

# AGROFORESTRY TECHNOLOGY DEVELOPMENT WITH FARMERS IN CENTRAL AMAZONIA: RESEARCH IN PROGRESS

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## SUMMARY

Agroforestry is generally considered an important land use option for Amazonia, but proven technologies for its promotion are almost not available. The research presented here contributes to the filling of this need. Existing agroforestry practices are studied, on-farm pilot agroforestry plots are installed and accompanied, information on the many potential agroforestry species is compiled, and new species are tested.

## IMPORTANCE OF AGROFORESTRY

"Agroforestry is a new word for the old practice of growing woody plants with agricultural crops and/or livestock together on the same land" (Anon., 1982): 'Agroforestry is generally seen as one of the few sustainable land use options for Amazonia, as it can mimic the high biomass, the permanent, dense root web, and the permanent canopy of the forest.

Tree canopies and litter control weed growth and protect the soil against erosion and extreme temperatures. The resulting higher organic matter content of the soil increases water and nutrient storage capacity and phosphorus availability. Expanding and decaying tree roots and increased soil animal activity improve soil structure. High biomass and a permanent, dense root web increase nutrient storage and cycling.

These aspects are very important in Amazonia due to strong insolation, heavy rains, and the fact that the majority of *terra firme* (upland) soils are poor in nutrients and have a low nutrient storage capacity.

*Várzea* (flood plain) soils are richer in nutrients than *terra firme* soils. Trees of species adapted to the *várzea* will survive flooding, once they are well established. This is important as flood levels change from year to year. Tree growing on the *várzea* is therefore less risky than the growing of annual or semi-perennials crops, which often are lost in years with

early or high floods. Tree growing on the *várzea* can also contribute to erosion control.

## LACK OF CONCRETE PROPOSALS

It is widely accepted that promotion of agroforestry in Amazonia is important, but it is generally not realized that proven agroforestry proposals are almost not available. Agroforestry research has started only very recently. Traditional farmers have used agroforestry for centuries, but it is not yet clear, if, and even more how, their solutions can be applied by other producers.

'Agroforestry' is an extremely broad concept embracing very different systems as: home-gardens, improved fallow, perennial crops with "shade" trees, pasture with trees, alley-farming, etc. Several hundred plant species, which can be combined in a multitude of ways, are of potential interest. For most species, little or no agronomic information is available, which increases the difficulties.

There are large differences among potential users of agroforestry in aspects such as access to capital, distance to markets, and cultural background.

Agroforestry field trials need large areas and have to be accompanied for many years. As a consequence only very little can be studied in this way, while the amount of items requiring field trials is very large (Van Leeuwen 1992).

The great many options and the lack of detailed information make it very difficult to make the right decisions for the promotion of agroforestry. Nevertheless these decisions will often be of strategic importance.

The research presented here aims at developing concrete proposals for the promotion of agroforestry in Amazonia.

## RESEARCH OBJECTIVES

- Contribute to the increased use of sustainable forms of agroforestry in Amazonia.
- Study Amazonian agroforestry potential and indicate priorities for agroforestry research and development.
- Develop agroforestry systems which fit Amazonian farmers and are socially, economically and ecologically acceptable.
- Integrate research results into Amazonian farming systems.
- Strengthen INPA's capacity for agroforestry research.

## ONGOING RESEARCH

### AGROFORESTRY SYSTEMS

#### *Study of practiced agroforestry systems and techniques*

It is important to understand the actual role of trees in the different farming systems. Projects promoting agroforestry should build on this. It is much easier to support and improve existing practices than to introduce completely new ones.

A list of fourteen agroforestry systems of interest to Amazonia has been prepared and systems in the neighbourhood of Manaus were studied.

A system combining an upper stratum of rubber tree canopies (*Hevea brasiliensis*) with a lower stratum of cacao (*Theobroma cacao*) is frequently found on the *várzea alta* (higher part of the flood plains). The cacao and rubber trees of this two-layer system are always old. New planting does not take place. Production of rubber and cacao was much more profitable in the past. Close to Manaus the system is slowly being substituted by the growing of more perishable products as papaya (*Carica papaya*), passion fruit (*Passiflora edulis*) and okra (*Abelmoschus esculentus*).

In home gardens fifty different perennial species were encountered. In shifting cultivation most trees are sown or planted in the cassava fields (*roças*). This is cheap, facilitates maintenance, and survival of seedlings is very high. Direct sowing of trees is a very important technique for the smallholder.

#### *On-farm pilot agroforestry systems*

Improved agroforestry systems are being designed in collaboration with farmers, to be installed on farms of volunteers. This is a relatively fast and cheap method to develop agroforestry proposals acceptable to the farmer.

Land and labour are furnished by the farmer, while the project helps with some of the planting material and technical advice.

The agroforestry system is designed in close collaboration with the farm family concerned. The proposal contains species composition, spacings, spatial combination of the different species, planting order, and scenarios for evolution in time. Trees and crops already present in the field are integrated in the proposal. For each farm a special proposal is elaborated. Final decisions are made by the farmer. (The project may eventually not follow up a proposal, if it is likely that it will not produce new knowledge.)

The plots will be managed by the farmer (thinning, weeding, pruning, introduction of new species) in collaboration with the research team. At regular intervals the plots will be described and measured.

After a one year preparatory period three plots have just now been installed and more will follow soon. These agroforestry plots, approximately one hectare each, transform *terra firme* land "degraded" by annual cropping into plantations combining different tree species of economic interest. This is an important alternative to the general practice of abandoning *terra firme* fields after two to four years of annual cropping.

The plots have to be followed for many years, which poses the problem of obtaining the necessary research support to do so.

## AGROFORESTRY SPECIES

### *Information gathering on husbandry and economics*

For most of the several hundred plant species with agroforestry potential, very little information is available. A part can be obtained by interviewing farmers and by field observations. A special methodology therefore is being developed.

Annotated species lists are being prepared.

### *On-farm testing of species*

If some seedlings of a new tree species are offered to a farmer he or she will often be interested in trying them. This is a cheap way of testing new species under farmer management.

### *Screening of species for live fences in the várzea*

In 1992/93 two trials were installed, using a total of 28 species. One of the trials has been installed

on a cattle ranch. This work is done in cooperation with Dr. Jörg Ohly (Max Planck) and Eng<sup>o</sup> Mauro Janssen (INPA-CPST). The obtained information will also be useful for other forms of tree use in the várzea.

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