

NOTA EXPLICATIVA SOBRE EL ANEXO
"AGRO-FORESTRY IN THE HUMID TROPICS"

En febrero de 1977 el "International Development Research Centre (IDRC)" de Canadá, solicitó mediante contrato con el CATIE, un informe sobre cómo podría estructurarse un programa mundial en sistemas agro-silvo-pastoriles ("agro-forestry") para los trópicos húmedos.

Se escogió el CATIE en vista de que allí funcionan bajo un mismo Organismo las tres disciplinas sobre uso de la tierra (cultivos, animales y bosques) y por el hecho de que la búsqueda de sistemas estables agro-silvo-pastoriles para el pequeño productor, era una de las 3 líneas principales del Departamento de Ciencias Forestales, aprobada por el Consejo Directivo del CATIE.

El IDRC pidió que ese informe fuese redactado por el Dr. Gerardo Budowski, Jefe del Departamento involucrado, y quien tiene amplia experiencia internacional.

El informe representa las opiniones de este especialista y es propiedad del IDRC.

Se adjunta aquí con el objeto de clarificar conceptos e indicar cuáles líneas serían susceptibles de desarrollarse, bajo un programa de fomento de sistemas agro-silvo-pastoriles para todo el CATIE.

AGRO-FORESTRY IN THE HUMID TROPICS

A Programme of Work

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Introduction, Scope and Limitations

The present report was commissioned by IDRC, the contract arriving on 22 February 1977. It was based on accumulated experience at CATIE where agro-forestry* is one of the three major lines of research within the Forestry Department (see Annex 1).

No pretense is made to produce a scholarly work in relation to the lines suggested as most promising. However, background material is available as well as a list of references, many on punched cards. The ideas forwarded are the result of many years of research, consultation and literature perusal and much material **has** been freely taken from colleagues and publications with no attempt to give due credit. The author alone is responsible for mistakes and misconceptions.

Agro-forestry itself is not easily defined although this has been attempted in many instances. In this paper, it is implied that

* Agro-silviculture is also used but may be more restricted in scope. Since agriculture in some languages does not necessarily include animal husbandry, the accepted Spanish term is "agro-silvo-pastoral" used as an adjective, for instance to qualify system, hence in English the terminology "agro-silvo-pastoral" has also been used (see Annex 1).

it involves the combination of trees in space or in time with either crops or animal husbandry - or both - in order to achieve a stable production system for the benefit of rural populations. Fisheries are not included in this report even if they have a rightful place. Only the humid tropics will be considered in this report.

The term humid tropics is somewhat confusing and has been the object of many discussions, definitions and papers. In this report it is understood to be a tropical region where the natural forest vegetation would remain continuously evergreen (in opposition to deciduous) or almost so, during the course of the year, because of relatively high rainfall (usually above 1800 mm, a year, with few, if any, dry months). In the lowlands a mean annual temperature at sea level of around 22°C or more, is expected, although there are some exceptions. The region does not necessarily coincide with the geographical boundaries of the tropics. As for the tropical highlands, also included in the report, the temperature here is naturally lower and varies with the elevation, but to qualify as moist, the criteria of maintaining an evergreen canopy, and the absence of several dry months, are maintained together with high moisture, mostly, but not exclusively through rainfall. Edaphically conditioned moist forest (mangroves, evergreen, gallery and swamp forests, etc.) may also be found in areas of low rainfall, but they are not included here.

These short and incomplete clarifications^s should not be confused with definitions; they merely should help to show the scope and limitations of the report.

The examples offered in the report are mostly from Latin America, where the largest extensions of moist tropics are found but examples from

certain areas of Southeast Asia and Africa, particularly those familiar to the author, are also included.

Some of the suggestions made are found in part in the report titled "Forestry research priorities in Latin America" (49 p.) submitted on 14 July, 1976 by Armando Samper of Colombia, with whom close contact was established while Mr. Samper was a consultant to IDRC. Other suggestions were freely taken and in some cases developed from the report produced for IDRC by a team led by John Bene in December, 1976, titled: "Trees, food and people; land management in the tropics" (73 p).

General Guidelines for a Strategy to Develop

Agro-Forestry in the Humid Tropics

There are undoubtedly many ways of developing agro-forestry throughout the humid tropics depending on socio-economic conditions, the level of local knowledge, the capability of transferring and/or adopting new technology and other factors. It would appear extremely risky to concentrate on one or very few lines, and ignore other ways.

As a first guideline it is therefore proposed that a certain diversity in approaches be favored while maintaining the unity in objectives.

In many humid tropical regions, there already exists a certain level of knowledge, and indeed successful practical applications of agro-forestry systems, although these may often be restricted in area and are frequently empirical in nature. One of the most promising approaches

therefore consists in locating, understanding and describing these success stories and evaluating as correctly as possible, their short and long-term value for promoting sound development. Development being the achievement of improvements without impairing future capacity for production.

In those same areas where success stories are being investigated, an assessment must also be made of alternative land use systems that do not involve agro-forestry. This need not to be in great detail but will nevertheless be necessary to produce valid comparisons if it is expected that agro-forestry will ultimately receive the necessary impulse, both from local authorities as from the rural inhabitants directly involved. In drawing comparisons it is particularly useful to show the short and long term benefits as well as drawbacks and to emphasize the sustained productivity of the land (stable systems).

As soon as a successful agro-forestry systems has been assessed and its technology well studied, efforts should be made to ascertain its transfer to other areas where ecological and socio-economic conditions allow reasonable hopes for adoption of similar technologies. This should of course be carried out in very close coordination with local authorities. The main initiative really corresponds to them.

In all the guidelines suggested above, it is essential that the local people, those living on the land or connected with relevant institutions, be fully involved and every effort should be made to secure such involvement in the very early stages of the research and its promotion.

Promising Lines of Research and their
Relation to Action Programmes

The following lines of research should lend themselves to a coordinated world action programme in agro-forestry. They are described here with no pretense of assigning any priority. However, it is proposed that those systems which are already functioning and have proven to be stable, productive and well accepted by local population, should receive a certain preference over others, particularly if they are in a phase of expansion.

1. Permanent mixtures of trees with domestic animals and food producing plants

In many parts of the humid tropics, it is common to find mixtures in various degrees, of trees - including palms - (for timber, bark, firewood, spices, fruits, saps, gums, resins, medicinal products, etc.) together with useful climbers, shrubs, annuals, as well as various animals (domestic or semi-domestic), forming stable and productive systems, with very little outside input of energy. This is particularly prevalent in wet environments. So far these multi-strata systems that emulate the forest, have received little attention by scientists (with the possible exception of anthropologists and botanists) and practically none by "rural developers", although they offer considerable scope for improvement. Such systems are found for example in Malaya, Sri Lanka, Bali, Papua-New Guinea, and particularly, but not exclusively, among many "aborigenes" in tropical Africa and America.

It is suggested that teams of scientists study the mechanisms and

efficiency of those systems with an aim of evaluating and, if possible, improving their productivity so that the knowledge can be transferred whenever the conditions are propitious.

2. Productive rotation and temporary combinations of trees with crops and/or animals

In many tropical humid areas, a certain degree of sophistication already exists in directing the tree phase in different systems of cultivation (including shifting cultivation) either by natural promoting natural regeneration) or artificial means (by planting), to favour certain tree species in detriment to others. Examples exist in tropical America where often fast growing valuable pioneer trees invade abandoned land. Such trees are gaining increasingly favour by farmers because of their promising value for timber or for other purposes (firewood, charcoal, poles, soil improvement or various combinations). Their density and growth can be manipulated by simple operations such as weeding and eventually thinning - obtaining poles and posts in the process. Moreover, planting of valuable fast growing trees to control the natural succession is gaining increasing acceptance in many areas. Species such as Eucalyptus deglupta are now being planted in humid areas of Costa Rica for banana props and five meter poles are being harvested within only 11 months after planting (see photo).

There are many possible variations of species choice and timing for planting of trees. The latter can be done jointly with the first crop of annuals or shortly after. Labour can be carried out by the owner, by other farm workers, or through cooperative arrangements. Often the land is Government owned and itinerant (shifting) farmers are used to

convert it cheaply into desirable tree crops ("taungya system"). Research is urgently needed to understand the advantages and the limitations of all these possibilities such as the choice of species, the degree of control that is needed, the willingness of local communities to follow the instructions, the number and the kind of annual crops, including possible associations (multiple cropping), the length of the rotation, the capability to meet future land pressure, and various marketing aspects. The social and political desirability of having the Government act as an entrepreneur must also be carefully examined particularly since the newly created forest may provide new jobs, facilitate erosion and streamflow control if watershed protection is involved, and produce other benefits.

Some species like Eucalyptus deglupta can produce poles in 2-3 years and some timber after only 10 years. In the Turrrialba area, Pinus caribaea will produce 320 cubic meters of wood inside bark per hectare after eight years, lending itself to interesting tree farm operations (see photo).

Although there exists some knowledge of the taungya system, it can hardly be considered comprehensive particularly in the more humid regions; in many countries it retains a "colonial" flavour which could possibly be obviated if adequate precautions for its implementation are taken and emotional approaches are avoided. There is no doubt that if successful techniques can be devised, such rotation with valuable species can transform destructive shifting farmers into useful forest workers, allowing for instance, the establishment of agro-forestry cooperatives or some other degree of participation by the itinerant farmers and forest workers.

At any rate, there appears to be a broad and successful basis for gathering facts along this line, to increase the scale of operations in those regions where successful experiences already exist, and to transfer the same technologies to other areas where scarcity of timber and a number of favourable conditions offer a reasonable chance of success.

3. Live fence posts

In tropical Latin America at least, considerable knowledge exists concerning the use of fence posts to which barbed wire is usually attached, be it for pastures or crop areas that need to be enclosed or protected. There is a need to investigate the best choice of species in relation to climate and soil, the techniques of avoiding that the wire attachment be "swallowed" or "repelled" by the live post and the size and conditioning of the cuttings prior to planting. Moreover much more needs to be known about the many uses and services rendered by live fence posts (fruits and flowers for human consumption, fodder for cattle, soil improvement through production of organic matter, nitrogen fixation, erosion control, refuge for desirable wildlife, the production of firewood and charcoal, poles, wood for ornamental purposes and cuttings for more plantations, as well as the possibility of harvesting ornamental seeds, medicinal products, gums, resins, etc.). There is ample room for improving existing techniques and transferring these to other areas whenever such action is justified in the light of other alternatives and its acceptability by the local rural community (see photo).

Naturally, the adverse effects of live fence posts such as

competition with nearby crops or grasses, costs of maintenance, harbouring detrimental wildlife and other factors should equally be investigated.

Ultimately, if successful, a programme of clonal propagation could be devised since the fence posts are usually propagated vegetatively. This would be combined with the publication of a series of manuals.

4. Valuable trees intermixed in coffee and cocoa plantations

In Costa Rica and in other tropical American countries, a quiet revolution concerning the use of trees is taking place wherein traditional species of shade trees are being supplemented or replaced by particularly promising native or exotic fast growing timber trees. In Central America, Cordia alliodora, a native tree characteristic of the secondary succession in humid areas, below 700 m elevation is a prominent choice, but other species are being used as well. The increase of management of natural regeneration of Cordia alliodora has been spectacular in the last 15 years with virtually thousands of square kilometers being "invaded" by this species (see photo). Naturally, it is the high price of this timber, which has surprising good form even if growing in the open, its natural durability and its fast growth, which have caused this recognition by coffee and cacao farmers. Growth of Cordia alliodora is well documented because of the annual growth rings that are correlated with the periodic loss of leaves over a period of about three months each year, irrespective of rainfall, which permit aging a tree. Diameters of 40-50 cm dbh can easily be reached in only 20-25 years although it must be added that the soil and

the drainage in areas where coffee and cocoa are usually grown is good, and that fertilizer is often added. Cordia alliodora is a prolific seed producer; in fact, it has also invaded thousands of hectares of abandoned agricultural or pasture lands in the humid tropics of Southern Central America.

In coffee plantations, the addition of Cordia alliodora has produced new combinations not yet well investigated. In Costa Rica, one of the traditional shade trees, the legume Erythrina poeppigiana and to a lesser degree Inga spp., are now very heavily pruned to produce low branching. Therefore, a three layer community (coffee, Erythrina and Cordia is produced with apparently excellent economic prospects (see photo).

Since in most countries of tropical America, coffee and cocoa are grown on small, private lands belonging to small farmers, the more widespread introduction of this tree appears very promising to provide a considerable additional income. Eventually methods could be devised for mixing timber trees with coffee in higher elevations or tea plantations.

The better knowledge of density of planting, various silvicultural treatments and the eventual development and use of clonal material from plus trees, together with economic and marketing information could provide the bulk of the research to improve this system.

5. Timber trees that improve pastures in the humid highlands

In Costa Rica, and more recently in Colombia, considerable knowledge is being accumulated in using a local fast growing pioneer tree of very wide distribution (North Argentina to Mexico) in combination with pastures

for dairy production. The local alder Alnus jorullensis H.B.K. (A. acuminata) fixes considerable quantities of nitrogen through nodules produced by a fungus Actinomyces alni in the roots. The trees are widely spaced and pruned (often poorly so) and the pastures between 1400 and 2200 m. (higher in some Andean countries), appear to be in much better condition than when the alder trees are absent. The tree finds a ready market for a general utility wood, for coffins and lately for matches and in the shoe industry. The growth is extremely fast and a diameter of 40-45 cm after about 20 years can be expected.

Research is urgently needed to ascertain the exact role of the alder tree in improving the pasture.

There is some information and sometimes a lot of speculation as to how much nitrogen is being incorporated in the soil by the alder, the role of the trees and their roots in improving the soil structure -particularly where the trees are harvested and the roots are left to rot- the high fodder value (protein) of leaves and other factors. Research should also include knowledge on the best management practices (including better pruning and knowledge of the best harvesting size).

A first and simple step should be to obtain reliable data on milk production (in comparison with nearby treesless areas) so as to be able to substantiate the use of this species in other regions. In fact, some initial planting has already been undertaken in Rwanda, Africa. In Costa Rica and Colombia this is a fact expanding practice.

6. Leucaena leucocephala and other fodder and soil improvement trees in the lowlands

The successful selection of very fast growing varieties of this promising leguminous species has produced high expectations concerning its further use. The tree or sometimes shrub, has multiple purposes, being used for fodder - although the quantity ingested must be watched because of the presence of an alkaloid - firewood, posts, and various benefits to the soil structure and fertility. Considerable knowledge is being accumulated concerning its acceptance by livestock, growth rate, and new varieties are being successfully developed. There is some speculation that the tree would grow well in very humid areas but initial trials in areas of 4000 mm. in the Costa Rican lowlands have been disappointing. It may well be that the best results could be found in some drier areas. Nevertheless, research is urgently needed to assess its economic feasibility in many moist areas.

There is in fact a dire need to investigate fodder trees in the humid tropics - almost 99% of the published research comes from arid or dry-wet regions. Actually there are various other promising fodder trees, notably Brosimum alicastrum of the Yucatan peninsula, well known for the local practice of lopping branches to feed horses and cattle. The leaves contain about 20% protein. Several species of Brosimum also grow naturally in the American wet areas but almost nothing is known as to their fodder value.

Some well known fodder trees from the drier regions will also grow in wetter areas, sometimes reaching even larger sizes than in their home localities. One example is Pithecolobium saman (Samanea saman), well known throughout all tropical countries where the English name is usually

"rain tree". The fruits are particularly rich in protein. Fruits of the pejibaye palm Gulielma gasipaes have also been used to feed hogs. In Asia and Africa several species of Parkia appear very promising. The leaves of some live fence post trees such as Glinicidia sepium and Erythrina spp. are readily eaten by cattle - although the fruits are reputedly unsafe for ingestion.

It is very likely that in the wet lowland areas, trees in combination with pastures may play a very prominent role in preventing soil compactation and in adding valuable amounts of organic matter and nitrogen (if they are legumes or otherwise able to fix atmospheric nitrogen). Whether these trees should best be harvested and replanted - so as to improve for instance the soil operation because the roots disappear and therefore produce channels - or whether they are best lopped or otherwise managed for cattle food, needs to be investigated.

Pastures can also be advantageously associated with trees that do not produce food for cattle. Best known is coconut, widely planted in Philippines, Sri Lanka and many other moist areas in Central America (for example the Atlantic coast of Central America and Southern Mexico) with cattle allowed to graze under it. The results of such combination are still poorly known due in part to the difficulties in undertaking long term research with trees. However, there are some trends which are worthwhile pursuing such as associations of pastures with various timber trees, rubber, African oil palm and tropical lowland pine. In Surinam, for instance, cattle is allowed to enter the Pinus caribaea plantations (on sandy soils) to keep the grass down once the trees have reached a sufficient size to with stand the animals but sufficient space is still available to allow the grass to prosper.

Pruning of low branches appears to be a necessary ingredient in this system.

It is clear that the present extremely destructive encroachment of pastures for beef production into the wet lowlands of many tropical countries is already producing disastrous consequences on the soil productivity after a few years. This is because many pastures will not allow themselves to be managed on a sustained yield due to the yearly increase in the cost of maintenance against weeds and the "weakening" of the grass due possibly to compactation, particularly when grass-land management is poor - which frequently the case.

It is possible that under certain conditions the establishment of some species of trees in combination with pastures may help in designing stable "silvo-pastoral" systems for the humid tropics. It may well be that the experience of Southeast Asia with water buffaloes could be of great interest.

At this stage there is more speculation than sound data. Should research confirm the usefulness of trees in pastures, this will certainly be one of the lines which will possibly receive widespread support. The present expansion of extensive grazing at the expense of forests is facing a proportional equal resistance not only by conservationists but also by responsible and concerned land use planners and even cattle production specialists, all who rightly view such expansion as a wasteful short term thrust with a considerable negative impact on future soil productivity. This will lead ultimately to the fast replacement of the last tropical rain forest complexes by a banal secondary vegetation of little value. In this line it is absolutely necessary to join forces with ecologists and land use planners. Certainly research should begin

with existing pastures under favourable ecological conditions while areas of very high rainfall, steep slopes, poor soils or swampy conditions, should best be left alone - that is, they should be left under forest.

7. Tree belts alternating with crops or pastures

In many tropical humid areas, such combinations are often advocated and occasionally seen, whether planned or not. However, little is known as to the ecological or economic benefits such as protection against wind or erosion, supply of wood products or various other benefits. Moreover, it has also been argued that such forest belts harbour undesirable pests such as monkeys or other mammals or insects. The fact is that little objective research has been carried out to make valid generalizations and eventually design acceptable techniques that could be implemented in future expansion plans or "habilitation" -the word "colonization" is now being avoided - of new land in the humid tropics, a process that is presently in full swing. Possibly a large percentage if not almost all of the areas being presently opened and "habilitated", should have remained untouched since they are usually too marginal for sustained food or cattle production. Nevertheless it seems that political or social imperatives - pressure on land because of population growth and inability to increase food production on land already cleared from forest - have the upper hand on ecological limitations. The establishment of belts may prove to be worthwhile only under specific conditions.

At any rate, the value of forest belts alternating with crops or pastures should be assessed and quantified for its benefits and

drawbacks. The results would be of great value to land use planning in the humid tropics and it may hopefully contribute in avoiding costly mistakes.

8. Wood as food for cattle.

This item has repeatedly come up in the literature as a promising field of research. Different processes are being used involving hydrolisis or similar changes of the wood properties leading to better digestibility. Some practical research with humid tropical wood species has been achieved by the Tropical Science Center in San Jose, Costa Rica and Mr. John Bene of IDRC had a chance to discuss this aspect while visiting the Center. At this stage some species have proven to be particularly promising but considerable more field tests are necessary.

The fact that large quantities of wood can be produced per unit of surface in the humid tropics and could be made available to cattle with convenient additions (urea, sugar molasses, etc.) make this a promising line of research and could lead to tree farms where food for cattle could be one of the products.

(The matter of protein production from leaves of tropical rain forest trees has also been the subject of some research, for instance by Prof. Pirie from Rothamstead. The author is not familiar with the latest publications, although this subject should be critically examined in the future).

9. Other promising areas and the need to reassess priorities

The eight themes described above are far from being exhaustive. The relation forest-fishery particularly in deltas or swamp areas has not been touched partly because it opens a new and often subtle relationship, well developed in some areas of Southeast Asia and Africa with which the author is not familiar. Likewise, there may be other subjects such as association of certain trees with pigs, poultry, the production of wildlife for commercial purposes, for instance capybara or agouti, which deserve considerable research.

Moreover, many subdivisions could be made for the above eight themes and in the course of the years, some may prove to be particularly worthwhile expanding while others do not warrant continuity. There is no doubt that periodic critical assessments of results and continuous consultation with an alerted scientific community that is belatedly taking an interest in stable agro-forestry systems, can produce significant progress, as well as changes in emphasis.

Some suggestions as to how to pave the ground to assure the greatest possible returns in the forthcoming years from a concentrated initial effort is described in the remnant pages:

THE ORGANIZATION OF RESEARCH

There is no need to repeat the various points made by J.G. Bene et al. of IDRC in their December 1976 report to the President of IDRC. They should be endorsed in their general context. The following comments, made with the humid tropics in view - but not restricted to this region - should therefore be considered as complementary with some suggestions as to how the proposed organization fits into a five year plan of work or into a more detailed program of work for the first year, to be carried out by the proposed International Support Unit for Agro-Forestry (ISUAF).

The Role of ISUAF in the Light of the Declared Objectives

Clearly the role of ISUAF will be to promote stable, yet productive agro-forestry systems for the benefit of the tropical countries, in particular its rural inhabitants of low income. If successful, this should be considered as a considerable contribution to sound development in favour of a sector of the population which has hitherto been considerably neglected.

To achieve this objective it is imperative to involve as much as possible the local community who can contribute towards this aim, not only the rural inhabitants themselves, but also the local planners the scientists, the decision makers and the public in general. A clear identification of objectives, the methodology applied and the continuous information of progress, all three are essential steps to insure success.

Case studies or areas of concentration

Once the research lines have been selected, it is suggested that the best methodology for creating an impact will best be achieved through concentrated research and follow-up work on case studies in the eight lines of research described previously. The most favourable sites for locating such areas of concentration should be carefully chosen, hopefully in different countries. For each line a main center should be located but every effort should be made to establish sub-centers where parallel research can be achieved at a later stage; depending on the level of knowledge acquired, new locations should be chosen to allow transfers of technology.

The identification of potential sites for establishing these areas of concentration for the case studies will involve the elaboration of a questionnaire, designed to find out if in each country there is already some promising agro-forestry development, which can lend itself to concentrated research and the eventual dissemination of the technologies acquired. In some cases this process is already well advanced. For instance, the combination of coconuts and animal husbandry may well be located in the Philippines with hopefully, minor replications in Sri Lanka and some Central American coastal areas; the various facets of rotation or combination of trees with crops and/or animals, including the taungya system, may be located in Nigeria with some replication in Southwest Colombia - where this is equally practiced - and possibly some South East Asian country. Costa Rica may qualify for research on alder in the highlands, and Cordia alliodora or other trees in coffee and cocoa plantations, and so on.

The location of some of these areas can be achieved by a group of

selected advisers (most of them should also be involved in selecting the most promising lines of research).

Consultants throughout the tropical moist region should then be contacted to provide a report in about three months time with detailed suggestions for places that lend themselves for case studies. Some may also attend a meeting when ISUAF, conscious of budget and other limitations, have digested the reports and will present a tentative draft for action that will be presented to the board of trustees for discussion, modification and/or approval.

The next phase should be to involve the countries concerned - a process that will undoubtedly have begun when the consultants were searching appropriate areas of concentration, since their endorsement and support is paramount to the success of the programme. This phase may also take up to four months, although for some countries, approval can be taken for granted almost immediately because of productive previous contacts. At the end of six months, several field teams should already be actively engaged in gathering data to assess one or various successful systems. At the end of the first year, at least two case studies in each of the three continents should be under way even if at this stage, efforts are still being undertaken to induce new countries to enter the concerted world effort.

Inducing the countries to cooperate

A key task almost since the initiation of the research, is to reach successfully the various sectors of the population of any given country. It is an imperative step previous any launching of a program.

This implies the preparation and/or adaptation to the conditions of the country - or like in the case of Brazil, for instance, to some region within the country - of the various materials capable of arising interest and generate desire for cooperation. This must be carefully planned and it is necessary to identify, approach and rally those within the country, be they individuals, or national, regional or international organizations, with the ability and the possibility of cooperating or joining in a concerted action and in their turn, assisting to identify those areas that lend themselves to case studies. Usually there should be at least one person within the scientific community (a member of a University or research institute appears most qualified) another in the planning office or its equivalent and someone who has access to communication mediae. Often, it may be more desirable to involve one or several institutions.

Within the area chosen for research it may be necessary to stage a careful campaign to explain the purposes and make certain that the rural people are conveyed the feeling that it is their accumulated knowledge and their willingness to cooperate which will insure the success of the gathering of data and its eventual dissemination to a much larger sector. It is they who will be key ingredients in making development possible, to benefit themselves and others.

For the transfer of technologies many approaches can be used but again it is indispensable to insure that local organizations are involved. In some cases this may include the strengthening of the relevant local bodies, capable of carrying out this task.

Meetings and communication

There is no doubt that frequent regional meetings, must be organized for adequate exchange of information and coordination. Likewise, a careful system of communication by periodic leaflets or newsletters, appears indispensable. This should be channelled through a central office. It may be that various types of publications may be necessary, according to the different audience, be they scientists, sponsors or the general public.

Documentation

At least one officer in ISUAF or at a convenient center should act as a central documentation officer to backstop the research. Close cooperation with other documentation centers is of course indispensable, such as AGRIS in FAO, Rome, with its regional sub-systems such as for instance AGRINTER in Latin America. It may well be necessary to establish a system devoted exclusively to agro-forestry.

Contracts

An opportunistic approach should prevail in engaging consultants or arranging with local, regional or international institutions the necessary contracts to fulfill the tasks demanded. Local research centers and local scientists should have preference over regional and international centers, or foreign experts whenever the competence exists at the local level.

Training and education

It is fundamental to organize both formal training as well as short courses dealing with the theme of agro-forestry and various general education activities. In universities or graduate schools, particularly but not exclusively in tropical countries, fellowships to students may be awarded to undertake research and this should provide a powerful generation of interest in this field (for example, the University of Costa Rica, through the Forest Department of the Tropical Agricultural Center for Research and Training in Turrialba, Costa Rica, admits three times as many students for a degree of Master of Sciences, than it has available fellowships. Therefore, a considerable number of Latin American students are deprived of an opportunity to receive a superior degree. If fellowships earmarked for agro-forestry research can be provided, a considerable effort could be undertaken by graduate students from the different countries of Latin America). Efforts should be made to stimulate the choice of agro-forestry. Other training activities should include workshops, and short courses in which field trips where data gathering, contacts with the rural population and evaluation of promising case studies could become important ingredients. At an appropriate moment, field days, popular essays, various concourses and similar activities could be staged.

Continuous evaluation

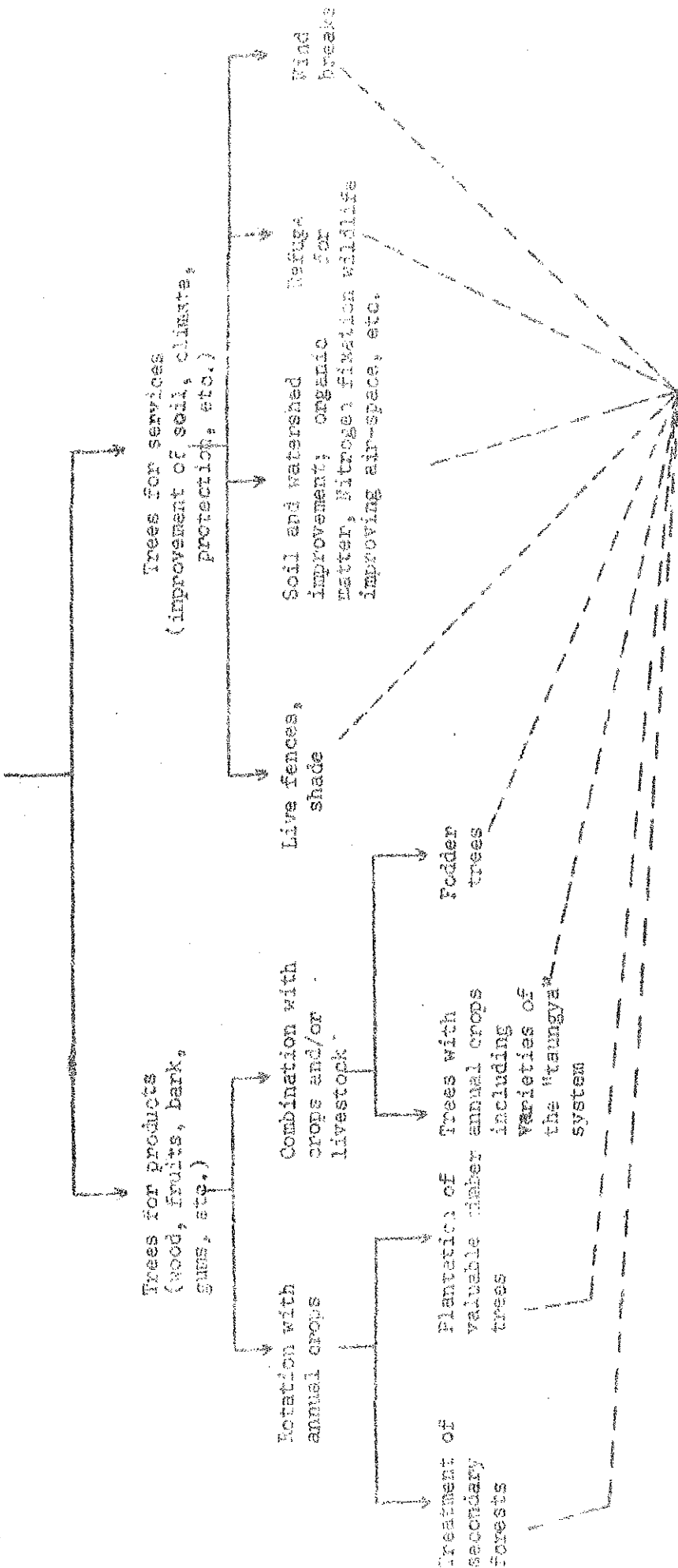
Periodically, a team of advisers hopefully rotating, should discuss with ISUAF the progress achieved, identify new gaps and readjust objectives and strategies in the light of the experience gathered.

The long term role of ISUAF

If the main objective of ISUAF is to stimulate the countries in promoting their own sound development in agro-forestry, this implies that, if successful, ISUAF should eventually fade out or evolve new objectives and strategies. However, if a better quality of life is sought for the people living in the rural areas of the tropics, there should be no practical limit to the scope of innovating and remaining a few steps ahead of others.

March 22, 1977
GB/fcpder

STABLE AGRO-SILVO-PASTORAL SYSTEMS FOR SMALL FARMERS (main line)



COMBINATIONS