de seis taxa vasculares endémicas: Hypericum foliosum Aiton, Lotus azoricus P.W.Ball, Euphorbia azorica Seubert, Daboecia azorica Tutin & Warburg, Tolpis azorica (Nutt.) P.Silva e Leontodon filii (Hochst.) Paiva & Ormonde*. Trabalho de síntese apresentado para prestação de Provas de Aptidão Pedagógica e Capacidade Científica, Departamento de Biologia, Universidade dos Açores, Ponta Delgada.

OLIVEIRA, J., PEREIRA, M.J., MACIEL, G.B., RAÚL, B.J., FURTADO, D., & MEDEIROS, M.C.:

1993. Contribuição para o estudo da flora e vegetação da ilha do Pico. *In* Universidade dos

Açores (Eds.) *Expedição Científica Santa Maria e Formigas. Relatórios e Comunicações do Departamento de Biologia.*

PEREIRA, M.J.:

1991. Contribuição para o estudo das plantas vasculares da ilha de Santa Maria Universidade dos Açores in (Eds.) *Expedição Científica Santa Maria e Formigas. Relatórios e Comunicações do Departamento de Biologia.*, **19**: 93-98.

RAMOS, J.:

1995. The diet of the Azores bullfinch and floristic variation within its range. *Biol. Conserv.*, **71**: 237-249.

IN PRESS. Action Plan for the Azores Bullfinch (*Pyrrhula murina*). Comunicação apresentada no 'Seminar for the Presentation of Action Plans for European Globally Threatened Birds. Strasbourg. Council of Europe.

RAPOSO, A.:

1991. As chuvas torrenciais de Setembro a Novembro de 1986 e suas consequências na Povoação e Faial da terra. In: Dias, E., J. Carretas & P. Cordeiro (Eds.) *Comunicações das 1^{as} Jornadas Atlânticas de Protecção do Meio Ambiente*, pp 442-465. Angra do Heroísmo.

SJÖGREN, E.:

1973. Recent changes in the vascular flora of the Azores Islands. *Mem. Soc. Brot.*, **22**: 1-453.

TOSTE, M.:

1995. *Micropropagação de Rumex azoricus Rech. fil.*. Monografia de estágio do curso de Biologia/Geologia da Universidade dos Açores.