Multi-strata agroforestry systems for conservation of tree species genetic resources [1]

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Introduction

The substitution of natural vegetation for monocrops had generally resulted in failures, vanishing natural populations of countless genetic value. Though there are no exact data on risks of species extinction, the estimation of 40 million hectares of altered forests, gives an idea for the loss of ecosystems and natural populations in Brazilian Amazonia EMBRAPA(1991).

The conventional methods of conservation, based on monocrops, had been considered unfeasible for genetic resources of autochthonous species due to high occurrence of pests and diseases. These methods disregard the strategies used by plants in order to maintain equilibrium in the tropical ecosystem: the genetic variability, inter-specific diversity, and plant density. The multi-strata agroforestry systems provide an ideal opportunity for integrating farmers, production, conservation and use of genetic resources of forest species, mainly, the ones with none orthodox seeds and the ones providing earlier services.

Lheras-Pérez (1992) had pointed out that the food reserve in an Amazonian community is not only based on grain stocks, or o tubercle or other storage products, but it is rather the result of a complex agroforestry mosaic with different harvesting times. Because these communities cultivate many local varieties and races, they are seen as safeguards of the high biodiversity, once they take advantage from and manage innumerous species with extreme genetic variability.

The genetic-ecological approach to the study of both tropical ecosystems and the cultivation practices from traditional populations allow a special consideration about the sustainability for the maintenance of collections of living plants. It also gives room for the study of the strategies that natural populations use in order to adjust to environmental changes and return to equilibrium. It is supposed that the tropical forest presents unique floristic composition and demographic characteristics and, that the forest ecological stability is associated with species diversity, plant density, and genetic variability of populations.

The agroforestry systems are proper for the establishment of models based on genetic-ecological aspects, though there is the need to explore the scientific knowledge of inter-specific interactions that guide the establishment of these systems. In this study, it is discussed the growth of five forest species, testing the viability model for in field conservation that put together agroforestry production principles with genetic and ecological stability of natural populations of autochthonous plant species.

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Materials and Methods

A model of field genetic resources conservation based on both agroforestry principles and genetic-ecological aspects was studied by Western Amazon EMBRAPA. The strategies the indigenous tree species use to maintain their equilibrium in a tropical ecosystem (diversity, density, and genetic variability) was tentatively simulated in a 0,25 ha experimental plot.

The research was started in January 1994, to study the genetic resource conservation of five forest trees (*Hevea* spp, *Ceiba pentandra, Jacaranda copaia, Buchenavia huber, Trattinickia burserifolia*) and the production of seven fruit tree species (*Theobroma grandiflorum, Theobroma cacao, Bactris gasipaes, Euterpe spp, Myrciaria dubia, Rollinia mucosa* and *Couma utilis*). The arrangement of the species in the field considered the level of shade tolerance the plants would theoretically support in natural populations((Sousa 1997). A group of four inter-specific quincunx of 5m x 5m were distributed in a $100m^2$ plot were set up at each $100m^2$ in a total of $2,500m^2$. The species with dominant characteristic (forest species) occupied the apex of the quincunx.; the species considered from sub-forest (cocoa) and the ones that could stabilize independently of shade tolerance (palmae) were placed in the center of each quincunx in mono-specific lines (Figure 1). The technical viability of the model was evaluated through plants survival capacity, plant growth, disease tolerance and the fruit species production capacity.

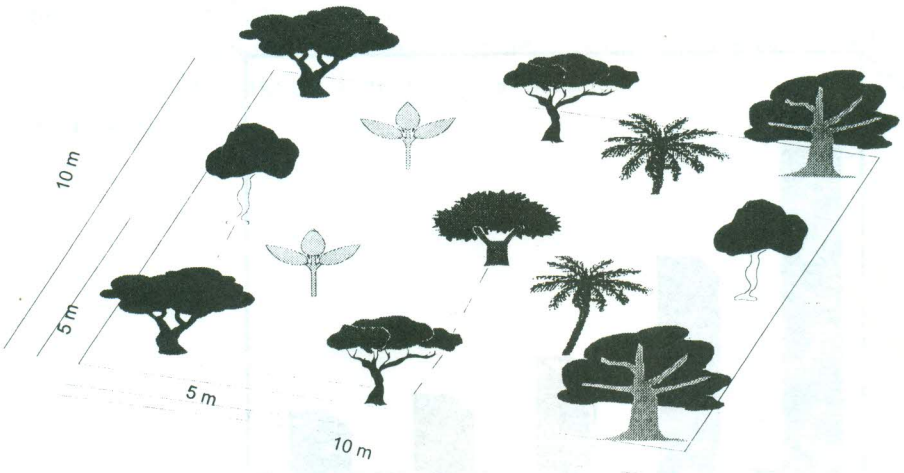
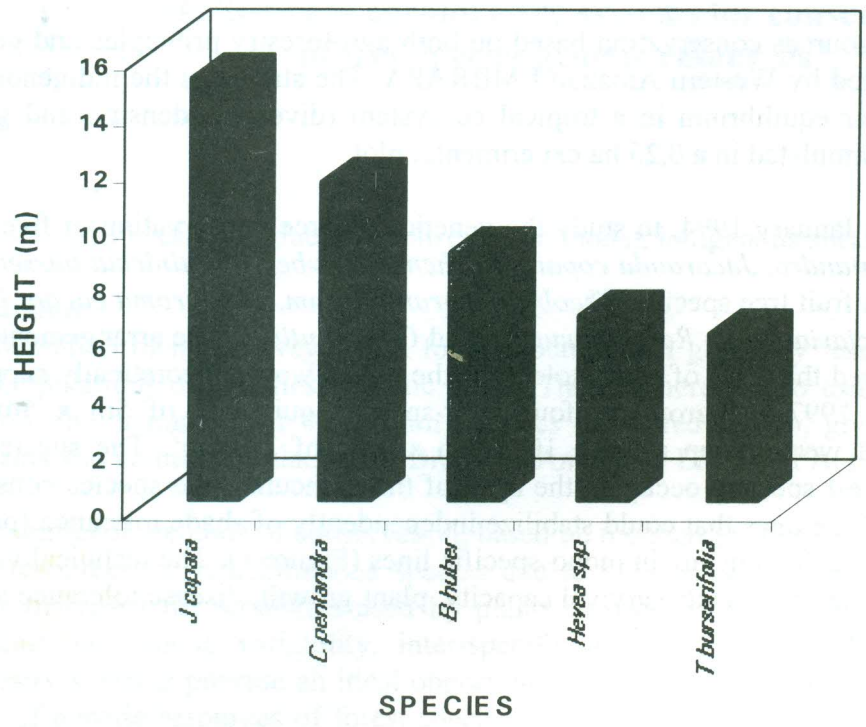


Figure 1. Detailed scheme of plants arrangement on the inter specific quincunx.



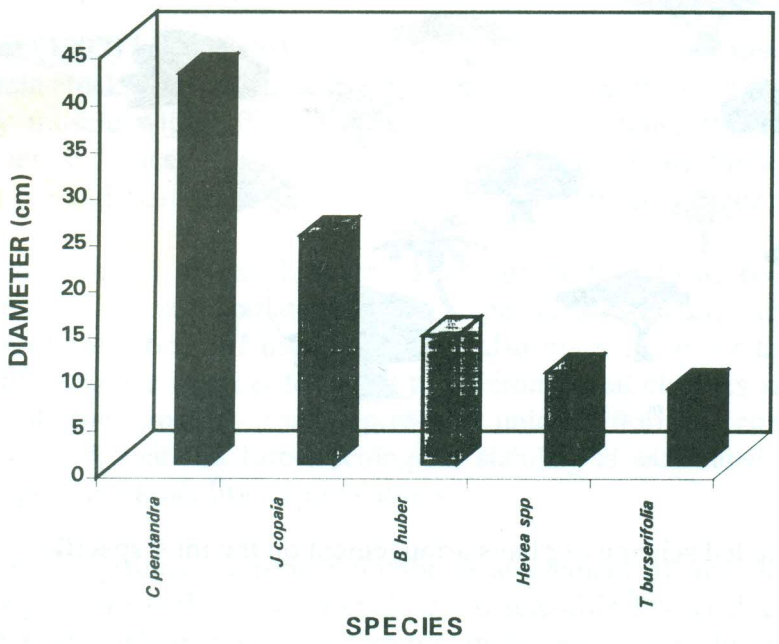


Figure 2. Average values for plant height (m) and stem diameter (cm) of five tree species with age of 48 months, in an multi-strata agroforestry conservation and production model.

Results and Discussion

Jacaranda copaia and *Ceiba pentrandra* were the tree species at the age of four years, showing the highest growth values in height (15.11m and 11.41 m, respectively) and diameter at 50 cm from soil

(24.61 cm and 41.97 cm, respectively). On the other hand, *Buchenavia huber* had the smallest value both for height and diameter, 6.03 m and 8.17 cm, respectively (Figure 1).
Tree growth, up to now, had not interfered with the production capacity of fruit trees, which had started production three years following plantation. The model, in summary, is appropriate for the conservation, under agroforestry systems, of small densities of tree species under genetic erosion risks. It also contribute to the valuation of bio-diversity as well as for adding value with sales of both seeds and tree species seedlings.

Conclusion

The preliminary results bring out the possibility for transferring the model through a participatory approach to family farmers, institutions with landscape projects, communities assisted by non-governmental organizations. In the model the species used for production should be chosen by the model users, whereas the species used for conservation should be the ones indicated from research (*pau-rosa*, mahogany, or virola).

References

Embrapa-Centro Nacional de Recursos Genéticos (Brasília-DF) (1991) Estratégias integradas para a conservação dos recursos genéticos da Amazônia. Brasília. 76 p

Lheras-Pérez E (1992) Uso tradicional da biota, manejo e domesticação de recursos genéticos. In: Seminário Internacional Sobre Meio Ambiente, Pobreza e Desenvolvimento da Amazônia-Simdamazônia. Anais. Belém, Prodepa 126-132.

Sousa NR (1997) Conservação de recursos fitogenéticos da Amazônia em coleções diversificadas – Avaliação do estabelecimento de doze espécies. Manaus, Embrapa-Cpaa (Embrapa-Cpaa Boletim de Pesquisa 2) 14 p.