

Restoring Brazil's Atlantic Rainforest: Reversing a Saga of Exploitation and Destruction

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Defined as a dense forest running along the coast from the north east of the country to the state of Rio Grande do Sul, influenced by the climatic conditions peculiar to being near the ocean, the Brazilian Atlantic rainforest was singled out as the most important biodiversity refuge on the entire planet, and nominated as a biosphere reserve and world heritage site by UNESCO in 1992. Consisting of a series of phyto-geographic typologies or units, the Atlantic forest biome constitutes a vegetation mosaic established as a national heritage site in the Brazilian Constitution of 1988. It is estimated that 80% of the Brazilian population depend on the Atlantic forest, one way or another, for their livelihoods including maintenance of soil fertility and water. As much as 70% of Brazil's GDP is estimated to come from the area of influence of the Atlantic forest.

The Atlantic forest biome is associated with coastal ecosystems including swampy inlets, major river estuaries, bays and tidal lagoons, vegetative strips on sandy coastal slopes and plateau pine forests. It originally extended over an area of approximately 1.3 million km², equivalent to nearly 15% of the Brazilian territory, and completely or partially covered 17 Brazilian states. As a result of five centuries of forest clearing for the cultivation of sugarcane, coffee and land for livestock, as well as the felling of hardwood trees to fuel ovens, locomotives, thermo-electric power plants and steel furnaces, the Atlantic forest has been reduced to 7.2 % of its original size, with approximately 94,000 km² remaining.

Unlike the Amazon region, which has very large trees, the Atlantic forest is lower and denser. Its tallest trees reach a height between 25 and 30 m. Calculations suggest that there are 20,000 plant species in the Atlantic forest, containing virtually infinity of different colors, forms and scents. They include innumerable medicinal plants, most of which have not been studied or catalogued, and some even unknown. For every two tree species occurring in the Atlantic forest, one is found only in this region. Among palm trees, bromeliads and other epiphytes, this endemism reaches 70%. Among mammals, butterflies, reptiles, amphibians and native birds, the endemic rate is almost 30%. Whereas all primate species that survive in the

Atlantic forest are endemic. There are 454 tree species per hectare in some regions; approximately 1.6 million animal species, including insects; and 1,364 species of mammal, birds, reptiles and amphibians, of which 567 are endemic. In several regions the Atlantic forest has been reduced to isolated fragments, incapable of sustaining certain species of fauna that need large tracts of land, or even to continue maintaining basic ecological processes. It has been shown that the financial cost of restoration is high and many times more than investment in preventive conservation or natural regeneration.

Restoration techniques with corridors of natural vegetation, as exemplified in the case study and the guide to regional forestry restoration activities proposed for temperate Atlantic forest areas in the south of the country recommend maintaining the small remaining fragments and the secondary forest areas surrounding them. These are necessary and essential for Atlantic forest restoration. The main limitations to the restoration process include the high degree of fragmentation of the Atlantic forest, the high economic cost of forestry activities, the need for long-term actions in restoration projects presented in degraded areas, and, particularly, **political will** to support a wide ranging government program. Other obstacles to restoration include the ineffectiveness of certain projects because of the absence of a **technical-scientific** foundation in their preparation and execution; a lack of maintenance in the post-planting phase; and a failure by government to enforce restoration of degraded and deforested areas.

The techniques being used to date are testing the use of a cocktail (or mix) of species from various succession phases. These are being implemented simultaneously in an attempt to optimize overall effort, time invested and financial resources. The results are encouraging despite issues with species selection. These issues are mainly related to the lack of consistent information on pioneer native species, their growth characteristics and necessary cultural treatments. In lieu of this information, rapid growth exotic species have been used, mainly symbiotic leguminosae species with nitrogen fixing bacteria.

There is an urgent need for regional diagnostic surveys and zoning, to define areas for priority-sequenced implementation of forestry restoration programs. The techniques proposed for restoration of forest cover must take into account the vegetation types occurring in each place, and establish appropriate silviculture systems in each case. In remnant forest areas, selective improvement thinning is recommended. In areas without forest cover, those that are deteriorated, or zones unsuitable for livestock breeding or crop growing, mixed reforestation programs are required. Forest corridors could also be developed to connect existing forest fragments. Programs must also provide for maintenance periods, until the forest structure is guaranteed and self-sustainability is realized.