DEVELOPING A BASIS FOR MANAGEMENT OF NATURAL POPULATIONS OF *DRIMYS BRASILIENSIS* IN BRAZIL, USED FOR ITS BARK

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Abstract

Atlantic Rain Forest (ARF) is a Brazilian ecosystem with high biodiversity along the coastal region of Brazil. Although it is important as a hotspot of biodiversity, this ecosystem is endangered, containing mainly forest fragments on small farms, together with large remnants in conservation units. The overall aim of the Research Group on Tropical Forests (NPFT) and the Graduate Program in Plant Genetic Resources at the Federal University of de Santa Catarina, southern Brazil, is to reconcile forest conservation with multiple use. In this context studies were developed with various native plant species in ARF since 1980, aimed at advancing knowledge and understanding, and training of human resources, through the development of strategies to integrate multiple use of forest resources and the conservation of Brazilian biodiversity. Research at NPFT aims to develop sustainable management strategies, to generate alternative income source to small farmers, and to aid ARF conservation. The bark of *Drimys brasiliensis* (Winteraceae), locally known as cataia or casca-de-anta, has been used by the rural population for treatment of various diseases, having principally anti-inflammatory properties. NPFT are developing several autecological studies about this species: demographic studies, spatial distribution, reproductive phenology and biology, pollination and seed dispersal, genetic structure and bark harvesting systems. These studies are in progress and the preliminary results show that this species can fit into the practices of a sustainable management system.

1. Introduction

Atlantic Rain Forest (ARF) is a Brazilian biome with high biodiversity along the coastal region of Brazil, with various forest formations, grasslands and other ecosystems (Decreto 750, 1993) (Figure 1). Originally, the ARF covered 1,3 million km^2, but today it is restricted to less than 10% (Fundação SOS Mata Atlântica, 2000). The principal reason for this decline was, and still is, timber and firewood exploitation, agriculture, cattle ranching, construction of cities and clearing for exotic forest plantations (principally pine and eucalyptus). These degradations and the high endemic level of species in ARF resulted in the classification of it as a *hot spot* (Mittermeier *et al*., 1999).

Figure 1. Original cover of the Atlantic Rain Forest in Brazil (Source: Fundação SOS Mata Atlântica).

The remnants of ARF are restricted to a small number of conservation areas. In general they are small forest fragments, mostly fragmented secondary forests localized in small farms. The reality of forest conservation on small farms in Brazil is not so good. The agricultural production is not very good, and clearing the forest fragments is seen as a means to expand cultivation and cattle production. Sustainable strategies for management of natural populations of species, principally non timber forest products like firewood, medicines, ornamental and food plants, represent an important supplementary income for forest owners, particularly small farmers.

In this way, the Research Center in Tropical Forests (Núcleo de Pesquisas em Florestas Tropicais – NPFT) and the Graduate Program in Plant Genetic Resources (PGRGV) at the Federal University of de Santa Catarina (UFSC) are working since 1980 towards the development of several autecological studies of species, as a basis of strategies for sustainable management and conservation of natural populations of plants in ARF. The principal aim of NPFT is the management of non timber forest products, because they believe that maintenance of the remnants of ARF can be solved through the management, sustainable use and conservation of genetic resources. The NPFT is localized in Santa Catarina State, in the south of Brazil.

The majority of studies are done in the Araucaria Forest, an ecosystem in the ARF. Araucaria Forest occurs between 500 and 1 200 m altitude, principally in the south of Brazil (Reitz & Klein, 1966). Like the rest of ARF, the Araucaria Forest represents a high biodiversity. In the past, only timber products were exploited, principally *Araucaria angustifolia* (brazilian pine) and *Ocotea porosa* (imbuia). Today, these species are much endangered and contained in the Red List (IUCN, 2006).

In this way, NPFT is studying *Drimys brasiliensis* Miers. (Winteraceae). It is a tree or treelet locally or popularly known as cataia or casca-de-anta, and has been used by the rural population for treatment of various diseases, having principally anti-inflammatory properties for men and animals (Simões *et al.*, 1986; Trinta & Santos, 1997). There is no sustainable strategy for management of this species in place, and overexploitation is very common. There are industries interested in *D. brasiliensis*, and good strategies of management are necessary to sustain the ecosystem of which it is part and improve opportunities for financial gain of small farmers.

We are using a sustainable management cycle, based on Reis *et al.* (2000) (Figure 2). The first step is to do an inventory to know how many plants of this species there are in the forest. With this information we can determine the growth potential and dynamics for recovery of products like bark, fruit, seed, leaves and roots. Secondly, it is necessary to know the reproductive biology of the species, including the genetic diversity, floral biology, phenology, pollinators and dispersers. But of real importance is the interaction between these studies and the interaction of analysis, to propose a good strategy of management, without, for example, inbreeding depression, low fruit production and growth of explored plants.

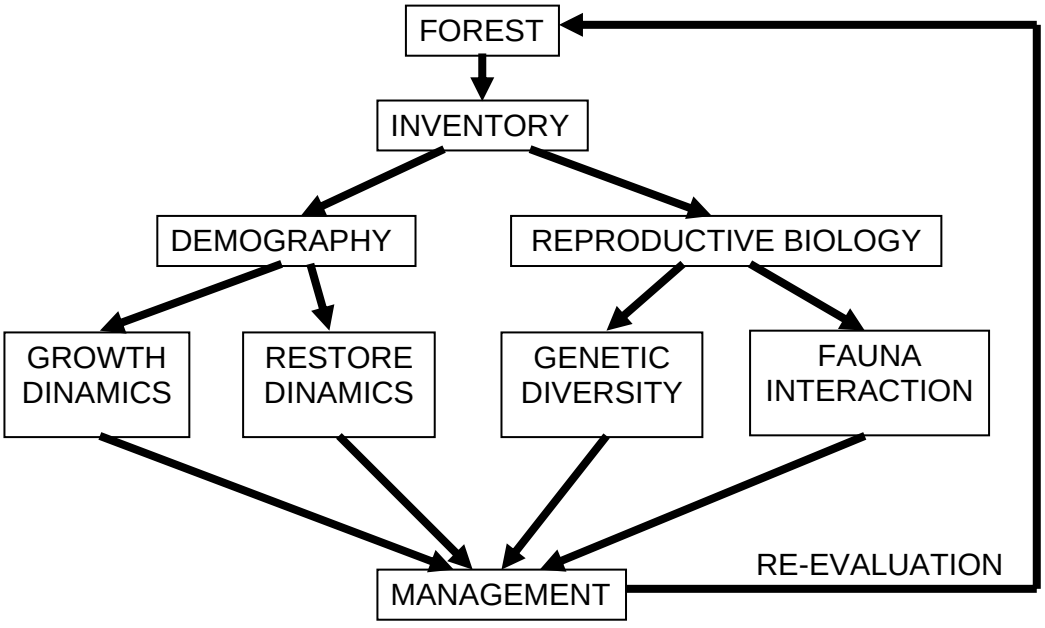

Figure 2. A proposed flowchart for sustainable management of tropical forest species (Adapted from Reis *et al.*, 2000).

The aim of present work is to develop various studies in natural populations of *Drimys brasiliensis* Miers in the Araucaria Forest in Caçador Region, Santa Catarina State, Brazil, to propose a basis for management of its bark, like a non-timber forest product. These studies are done together with small farmers, in a participatory way. We have some experiments on their small farms. We are studying 3 different situations: a primary forest, a secondary forest on small farms and an *Araucaria angustifolia* plantation of 50 years age.

2. Overview of current studies

2.1 Demography studies

The demography studies were done in the primary forest and araucaria plantation. One permanent plot in the araucaria plantation and two permanent plots in primary forest (1 ha plot size each), were evaluated between March 2004 and March 2006. The parameters evaluated in all plants are diameter at breast height for plants with height higher than 1.3 meters, height for all plants, and all plants are labeled and mapped.
The primary forest presents fewer plants than the araucaria plantation. The principal factor is the preference for sunlight, which is higher in the araucaria plantation than the primary forest. This preference can be seen in Table 1. The araucaria plantation has more than double the number of plants than the primary forest. In the araucaria plantation the plants have a lower height and diameter, but a many more branches because they do not have to grow to the light like in the primary forest. In primary forest the maximum number of branches is 3, and in the Araucaria plantation it is 9.

Table 1. Results of demographic studies in Primary Forest and Araucaria Plantation for *Drimys brasiliensis* in Caçador Region, Brazil

	Total	>1,3M height	Reproductive	<1,3m height	Circumference at breast height (cm)	Height (m)	Numbers of Branches
Primary forest	203	91	35	112	5,0	4,61	1,05
Araucaria plantation	470	374	226	96	4,4	4,11	1,60

2.2 Reproductive phenology

We are evaluating the reproductive phenology in Primary Forest and Araucaria plantation. The phenophases evaluated are flower buds, flower anthesis (opening), unripe and ripe fruit. In the araucaria cultivation 226 trees and in the primary forest 70 trees are studied monthly over 24 months (March 2004 – February 2006). The pattern is the same in the two areas, without big differences (Figure 3). *D. brasiliensis* has a continuous production of fruit, which peaks in January and February, supplying fruit throughout the year. These studies are in progress and the results are partial.

2.3 Floral resources and visitors

D. brasiliensis does not make nectar, but produces stigmatic exudates, pollen and odour, and has low attractiveness for floral visitors. We watched the flower visitors during 100 hours during the flowering periods in 2005 and 2006. The floral visitation is low compared with the high number of flowers produced. The regular visitors are Coleoptera, Diptera and Thysanoptera, and occasionally Hymenoptera, Hemiptera and Lepidoptera. The next step is the identification of the insects to species level.

2.4 Seed dispersers

We watched the fruit dispersers during 100 hours during the fructification periods in 2005 and 2006. As with the floral visitation, fruits attract a low visitation. We watched 3 species of birds like primary seed dispersers: *Elaenia mesoleuca* (olivaceous elaenia), and 2 others species not identified yet. We watched the occurrence of secondary dispersal, and believe that is done by small rodents, but have not yet captured any animals. These studies are in progress.

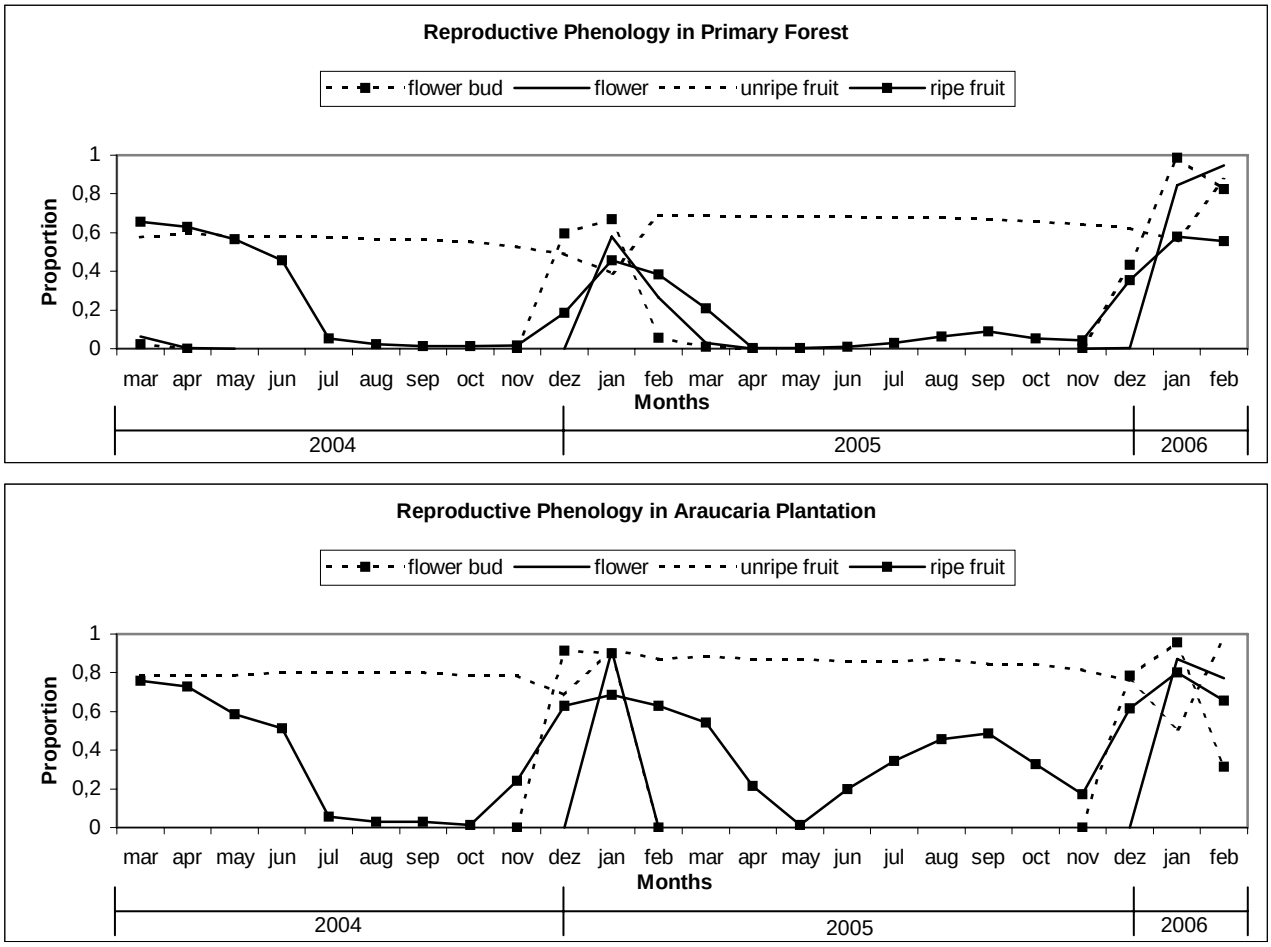

Figure 3. Patterns of reproductive phenology of *Drimys brasiliensis* in primary forest and Araucaria plantation in Brazil.

2.5 Bark Harvest

2.5.1 First Experiment

Our first bark experiment was the testing of different ways to obtain bark from *Drimys brasiliensis*. We studied three sources of variation: season (Autumn and Spring), percent of CBH (circumference at breast height) (20%, 30% and 40%), and number of strips (1, 2 and 3). The strip width varied with stem circumference. The length of the strip was 1 meter.

After 1.5 years there are no significant differences between treatments in terms of increase in CBH and height, in phenological pattern and in fruit set and seeds per fruit. There were some differences in bark regeneration between treatments. There were no differences between seasons, but there are differences between percent of harvesting (% of circumference?) and number of strips (Table 2).

Bark regeneration is more efficient in low percentage of CBH harvested and in more strips. In the same percentage of CBH harvested, more strips are better than only one. The most important factor is the width of the strip, as shown in Figure 4: narrow strips regenerate better than wider strips. This was an important result for the next experiment. It is also important that more exposure means more fungal attack. There was no fungal attack in plants with 20% of CBH harvested, but the fungal attack was 16% in plants with 30% harvested and 33% in plants with 40% harvested.

Table 2. Newman-Keuls multiple range test for bark regeneration in *Drimys brasiliensis* under different percentages of the circumference at breast height (CBH) and number of strips, in Brazil (numbers with same letter are not significantly different)

% of CBH	Number of Strips		
	1	2	3
20	0.305 C	0.698 AB	0.790 A
30	0.240 C	0.573 AB	0.755 AB
40	0.232 C	0.323 C	0.538 B

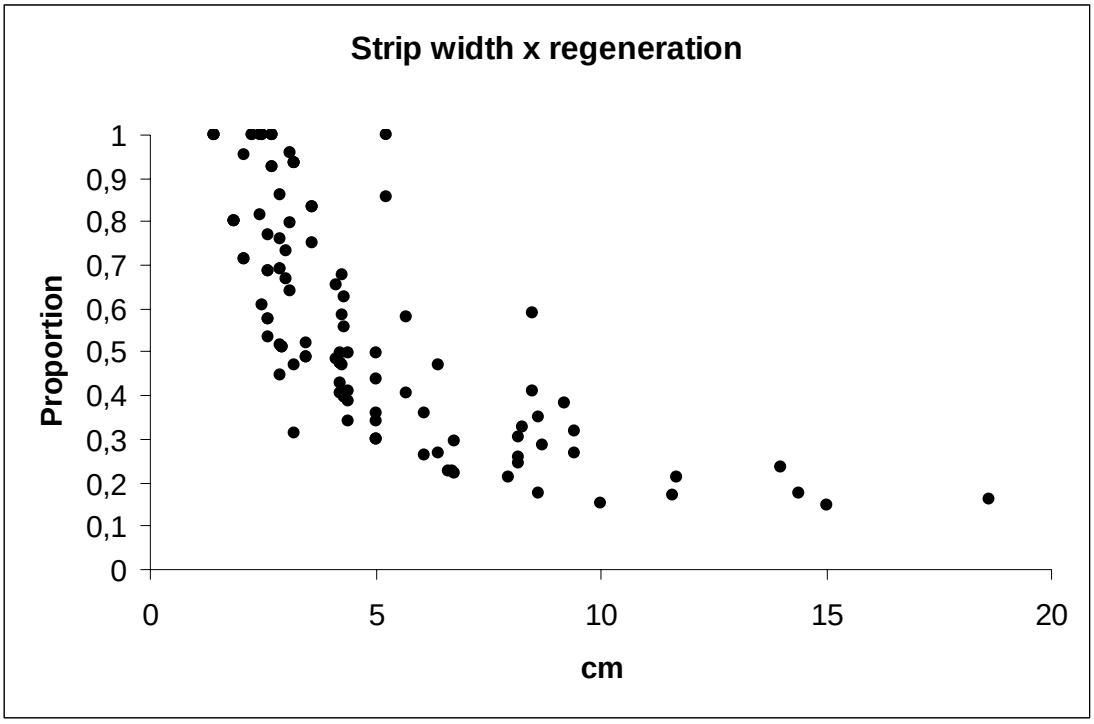

Figure 4. Relationship between strip width and proportion of bark regeneration in *Drimys brasiliensis*, Brazil.

2.5.2 Second Experiment

After obtaining the results from the first experiment, a new experiment was started with a fixed strip width of, 2 cm, and 4 or 8 cm between strips, with strips 1 or 2 m long. After 1 year, there were no differences between treatments. The width between strips and strip length had no influence on bark regeneration, and the mean percentage of bark regeneration after 1 year was 67%.

3. Final Considerations

These results are preliminary, and will continue to be evaluated to develop a sustainable management system for *Drimys brasiliensis*. The next step is to analyze the genetic variation in natural populations, using allozymic markers, to characterize the distribution of the genetic variability in natural populations. *D. brasiliensis* has a high potential for sustainable management of its natural populations and can contribute to maintaining forest remnants. The NPFT believes in sustainable management of non timber forest products as a possibility to preserve the remnants of Atlantic Rain Forest, reconciling use and conservation.

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