
Land degradation on forest lands of Brazil

The Atlantic Rainforest of Brazil is an area of exceptional biodiversity, severely threatened, and now reduced to only 7.5% of its original extent. The principal causes of its destruction have been its exploitation for industrial development and agriculture, especially coffee cultivation.

The Iracambi Atlantic Rainforest Research and Conservation Center has been undertaking a series of empirical trials on different technologies to find more sustainable land management methods. A first priority is to understand the causes and effects of land degradation. The Center's work focuses on the development of technology for better land management and the creation of value for biodiversity conservation.

In land management technology, the main focus is on the maintenance of soil fertility and soil and water conservation, the objectives of which are to reduce soil loss water run-off and maintain water resources by improving the recharge aquifers and protecting water courses.

Iracambi has successfully used *Mucuna* and *Canavalia* as a green manure in maize and beans, but they did not do well as a catch crop on residual moisture where the fields are invaded by very aggressive *Brachiaria* grasses. It is a local custom to clean weed coffee, exposing the soil to erosion. Farmers are concerned about nutrient competition from weeds, but resultant nutrient losses are far lower than the less easily perceived losses from erosion. Evidence from elsewhere indicates that these could be as high as 90 tons per ha per annum. Vegetative erosion barriers using Vetiver grass (*Vetiver zizanoides*), have been successfully used in Central America and in the State of Espírito Santo, but the grass has not developed well on Iracambi's very acid soils

Iracambi has also worked on agroforestry. It has experimented with *Piptadenia* spp. in pastures. *Leucaena* grows well in the areas of lower altitude, but its sensitivity to acid soils is well known, and on Iracambi's soils it has not done well: both species are highly susceptible to attack by *Atta* ants. *Erythrina*, some varieties of which grow locally, will be tried further, as the species generally has good nitrogen fixing capacity. An important element of the association of trees and pasture is the potential of the tree as a protein supplement for cattle. More understanding of the potential of non-nodulating leguminous trees for this purpose is important.

There has been little practical experience of minimum tillage and direct seeding in the study area. Iracambi's experiments have been promising on certain types of soil that do not dry out too much during the winter. On newly cleared forest land minimum tillage would be the best method of planting to replace the traditional slash and burn. On lateritic soils, we have found that the ground is too hard to direct seed by hand (the topography does not allow mechanical seeding) and by the time the rains have softened the soil, the weeds have become uncontrollable.

In forest management, we have experimented with reforesting degraded pastures of *Brachiaria* and

molasses grass (*Melinis minutifolia*). This did not prove a successful, low input, method as the depleted soils with very low organic material contents are not a favourable environment for most forest seedlings; the competing grasses either hinder root development (*brachiaria*) or overgrow the seedlings (molasses grass). In both cases the new seedlings are very susceptible to *Atta* ant predation. Trials of pre-establishing shade, using a mixture of guapuruvu (*Schilozobium parahyba*) and guava (*Psidium guajava*), show promise, and jatobá (*Hymanea coubarii*), a climax forest species with a valuable timber and important medicinal uses, has proved resistant to *Atta* attack. Enrichment planting under regenerated forest is more promising: it is less labour demanding, and the survival rates of seedlings is better. Ingra (*Ingra edulis*) is a useful tree for reforesting gallery forest on river banks: it is fast growing and tolerant to water logging, Bamboo has also been successfully used as a fast growing plant to provide shade for other slower growing species.

The other main focus of the Center's work is on developing the awareness of the value of forest biodiversity. Economic losses to Brazil from deforestation have been estimated at US\$500–\$1000 million, but the more immediate concern for local farmers is their own subsistence. Iracambi has therefore focused its attention on the value of forests in the conservation of water resources, and the potential value of biodiversity as a source of income generation for small-scale landowners. The Center's programmes therefore emphasise the role of forests in water conservation and how deforestation damages the water cycle.

As part of its search for alternative sources of income, the Center is studying the use of plants for medicinal purposes. A database has been established of local plants and their traditional uses: the areas of main occurrence of these plants and their associations catalogued. Five species have been identified as having particular potential. The next phase of this work is to test potential products and markets.

The Center also runs an environmental education programme for local school children, giving a basic introduction to the concept of conservation in the context of their daily lives and showing why biodiversity conservation matters.

The reaction of other research institutions has been highly encouraging, strengthening Iracambi's belief that it is on the right track. The positive response of the local community caught Iracambi by surprise and has pressured it into broadening its activities into the education and extension activities much earlier than it had planned. As a consequence, Iracambi plans to expand its capacity to attend to local demand and seek other research partners.

Further Information

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