DEVELOPMENT OF MORE INTENSIVE AND SUSTAINABLE PRODUCTION SYSTEMS FOR SMALL FARMERS IN THE AMAZON REGION-BRAZIL

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PART I: PROJECT OBJECTIVES AND PERFORMANCE MEASUREMENTS

1. BASIC PURPOSE

The quantitative data of deforestation in the Brazilian Amazon does not discriminate the area of forest converted to slash-and-burn agriculture from that due to big extensive pastures or other purposes such as hydroelectric dams and urban development. It may however, based on the massive migration of small farmers from central and northern Brazil, be inferred that a substantial amount of deforestation is due to shifting cultivation.

Moreover, the main motivating force of the big cattle projects was represented by tax incentives, now cancelled, but the need for subsistence of the small farmers will persist and a future increase of demographic pressure may be inevitable.

Shifting cultivation is the only alternative left to the small subsistence farmer in the Amazon where the economically sound extractive products have been depleted or ceased to be remunerative.

Various factors lead to the vicious cycle of subsistence poverty level such as lack of education, access to credit, infrastructure of storage and transportation, marketing conditions, local availability and cost of inputs, etc. Nevertheless the primordial factor is the lack of appropriate,, more intensive and sustainable farming systems to offer as alternatives for shifting cultivation. The main purpose of the project is to fulfill this prerequisite.

The evaluation of the possibilities of achieving this goal is based on the results obtained with agroforestry in other regions of the world and the promising scopes for agroforestry in the Amazon, under the basic assumption that sustainable farming systems must contain a variability of tree components to imitate the original forest.

2. SPECIFIC OBJECTIVES

In the establishment of the specific objectives to achieve the ultimate goal, the lack of a clientele-oriented research program was considered the first obstacle to be removed, since the research towards small farmers demands institutional rearrangement of priorities in the use of resources as well as a change of attitudes of researchers and managers.

The systematic procedures to identify the small farmers' constraints and potentials to adopt agroforestry technologies and the acceptance of its fundamental concepts will lead towards this

aimed institutional change and represents another important action converging to the basic purpose of the project.

These and other important specific objectives are assembled in Table 1, together with the corresponding performance indicators. Attention is drawn in Table 1 to the need of forcing consistency from organizations working with agroforestry.

TABLE 1: SPECIFIC OBJECTIVES AND PERFORMANCE INDICATORS

Objectives	Performance Indicators
1. Training agroforestry course to 15-20 research and extension agents given by the group trained at the University of Florida (first 2 months)	1.1 Course evaluation with numerical score 1.2 New preliminary action plan proposed by the participants
2. Identification of the main constraints and potentials for agroforestry in three representative counties (to be carried out by the research and extension team during the first 12 months in joint work with farmers and external consultants)	2.1 Better knowledge of the farmers' needs and aspirations 2.2 Number of agroforestry practices and/or other interventions proposed to improve the farmers'system
3. Survey of the existing technologies which can be used as "best bets" to change from the existing system to a more sustainable production system (to be carried out by the research and extension team, with the assistance of external consultants, during the first 12 months)	3.1 Number of "best bets" technologies identified to transform the traditional system
4. Carry out 12 "on-farm" experiments in the three representative localities to evaluate the technological innovations (to be carried out by the research and extension team during a five-year period, with periodic assistance from external consultants)	4.1 Evaluation of the % of increases in the farmers' incomes 4.2 Evaluations of the % of reductions in the use of the farmers' land as compared to the traditional system

5. Design of an inter-institutional multidisciplinary "on-station" agroforestry research program (during the first eight months, by the research and extension team and external consultants)	5.1 Development of specific research projects to solve specific problems
6. Development of "on-station" experiments specified and quantified after the establishment of the research program (to be carried out during the five-year period with the periodic assistance of external consultants)	6.1 Number of experiments concluded and results obtained 6.2 Number of new technologies which can be tested and adopted by the farmers
7. Diffusion of the results obtained in the five-year period	7.1 On-farm research plots used as examples for the farmers 7.2 Demonstration of field days 7.3 Annual reports and publications in scientific and extension periodicals 7.4 Seminars, workshops 7.5 Number of other neighboring farmers interested in/or adopting the innovations

PART II: IDENTIFICATION AND ANALYSIS OF PERFORMANCE PROBLEMS AND DRIVING AND RESTRAINING FORCES

1. PERFORMANCE AND ANALYSIS OF PROBLEMS

There are at least six problems of primary importance in the Amazon Region which may affect the objectives of this project. Some can be solved easily, but others can be solved only with great difficulty.

A. Performance problems:

1) Lack of a clear government research and development policy for the Amazon region
2) Shortage of funds for adequate development
3) Low fertility of the Amazonian soils
4) Insufficient knowledge about on-farm research

5) Insufficient knowledge of the research and extension teams about farmers' practices and desires
6) Poor institutional integration

B. Analysis of the problems:

The first problem, which concerns the lack of a clear government policy for the Amazonian development, presents a considerable barrier to the development of new technologies. This is a problem which can be solved, but only with great difficulty and effort.

Shortage of funds also represents a considerable inhibiting factor in this project, but is easier to solve, since funds may be found from other governments and institutions.

The low fertility of the soil is also a considerable inhibiting factor, but can be solved with only minor difficulty, because the soil responds well to the new technologies.

The lack of a consistent knowledge of on-farm agroforestry research is a problem which is easily solved. However, the lack of a consistent knowledge of the farmers' practices and desires limits the development of new technologies and systems and is more difficult to solve since so little information about them exists.

Finally, poor institutional integration may result in a small but significant inhibiting effect, but can be fairly easily solved since there are always opportunities for group integration among people from different institutions.

2. DRIVING FORCES AND EXTENT OF CONTROL:

There are at least six driving forces which may help in developing new technologies and systems in the Amazon region. The research team, as well as other people and institutions, have varying degrees of control over these different driving forces.

A. The driving forces are:

1) High response of the soil to technologies
2) There are some qualified research people and institutions in the region
3) There are some research results about species and technologies that can be used in the research to achieve the main purpose
4) There is a group of researchers trained in agroforestry training
5) International pressure to preserve the Amazon forest

6) Recognition that there is a low level of adoption of the technologies

B. The extent of control over these driving forces are:

Our group has partial control over the quality of the soil in terms of response to technologies, since this would be an intrinsic characteristic of the soil. Farmers, researchers, and government attitudes also influence the use of these technologies which could be beneficial if well-utilized.

Our group has extensive control over qualified research teams and institutions, however we do depend on government policy and attitudes.

The knowledge of good technologies developed in the region in partially under our control, since our work can contribute to their use; however, other researchers and farmers also exert some influence and control over them.

The presence of a group trained in agroforestry systems is largely under our control, but it is also influenced by our superiors and external institutions which have funds and technologies.

The international pressure to preserve the region in completely beyond our influence and control. All of the influence and control over it is related to the international media.

Finally, the recognition that there is a low level of adoption of the new technologies is largely under our control and influence. Other researchers, private volunteer organizations (PVOs) and local governments also exert some influence over this.

3. RELATIVE STRENGTHS OF DRIVING AND RESTRAINING FORCES

As a final step in our analysis of the forces, both favorable and unfavorable, which affect this project, the strength of each force has been assessed on a scale of 5 (very strong) to 1 (very weak) as indicated in the table below.

TABLE 2: RATE OF STRENGTH OF THE DRIVING AND RESTRAINING FORCES IDENTIFIED

DRIVING FORCE (D)	RATING	RESTRAINING FORCE (R)	RATING
D.1 High response of the soil to technologies	4	R.1 Lack of a clear government research and development for the Amazon region	2
D.2 Qualified research people and institutions	3	R.2 Shortage of funds for adequate development	3
D.3 Good research results about species and technologies known in the region	3	R.3 Low fertility of the Amazon soil	4
D.4 Group of researchers able to train others in agroforestry systems	5	R.4 Insufficient knowledge about on-farm research	5
D.5 International pressure to preserve the Amazon forest	2	R.5 Insufficient knowledge of the research and extension teams about farmers' practices and desires	5
D.6 Recognition that there is a low level of adoption of the new technologies	5	R.6 Poor institutional integration	3

4. INTERRELATION OF FORCES

Some of the driving and restraining forces listed are interconnected and bear on each other. We would say that these forces are part of a big and very complex problem to be solved.

5. KEY FORCES

On the basis of the analysis carried out, the forces listed below have been selected as those most crucial to the project.

A. Key Driving Forces

1) There is a group of researchers trained in Agroforestry extension and training.
2) Recognition that there is a low level of adoption of new technologies
3) There are some research results about species and technologies (Annex I) that can be used in the research to achieve the main purpose.

B. Key Restraining Forces:

1) Insufficient knowledge about "on-farm" research
2) Insufficient knowledge of the research and extension teams about farmers' practices and desires
3) Lack of a clear government research and development policy for the Amazon region

PART III: STRATEGIES AND ACTION PROGRAMS

1. COORDINATED ACTION PLAN

For each of the key forces a strategy has been identified. The table which follows indicates all of the key forces and corresponding action ideas.

TABLE 3: KEY FORCES AND CORRESPONDING ACTION IDEAS

No.	Driving(D)/Restraining(R) Force	Action Ideas
D.1	There is a group of researchers trained in Agroforestry extension and training	a) The group will administer a training course to 15-20 researchers and extension agents b) Request of funds and external consultants
D.2	Recognition that there is a low level of adoption of new technologies	a) Training the Research and Extension team in on-farm methodologies and Diagnosis and Design methodology for small farmers

D.3	There are some research results about species and technologies that can be used in research to achieve the main purpose	a) The Research and Extension team will propose "best bets" to be tested in on-farm research b) The Research and Extension team will carry out on-farm experiments in 3 localities c) The Research team will conduct the on-station research
R.1	Insufficient knowledge about on-farm research	a) External advice from experts in on-farm research for training b) External funds to conduct the research c) The Research and Extension team will carry out on-farm experiments in 3 localities d) The Research and Extension team will propose "best-bets" to be tested in the 3 localities
R.2	Insufficient knowledge of the Research and Extension teams about farmers' practices and desires	a) The Research and Extension team together with the farmers will identify the main constraints and potentials for agroforestry and for other interventions in the 3 localities b) In this action the team will request external assistance c) The same as D.1.a
R.3	Lack of a clear government research and development policy	a) Support from legislators as a result of lobbying b) Proposed actions of the research institutions to provide adequate funds for research with small farmers

2. CONCLUDING STATEMENTS

This project draft came out as a result of the training of the Brazilian participants of the Agroforestry course.

It will serve as a guideline for the elaboration in the near future of a more consistent and definitive action program to be implemented in the Amazon region, with the collaboration of foreign organizations, after being submitted to the Brazilian research administrators.

Since IFAS already has an agreement with EMBRAPA - Brazil, this can be used as a starting point for reinforcing these links for further action.

ANNEX 1

Some Agroforestry systems have been tested by the research organizations in the Amazon region, and can be used by the small farmers:

- the introduction of forestry species and fruit trees in shifting cultivation systems (Taungya system) has been successful, particularly the woody species Cordia goeldiana and Swietenia macrophyla and the fruit trees Musa spp and Theobroma grandiflorum.

-the intercropping of annual crops (beans, corn and rice), semi-perennial fruit trees (banana, passion fruit, pineapple, papaya), and others (black pepper) with industrial crops (rubber, oil palm, coconut, and citrus) is very common as a means of reducing costs of investment and management.

Some potential species that can be used to formulate "best bet" agroforestry systems:

ANNUAL CROPS:
- -Beans (Vigna unguiculata)
- -Maize (Zea mays)
- -Rice (Oryza sativa)
- -Sweet potatoes (Ipomoea batatas)
- -Cassava (Manihot esculenta)

FRUIT TREES/BEVERAGES
- -Cupuacu (Theobroma grandiflorum)
- -Peach palm (Bactris gasipaes)
- -Guarana (Paullinea cupana)
- -Araca-boi (Eugenia stipitata)
- -Passion fruit (Passiflora edulis)
- -Acai (Euterpe oleracea or edulis)
- -Camu-camu (Mirciaria sp)
- -Papaya (Carica papaya)
- -Pineapple (Ananas comosus)
- -Banana (Musa sp)

INDUSTRIAL CROPS
- -Brazil nut (Berthollethia excelsa)
- -Rubber tree (Hevea brasiliensis)
- -Oil palm (Elaeis Guineensis)
- -Coconut (Cocos nucifera)
- -Cocoa (Theobroma cacao)
- -Coffee (Coffea arabica)
- -Black pepper (Piper nigrum)
- -Citrus spp.

WOODY SPECIES
- -Freijo (Cordia goeldiana)

-Mahogany (Swietenia macrophyla)
-Quaruba (Vochisia maxima)
-Cumaru (Dypterix odorata)
-Tatajuba (Bagassa guianensis)
-Parapara (Jacaranda copaia)
-Parica (Schizolobium amazonicum)
-Eucalyptus spp
-Gmelina (Gmelina arborea)
-Pinus spp
-Tachi branco (Schlerolobium amazonicum)

ALLEY CROPPING TREES/SHRUBS
-Leucaena leucocephala
-Gliricidia sepium
-Inga spp
-Tephrosia candida
-Flemingia macrophylea
-Cajanus cajan

FODDER/PASTURE CROPS
-Panicum maximum
-Brachiaria humidicola
-Brachiaria brizantha
-Andropogon gayanus
-Pueraria phaseoloides
-Desmodium ovalifolium
-Centrosema macrocarpum
-Pennisetum purpureum