PHILIPPINE INSTITUTE FOR DEVELOPMENT STUDIES
Working Paper 84-06

TENURE, TECHNOLOGY, AND PRODUCTIVITY OF AGROFORESTRY SCHEMES

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TENURE, TECHNOLOGY, AND PRODUCTIVITY OF AGROFORESTRY SCHEMES[1]

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Increasing attention is being given to the problems of excessive deforestation, environmental degradation, and migration to upland and forest areas in the Philippines. While government policies have attempted to regulate timber harvests and to control the continued settlement of agriculturalists in forest and upland areas, both legal and illegal cutting and settlement by *kaingínero* farmers continue. Prohibiting the settlement of "squatters" in forest areas has proven to be ineffective; and upland/forest populations continue to increase through both natural growth and in-migration. In many cases forest occupants have settled in areas made accessible by logging activities. These relatively recent settlers along with indigenous forest occupants, agribusiness enterprises, and logging concessions now compete for increasingly scarce and increasingly degraded forest resources. Environmental degradation has

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been significant in terms of tropical forest (often dipterocarp) destruction, soil erosion, downstream flooding alternating with droughts, reservoir siltation, and decreasing water retention capabilities of watersheds

Much of the land area of the Philippines (62% or 18,694 000 out of 30,000,000 hectares) is officially public domain' The Philippine Bureau of Forest Development (BFD) claims to have jurisdiction over more than 16,000,000 hectares, i e , over more than one half of the land area of the country Other claimants to the uplands include the indigenous or tribal minorities and the "non-Christian Filipinos' Recently, the Upland Development Working Group (UDWG) of the BFD guesstimated that 7 5 million people live in the uplands While current data does not allow a check on the accuracy of the estimate, it would be safe to say that an increasingly large population is now occupying lands under the jurisdiction of the BFD

Many of the upland areas currently provide common access resources--land, remaining timber, soil, and biomass--to present occupants Somewhat impressionistic evidence indicates that upland environmental degradation can be said to represent a "tragedy of the commons" in which the resources are overutilized and otherwise mismanaged by local residents given that they are available to all, but owned by no one. One response of the BFD and other agencies working in the uplands has been a shift from attempting to prohibit settlement in forest areas to developing technnologies, land tenure policies, and upland resource management practices--including agroforestry--to make such upland agricultural systems more environmentally stable and economically productive.

The following paper will describe and review the literature on some of the agroforestry-based technologies currently being developed, government and non-government program efforts in "social forestry", accompanying land tenure issues and emerging policies, productivity of these developing technologies, as well as related issues and problems. Where the data base is insufficient and where appropriate, recommendations for further specific research and policy discussion is offered.

AGROFORESTRY AND RELATED TECHNOLOGIES. "Technologies" can be discussed in terms of traditional/indigenous agroforestry and land use practices that were generally suited to much lower than present population levels, in terms of existing farming systems and land use patterns in various upland areas throughout the country, and in terms of practices and land use changes introduced by government (largely the BFD) and non-government agencies active in the upland and forest areas. Similarly, land tenure problems can be examined in terms of indigenous property rights, in terms of systems of ownership in upland areas that are already classified as "alienable and disposable", and in terms of the land tenure componants of developing "social forestry" projects. One of the main interests of the paper is to then examine the productivity of some of these various tenure-technology-project combinations.

Agroforestry is the combined planting of trees and agricultural crops. The trees may be forest species, introduced fast growing species, and/or fruit trees. Agricultural crops can include both annuals and perennials. Agroforestry is thought to be environmentally more stable in upland and forest areas than agricultural systems either without trees or relying heavily upon annual crops, and is considered economically feasible for small farmer occupants.

Several technologies being introduced in upland areas attempt to effect soil conservation and slope stabilization and are often utilized in combination with agroforestry projects. Strip cropping of fast-growing tree species along contour lines is intended to reduce soil erosion, increase water retention of the area, provide fuelwood and fodder, and can eventually naturally "terrace" the plot. Strip cropping of other species or of perennial crops is intended to be soil conseving as well. From the indigenous "tribal" groups, bench terracing is of demonstrated utility for land and soil consevation. Unfortunately, heavy labor inputs are required, along with specific physical characteristics of the land. Contour ditching is the digging of small ditches along contour lines. When either grasses or permanent crops or trees are planted on the resulting bunds, water runoff and the resulting soil erosion can be controlled. Terracing occurs naturally through this system. Construction of terraces using heavy machinery is, of course, not generally appropriate to small upland *kainginero* farmers. At the opposite technological end, the simple planting of crops along contour lines represents an improvement for soil conservation over planting up and down slope.

Other "technologies" include tree lots for fuel and fodder, tree plantations for dendrothermal use, various forms of reforestation and accompanying forms of labor organization, as well as development of various "minor" forest products such as bamboo, rattan, *nipa*, *pandan*, and *anahaw*, combined with approppriate cottage industry development.

Various forms of intercropping and multiple cropping can result in soil protection through the provision of a multi-layered canopy (reproducing the natural tropical forest canopy at a lower level), can aid in nutrient recycling through continual harvesting and planting with the soil-layer and biomass continually protected from heavy rainfall and excessive sunlight, and can be more resistant to pests and diseases through species diversification. Different studies of traditional and/or indigenous swidden agriculture describe high-diversity, continuous harvesting and planting agroforestry systems that were well adapted to their respective environmental conditions given low population levels and enough land for complete fallows. A more contemporary example of very successful hilly-land multiple- and intercropping is provided by the Batangas and Cavite farmers who plant various combinations and sequences of coconut, coffee, cacao, papaya, pineapple, vegetables, fast growing trees, banana, jackfruit, langka, lanzones, citrus, root crops, and other trees and crops.

Starting with the lessons from both the more successful indigenous or traditional swidden agroforestry systems and from the Batangas-Cavite farmers, institutions such as the Program on Envronmental Science and Management at the University of the Philippines at Los Banos are attempting to develop environmentally sound and economically viable multiple cropping systems for use by upland farmers. These systems can combine the growing of fast growing tree species planted along contour lines with subsistence and cash crop production. Similarly, the Forest Research Institute, the Highland Agricultural Research Center, the University of the Philippines College of Forestry, Visayas College of

Agriculture, and other institutions are working to develop similar technologies (or farming systems) for use by upland farmers.

Soil erosion control measures, traditional swidden system cropping diversity, and multiple cropping can ideally be combined into "integral agroforestry", one form of which--the Taungya system developed in Burma--is described as "...where forest and food crops are established simultaneously at the initial stages but will eventually evolve into pure forest as the food crops are phased out through shading"(Vergara 198). This system was workable in areas where land was available for populations to shift to new plots once the forests were reestablished. Agroforestry and related or component technologies are now mostly being developed with a goal of relatively permanent occupancy through diversification, environmental protection and improvement, and economic benefits for adopting farmers.

SOCIAL FORESTRY PROJECTS AND PROGRAMS: A SURVEY: Most of the technologies described above are now being tested in real life applications, mostly through "social forestry" projects and programs. For our purposes, social forestry can be defined as: Projects in upland and forest areas that work with local communities and seek to: protect or rehabilitate the forest environment, develop stable and productive resource-use patterns (including agrofrestry based systems), and introduce other inputs (ranging from technologies to land tenure arrangements) appropriate to both environment and local community.

As of December, 1981, social forestry projects in the Philippines were reported to cover almost 500,000 hectares, or about 2.7% of the public domain (Bernales, Sagmit, and Bongalos 1982). At the time of that inventory, there were 255 projects, 224 of which were government, 15 non-government, and 16 combined government and private. Most of the government projects were being carried out by the BFD (177 projects) and by the Presidential Assistant for National Minorities (PANAMIN, 25 projects).

Prior to 1982 the BFD offered two types of social forestry programs. In Communal Tree Farming projects the BFD and local communities (municipalities) entered into 25 year renewable lease agreements for individual participants to raise trees and agricultural intercrops on allocated (supposedly two hectare) plots of land. The BFD was to provide technical assistance; while participants purchased seedlings and provided labor (Aguilar 1982). The BFD was also to provide market linkages for the CTF forest products. The BFD 1982 annual report claims 461 CTF projects and 22,680 participating families.

Forest Occupancy Management projects of the BFD allot up to seven hectares to individual kaingineros through a two year renewable permit. In these projects the BFD supplies technical assistance in the form of agroforestry planning and possibly other appropriate income-generating activities. The participant need not plant particular tree species, but must not contribute to environmental destruction and can no longer practice shifting cultivation. That is, the program attempts to encourage agricultural intensification and permanent cropping patterns. The BFD 1982 annual report claimed 77 projects, 19,622 participating families, and 16,173 hectares for the program.

The FOM and CTF programs were subsumed in an Integrated

Social Forestry Program of the bureau in 1982. This program will grant 25 year renewable "stewardship contracts" for plots of up to seven hectares to project participants. Technologies employed will be varied; but will emphasize agroforestry, participatory approaches (involvement of community members in as many project activities as feasible), and other inputs deemed locally appropriate.

The PANAMIN projects involve cultural minorities. In a PANAMIN project with a Mindoro Mangyan group studied by Bernales and De la Vega the inputs included, "...introduction of upland agricultural technology, establishment of a marketing system, food and medical assistance, and legal or para-legal assistance" (1982:i). The project started with carabao dispersal, infant feeding, and loan projects. Present activities include medical treatment, reforestation, goat dispersal, legal services, a cooperative, and a piggery. Reforestation activities include seedling preparation (of Peruvian and native ipil-ipil, lanzones, ipil-ipil, calamansi, rambutan), planting (of the above and coffee), and distribution of various tree species.

THE ANTIQUE UPLAND DEVELOPMENT PROGRAM: In addition to the LFD and PANAMIN projects, several other specific "social forestry" projects have recently received considerable attention. Several of these were reported on in a series of studies commissioned by the bureau's Upland Development Working Group. The Antique Upland Development Program is a project funded by the provincial government of Antique and the Ford Foundation. The Antique farmers of the project area are reported to be slash-and-burn subsistence producers of rice, corn, and some peanut. Incomes are supplemented by firewood and charcoal production, and by wage labor out of the community. Basic project goals are to develop means for achieving economic self sufficiency and to restore upland ecological stability. The project has developed a nursery and demonstration center with areas for reforestation, pasture, orchard, field crops, and vegetables and other cash crops. Bench terracing, strip cropping, and contour farming techniques are demonstrated. New crop varieties and new tree species have been experimented with. Specific project activities with farmers include a mango production scheme, a coffee growing venture, a cattle fattening plan, a goat raising and dispersal program, and encouragement of the adoption of a "Self-Sufficent-Small-Time-Farmers" concept in which participants are to raise various crops, trees, (including cash fruit and vegetable crops), and animals within a three to five year period. "SSSTF" farmers are to divide their two hectare lots into homelot, farmlot, pasture, and woodlot. Unlike many other social forestry project areas, the Antique program area is largely "alienable and disposable" even though it is clearly "upland". Most of the farmers of the project area are owner-cultivators (Bernales and De la Vega 1982).

HUNANOO MANGYANS: A United States Peace Corps project working with Hunanoo Mangyans in Occidental Mindoro has concerned itself with land security, economic activities, health conditions, and children's education. The project area is classified as forested by the BFD, and includes old and young growth, some areas reforested through the project, and areas producing root crops and some rice and fruit trees. Perhaps the most important project input has been the incorporating of a local group and the subsequent securing from the BFD of a 25 year lease for 1,340 hectares. Some other project inputs include plant nurseries, introduction of the carabao as a work animal, introduction of new cultigens, water and weed control measures, a crop warehouse, a blacksmith shop, introduction of organic fertilizers, and encouragement of cottage industries (Bernales and De la Vega 1982).

THE KALAHAN EDUCATIONAL FOUNDATION: A project with the "Ikalahan People" in Nueva Viscaya similarly involved legal incorporation of a local organization (The Kalahan Educational Foundation) and the securing of a 25 year lease for 14,730 hectares from the BFD (indeed, this project served as the model for the Mangyan lease described above). The Ikalahan are described as a traditional swidden agricultural group, producing rice (from terraced fields), rootcrops, ginger, and some fruit trees. Income is also generated from the manufacture of brooms and through wage labor outside of the area. KEF projects include: fire control measures (firebreaks), environmental protection measures such as the prohibition of cultivation in two watershed areas on the lease area, cottage industry development, reforestation, orchard development, nursery development, and research on upland agricultural systems. Since fires are a local problem, the project has attempted to regulate field firing and is fining those allowing fires to go uncontrolled. Lease area residents are entitled to 15 hectares of land. The social forestry project itself combines land-use regulation and improvement of environment and production (Aguilar 1982).

BRBDP-BUHI: Aguilar also reported on an agroforestry/watershed development project in the areas surrounding Lake Buhi in Camarines Sur. The project--being carried out by the Bicol River Basin Development Program and USAID, with support from the Buhi municipal government--includes in its goals, "...the improvement of the socioeconomic condition of the area's upland farmers and the arrest of environmental degradation as well as the conditions which will allow the repair of damage already inflicted on the ecosystem" (1982: 149). Technologies and strategies for project participants include bench-terracing, nursery, orchard and firewood lot development, and farmers' training seminars. Project "primary cooperators" received a 50 percent subsidy for their labor inputs. Two demonstration farms have been established to introduce vegetative terracing, contour ditching, bench terracing, and the planting of cover crops. Project area farmers are reported to practice swidden agriculture on parcels that are owned (through inheritance or purchase), tenanted, or borrowed. Most of the land is titled. Some of the area is still covered with some forest trees. Cropping systems include fruit trees, abaca, rootcrops, and some corn and rice. Other income comes from outside wage labor. Apparently the participants have received additional income from project employment and from the subsidies, and have received free seedlings (Aguilar 1982). Farmer adoption of new technologies has been very limited. The project has emphasized farmer training and organization and its own demonstration nursery and farm.

A grab-bag of other projects and their favored technologies include: The Baptist Out-of-School Training Program in Davao del Sur trains school drop-outs to return to their respective communities to train others. Their major project is designed to rehabilitate eroded hillsides through the thick planting of ipil-ipil strips along contour lines, monthly pruning of the trees, combined with the planting of crops of different harvest times (rice, corn, beans, peanuts/camote, castor beans/gabi, pineapple/permanent crops such as coffee, cacao, citrus). This "Sloping Area Land Technology" (SALT) thus, combines agroforestry and contour erosion control.

PICOP: The Paper Industries Corporation of The Philippines agroforestry development project (with considerable outside funding) aids landowner-farmers living near its Surigao del Sur paper mill to raise fast growing tree species for sale to the mill along with intercropped annuals--rice, corn, root crops, and vegetables.

WORLD NEIGHBORS: The World Neighbors project in Cebu utilizes cooperative labor to install contour ditches for erosion control and eventual natural terracing. Planting of napier grass on ditch bunds, composting, organic fertilizers, crop diversification, and water-soil traps are also a part of the project.

LAND TENURE. Up to this point this paper has described a situation in which the BFD is the major landlord of the upland and forest areas. The BFD can and has granted two year renewable permits to its Forest Occupancy Management project participants, 25 year renewable leases to Communal Trece Farm participating communities, 25 year renewable stewardship contracts to participating Integrated Social Forestry community residents, and 25 year leases to legally incorporated organizations (Kalahan and the Mangyan group in Mindoro). These use rights have been granted in recognition that legal prosecution of upland settlers/occupants is ineffective and in light of the acccepted view that land insecurity results in mismanagement and unwillingness to intensify or otherwise invest in the land. So far, so good. However, the situation regarding land tenure in the uplands is not so simple.

Lynch (1983) cites a number of national laws which ostensibly protect the property rights of upland indigenous Filipinos, even though they lack paper titles. Moreover , "The Public land Act provides that Filipino citizens who have continously occupied and cultivated, either by themselves or their predecessors-in-interest) agricultural lands of the public domain since 4 July 1945 shall be conclusively presumed to have performed all the conditions essential to a government grant and shall be entitled to a certificate of title" (Lynch 1983).

Agricultural lands are considered as "alienable and disposable". Land used to be considered as "agricultural" when applications for titles were submitted; and the Bureau of Forests had to file an objection if that land was to be classified as forest. Now, however, lands a part of the public domain are automatically assumed to be forest by the BFD.

As a step beyond the Public land Act, President Marcos in 1974 declared that, "...all unappropriated agricultural lands forming part of the public domain...and cultivated by ethnic minority citizens since 1964 are alienable and disposable." The BFD continues to claim that it must certify lands as alienable and disposable. In yet another step to promote responsible land utilization and to acknowledge the entrenched existence of the forest occupants, the Revised Forestry Code of 1975 says: "Kaingineros, squatters, cultural minorities, and other occupants who entered forest lands before the effectivity of this code without permit or authority, shall not be prosecuted provided that they do not increase their clearings" (cited by Lynch 1983). The "cutoff" date was later extended to December 31, 1981 (LOI 1260, Lynch 1983).

Several laws pertain specifically to indigenous groups. The Ancestral Land Decree of 1974 says that lands settled by ethnic minorities since 1964 are also alienable and disposable; and PD 1414 prohibits the BFD from issuing permits, leases, or concessions for tracts of land unless PANAMIN first certifies that no tribal Filipinos reside in the area. Reservation for "non-Christian" Filipinos have been established since the 1940s; but encroachment by migrants, loggers, and others continues to be a problem. Indigenous groups and migrants protected by the Revised Forestry Code continue to be displaced by loggers, "unauthorized migrants" (according to Lynch 1983), as well as resettlement programs sponsored by the Ministry of Agrarian Reform, agribusiness, and hydroelectric dam construction. A recent (1983) proclamation by the BFD grants 1.5 million hectares of uplands to the ministry of Human Settlements for development as "agroindustrial estates". Lynch (1983) says that national land laws for ethnic minorities exist but are not implemented. Migrants settling in upland areas prior to 1945 are similarly protected by law; and migrants settling in the uplands prior to December 31, 1981 are presently at least not subject to prosecution (i.e., eviction?).

In sum, current forest policies of the Philippines apparently acknowledge that forest populations are continually increasing and that eviction of such populations will not be possible. Recognition of upland use rights and ownership has been, at least by law, given to indigenous uplanders and relatively early migrants. Land use rights are also being granted to upland and forest communities through various projects and programs recognized or sponsored by the government. The current major government program (Integrated Social Forestry) explicitly contends that there is a need to grant security of land tenure if upland and forest communities are to participate in the maintenance, protection, and sustainable long-term use of their resources. Thus, BFD programs are attempting to avert the ongoing "tragedy of the commons" through making individuals and communities, if not outright owners, at least holders of recognized rights over their upland farms.

At the same time, projects, programs, universities, and agencies concerned with forest and upland issues are attempting to develop sets of inputs or technologies appropriate to the forest/upland ecosystems and to those utilizing those ecosystems. The ideal technology is usually described as environmentally sound, socially acceptable, and economically productive. Candidate technologies and sets of technologies are being combined with land tenure policies and are being introduced as project inputs throughout the Philippines. Some of the technologies have been briefly described; programs and projects have been identified; and polices concerning land tenure have been mentioned.

But the key questions remain. Are the ideal technologies being developed? Can the types of projects and programs described effectively introduce and support such new technologies and policies? How productive are such technologies and sets of technologies? Does security of land tenure actually lead to more environmentally sustaining resource use practices? The remaining portion of this paper will review what data is available to answer some of these questions. Unfortunately, the lack of needed information necessitates our closing with a present and future research agenda.

PRODUCTIVITY OF AGROFORESTRY SCHEMES. Although it is generally expected that agroforestry and related upland development technologies can lead to more productive use of marginal upland areas, actual data on the productivity, especially in the long run, of various agroforestry schemes are few. Where available, productivity data are normally expressed in terms of technical productivity, i.e., biomass yield per unit input. Only a handful of studies go as far as to compute for the economic productivity of agroforestry systems. Several reasons can be cited for the dearth of technical and economic productivity data: (1) The long term nature of agroforestry systems makes it difficult to estimate yields and actual productivity. Case studies currently being conducted have for their subject agroforestry projects that are still relatively young. Hence, it is still too early to come up with a measure of such systems' long run productivity. (2) Unless there is rigorous record keeping, the staggered harvesting of output in agroforestry systems, as in other subsistence systems, makes it difficult to keep track of actual output. (3) Studies and evaluations of upland development projects have been focused more on the project management and implementation and lessons learned from these, rather than on actual productivity and profitability.

Since agroforestry is the most important component of the mix of upland development packages, the following discussion revolves around agroforestry schemes. There has been a tendency to equate agroforestry with the planting of ipil-ipil (PCV, 1980). As a reflection of this tendency, most available productivity data are estimates involving ipil-ipil, especially of the giant or K varieties. Most agroforestry have dealt with institutionally supported development projects rather than spontaneous, non-externally induced agroforestation (Aguilar 1982 ;Bernales and De la Vega 1982; De los Angeles 1982;Sajise 1980; Rice 1980; Tapawan 1981; PCV 1980). An exception is the intensive case study conducted by Fguu and Corpuz (1980) of two kaingineros practicing some form of agroforestry out of their own initiative.

Some of the earlier productivity and profitability figures in the agroforestry literature are presented in Table 3. These figures demonstrate that venturing into agroforestry would be economically desirable for the upland farmers. According to more recent reports, however, productivity and profitability performance turn out to be lower than initially expected. For example, expected net returns to agroforestry with ipil-ipil in the Visayas has been initially estimated to be P700 per hectare per year. Average annual net income was later found to be only P290 per hectare (Durst 1980).

CONSTRAINTS TO HIGH AGROFORESTRY YIELD. The yield gap in agroforestry schemes derives from both overestimated standards against which actual yields are measured and a host of other common and very real situations in the field. Projected output from agroforestry systems are normally based on experimental or ideal conditions and management practices usually not replicable in upland kaingin farms.

For one, actual material inputs such as water and fertilizer are not always available, and if they are, not in the quantities required for optimal growth. The effects of water and fertilizer deficiency on the biomass yield of six commonly recommended agroforestry species, for instance, has been demonstrated by to be significant (Samson 1981; See Table 4). Actual productivity in the upland farmer's field would, therefore, be generally lower than what the early literature would lead one to expect.

Agroforestation requires some minimum amount of capital resources as well as cash for use in land preparation and in the purchase of seedlings and other inputs.Financial constraints generally prevent farmers from applying inputs in the recommended amounts, thereby reducing production levels. Immediate demand for cash may also cause fuelwood, pulptimber, etc. to be harvested for sale or home consumption before optimum sizes are reached. The lack of cash for even the basic subsistence needs of upland households influence the choice of crops plant. Short term crops that could be directly consumed or readily sold where markets are available, are favored over long maturing perennial crops (Nguu and Corpuz 1980).

Aside from material and financial constraints, labor may also be a constraint in agroforestry systems. Many modern agroforestry and related erosion control technologies are labor intensive. This labor intensity has been identified as one of the major obstacles to agroforestry practice (UHP,1980). In Eastern Bohol, the total manlabor requirement for ipil-ipil leaf and fuelwood production per hecare for the first harvest was placed at about 170 mandays and 50 and 94 mandays per hectare for the second and third harvests, respectively (Table 5). These represent a rather substantial addition to the competing demands on available labor (Durst 1980).

Productivity suffers where there is insufficient household labor or no institutionalized set-up such as bayanihan or other forms of exchange labor that would make extra-household labor available when needed. Agroforestry projects, especially those supported by the government, are premised on the availability of household labor as well as on the absence of alternative employment, implying near zero opportunity costs to labor. In fact, a strong justification for having small kaingin communities participate in agroforestry efforts is that the uplanders can use their own labor in the process, with the government then providing only a small amount of financial support (Duldulao et. al. 1977). However, it must be noted that most upland communities are sources of informal marginal labor to lowland agriculture, service and industry (Floro 1980; Tapawan 1981). In areas isolated from market centers by lack of transport and communication facilities and where there are no sources of wage labor demand, illegal logging is often a more lucrative alternative to agroforestation .

Competition for available labor between and among tree crops and short term crops also occur within upland farm systems. As expected, short term cash crops have priority over tree crops; and among tree crops, early bearing types are preferred over long maturing ones (Tapawan 1981). In Pantabangan, labor available for planting and tending fruit trees reportedly diminished during the onion planting season. In that case onion is the cash crop in the area (De los Angeles 1982).

Such realities as a neighbor's stray animal (goat, chicken, pig, cattle and carabao) can also to be blamed for lower yields and productivity. Citations of stray animals often appear in the literature as a major problem and source of conflict among farmers engaged in agroforestry (Aguilar 1982; Rinconada-Buhi Agroforestry Project Management 1980; PCV 1980). Minutes of meetings of upland farmer groups would invariably have this problem in the agenda (SAMABUN Records; PCV 1980).

Rodent attack on outplanted tree seedlings have also been noted to negatively affect productivity. Especially susceptible was the K-8 variety which the rodents found more to their liking than the K-28 and the native varieties (Balmocena 1979; See Table 5).

The human component, i.e., the upland farmer or farm laborer himself, his attitudes and feelings, has been ffered as a contributing factor in agroforestry yield and productivity. Bernales and De la Vega (1982) report the burning and uprooting of trees and seedlings in BFD-financed projects following delays in the payment of wages for contractual laborers and disagreements in the manner of payment. De los Angeles (1982) also reports similar burning incidents in the BFD reforestation project in the Pantabangan watershed. In this case, burning of tree seedlings was caused by the desire of the upland farmers to be continuously employed in the project, something which is not possible if the reforestation area were completely replanted.

PARTICIPATION IN UPLAND DEVELOPMENT PROJECTS. The recognition of the importance of the human component in upland development efforts has given rise to so-called participatory approaches to upland development wherein upland residents are encouraged to share in project decision-making. Ideally, decision-making should start from the bottom going up. However, genuine participation in the field still has to be realized. A question repeatedly raised by project implementors and evaluators is whether involvement in the project constitutes participation (Aguilar 1982). Most of the so-called participation in agroforestry projects are limited to the provision of labor, attendance of seminars and meetings to choose tree species to plant. Involvement in setting up project objectives has been very limited (Bernales and De la Vega 1982; Aguilar 1982). It has been suggested that the lack of substantive participation in upland development projects may be due to inability of upland farmers to translate their needs into strategies even if they are clear of their wants and needs (Fujisaka 1983). The attitude of project implementors may also have discouraged popular and genuine participation. Reports indicate a top-down flow of decision-making where compliance is a foregone conclusion. The following is an illustration: "Using the demonstration area as a basis, the Trustees and Agro-Forestry staff will attempt to convince all the resident farmers to become cooperating farmers and voluntarily implement all the improved technologies which are being developed. This should not be very difficult but in case a few farmers should object, they will be eventually required to implement those technologies in spite of their objections." (Rice 1980:192).

QUESTIONS ON THE APPROPRIATENESS OF THE RECOMMENDED AGROFORESTRY TECHNOLOGY. It could be recalled that with the "rediscovery" of the giant ipil-ipil, technocrats made blanket recommendations for the massive planting of ipil-ipil especially in marginal areas. Hence, many current agroforestry technologies are ipil-ipil based. Aside from being a fast growing species, the popularity of ipil-ipil stems from its ability to fix nitrogen, survive drought and thrive better than other plants in adverse ecological environments (Samson 1980; Mendoza and de la Cruz 1978).

However, the blanket recommendations were made without prior studies as to the suitability of ipil-ipil to local conditions. Later reports on the so-called "miracle tree" show that, contrary to popular belief, the fast growing ipil-ipil is just as exacting in its requirements as any other economic plant. As a reforestation and agroforestry crop, its management could, likewise, present formidable difficulties (Halos 1980). Questions have also been raised on the emphasis on ipil-ipil and very few other species on the ground that this runs counter to the ecological principle favoring gene pool diversity (Kummer 1983).

Several experiences can be recounted to underscore the fact that the ipil-ipil based agroforestry technology still needs fine tuning and/or scrutiny. A field experiment conducted by PESAM at its Mt. Makiling Research Station evaluated the effects of ipil-ipil and kakawate (gliricidia sepium) contour strips on the productivity of interplanted upland rice Grain yields in the non-stripped (control) plots were

Value of the rice output per peso of total input cost was P0.09 for the stripped plots and P0.21 for the non-stripped plots (Samson and Capistrano 1983).

As a means of erosion control, however, the strips were found to be effective only during the first two heavy rain events when the plots were still devoid of vegetatin cover. During succeeding rains , by which time the rice plants already provided ground cover, erosion rates did not vary significantly in plots with and without the strips.

An initial report on an ipil-ipil - camote -ubi intercropping experiment in Mt. Makiling of the UPLB Upland Hydroecology Program likewise indicated lower rates of soil erosion with intercropping. Ipil-ipil growth with intercropped camote and ubi, however, was observed to be lower than in a pure ipil-ipil stand. Unfortunately, productivity and yield data on the intercropped camote and ubi were not yet available at the time of reporting (Jacalne and Florece 1980). Although the reported experimental results were preliminary and still need further investigation, it would seem that available agroforestry technologies have yet to reconcile the opposing objectives of high production and low erosion rates.

Questions about the suitability of ipil-ipil based technologies in certain areas have been raised not only by farmers but by project implementors as well. Several examples can be gleaned from the PCV Agroforestry Group 120 Report (1980). Planting of giant ipil-ipil in Camarines Norte, was found to be impractical because of susceptibility to breakage during typhoons that regularly sweep through the area. This not only results in lower ipil-ipil yield but also damages the other crops with which it is planted. In Eastern Bohol, an area with an even distribution of rainfall throughout the year, planting ipil-ipil for leafmeal production was found to be impractical because there was not enough sunshine to dry the ipil-ipil leaves. In Capalonga, also in Camarines Norte, ipil-ipil-coconut intercropping technology met with resistance from the upland farmers because ipil-ipil competes with the coconut plants for phosphorus. Coconut harvesting is also made a lot more difficult by the presence of the ipil-ipil intercrop.

Indeed, experience has led to the realization that agroforestry is not a "cure all, strike everywhere and anywhere sort of technology" and that it has differential potentials in different areas. Such a realization has caused the Forest Research Institute to focus its technical research on the biology and ecology of agroforestry species in different site conditions, varietal/species selection and improvement, and rediscovery of promising indigenous species for agroforestry systems (Generalao 1979).

LAND SIZE, TENURE AND AGROFORESTRY TECHNOLOGY ADOPTION. The government views agroforestry technology transfer as an important means of achieving upland development. This is apparent from the number of government financed agroforestry projects located all over the country. However, aside from the above mentioned factors constraining upland farmers from practicing agroforestry, there are two commonly mentioned obstacles to technology adoption: (1) the small size of landholdings and (2) insecurity of tenure on the land.

The average landholding size of an upland cultivator has been estimated as ranging from one to five hectares (Floro 1980; Tapawan 1981; PCV 1980; De los Angeles 1982). It is generally agreed that these land holdings are small. It is no secret either that the quality of the land resource in the uplands severely limits returns per unit of land. Hence, larger land areas are required to support the subsistence needs of the upland cultivator and his family. De los Angeles (1982) notes the tendency of compensating for poor land quality by cultivating larger areas.

The need for studying the optimum farm size that could support the subsistence needs of the kainginero household and at the same time allow him to engage in agroforestry has been pointed out to be an important research question (De los Angeles 1982). Tapawan (1981), referring to the problem of small land sizes in the AUDP area, suggests that agroforestry schemes should initially have annuals as an important component. Cadelina (1983) recommends that allocation of land to cooperator-farmers in agroforestry projects should take account of the particular stage of a household's lifecycle. Paying attention to the stage in the household's lifecycle will enable project implementors to more realistically assess labor availability as well as subsistence needs. Other than the general observation that small land sizes hinder adoption of agroforestry technologies, there are no systematic investigations on the direct relationships between land size and/or quality with the conduct and extent of agroforestry.

It would appear that farm size needs to be operationally defined for purposes of socio-economic investigation. Apparently it is not only farm size per se that is important but also the size of area under fallow and other areas the household has access to. An intensive case study of two kaingineros by Nguu and Corpuz (1980), for example, showed that the area being cultivated and planted to annuals is small; but that the kaingineros planted perennials in their fallows, and convert an average of 1000 square meters of forest area per year into kaingin. Conversion is subject to the availability of labor, availability of existing kaingin areas, expectation regarding price of their products, and the needs of the family for subsistence.

Land tenure security assumes importance in the agroforestry literature primarily in relation to the adoption of agroforestry technology. The literature is replete with accounts of uplanders feeling the need for an assurance that the lands they currently occupy and cultivate will not be taken away from them (Samonte 1980; Sajise 1980; Rinconada-Buhi Agroforestry Project Management 1980). Tenure insecurity supposedly effectively shortens the farmer's planning horizon and biases his land use practices in favor of short term crops with immediate returns and high profits but which often degrades the environment (Mindajao 1979) To the general question of whether or not security of tenure for upland or forest farmers leads to more productive and environmentally sound management practices, i.e., intensifsication and greater investment by individual farmers in their farms, available literature seems to imply an affirmative response although this is one area that still has to be subjected to a more thorough investigation. The following example can be cited. In Buhi, Camarines Sur, even after terraces were constructed through external funding, the tenant farmers were hesitant to plant perennial crops because of uncertainty of sharing future produce. Land owners were also apprehensive that the tenants may lay claim to the terraced lands (Rinconada-Buhi Agroforestry Project Management 1980).

Although the granting of private titles to the land may arrest short term exploitative land use practices, it has not been generally regarded as a way of ensuring that the upland cultivators keep the land. The granting of private titles has been viewed as an easy, albeit indirect, way of losing the land to wealthier uplanders, migrant lowlanders and/or speculators (Aguilar 1982).

The long term communal lease granted by the BFD was a move to provide security of tenure as well as limit the open access nature of the uplands. In the Kalahan case, with the lease, upland farmers were reported to have taken measures to police their own ranks, thereby preventing and checking the overexploitation of the forest reserve by some members of the community and especially by non-members (Aguilar 1982).

Although upland cultivators are reported to generally feel they can sleep better with secure land tenure, agroforestation is not limited to those who actually possess some form of tenure security. Land titles, as they are known to lowlanders, seem not to be intrinsically important to indigenous/tribal groforestry practitioners. A well defined system of land claim that is respected by all in the community serves the purpose just as well, if not better (Rice 1980; Aguilar 1982). It is only when a threat is present, i.e., the danger of losing the land to some other groups or to the government that the question of tenure security becomes very critical. This could be observed especially in groups which have had prior experience with competing land claims as in Pantabangan. In some areas, however, as in the case of the Masalukot farmers on the slopes of Mt. Banahaw, despite legal battles over land ownership, the community has a very good system of agroforestry consisting of horticultural and agronomic crops. De los Angeles (1982) notes two types of farmer cooperators in the Diadi Agroforestry Project based on the willingness to take risk. The risk takers were observed to have fully planted their farms with agroforestry crops even without secure tenure. One could speculate therefore that for farmers who are both risk takers and familiar with agroforestry technologies, agroforestry will be practiced despite tenure insecurity. Or, that the feeling of tenure security is not the main factor in agroforestry technology adoption.

Efforts to sell the agroforestry technology package through information dissemination backed with inputs and resource availability have met with limited success. Project implementors often complain about the refusal of upland farmers to involve themselves in the project (Rinconada-Bubi Agroforestry Project Management 1980). Clearly, a successful agroforestry or upland development project needs more than just technology transfer, tenure security and the provision of inputs. De los Angeles (1982) mentions other requisites, namely: organization building among cooperators, complementarity with other upland development projects, human resource development and marketing. Experience in some areas, particularly in Villarica, Pantabangan, however, has shown that an equally important ingredient was missed in the above listing -- the equitable distribution of benefits from the communal agroforestry effort.

ECONOMIC CONSIDERATIONS IN AGROFORESTRY. Agroforestry technology, just like any other technology, must be consistent with the upland farmer's optimization behavior for it to be adopted. While factors such as land size, tenure, labor, cash and capital availability, profitability and alternative income sources are apparently important, little is known about their relative importance in quantitative terms. In the final analysis, however, the upland farmer must first be convinced that there are benefits to be derived from the practice of agroforestry in excess of what the practice would cost him. The question that he asks of himself is, "What is in it for me?".

Although recognizing the subsistence orientation of upland cultivators, studies in the economics of agroforestry tend to make the a priori assumption that upland farmers are net profit maximizers, and by implication, an agroforestry scheme that is shown to be profitable must also be desirable and hence acceptable. Profitability of agroforestry activities over time is usually judged using the net present value criterion. The application of this evaluation method in Philippine agroforestry, however, has so far been confined to the PICOP agroforestry program (Tomboc 1978; Mindajao 1979). An exception is Corpuz´ (1979) attempt to compare returns from a traditional agroforestry system in Mt. Makiling with an Albizzia falcataria based system in PICOP´s agroforestry farm.

Most other computations of the profitability of agroforestry schemes consider the short term and often pertain to returns for a single year or cropping season. Results of long term profitability studies demonstrate the economic desirability of agroforestry; but short term studies show less profitable, if not downright unprofitable results (Samson and Capistrano 1983; Durst 1980). Durst (1980) reports that although gross income from agroforestry in Eastern Bohol appeared reasonably competitive with other activities, net income came out less than all the direct costs and marketing costs incurred.

The existence and feasibility of markets was pointed out to be of major importance in determining economic returns and consequently, incentives to agroforestation (De los Angeles 1982; Tapawan 1981; Durst 1980; Sajise 1980). Indeed, markets and price considerations affect the economic desirability of agroforestry in particular and upland development programs in general . Existing markets generally favor annual crops like garlic, vegetables, rice, corn and others, providing incentives to the cultivation of this crops rather than tree crops. Case studies in upland development show, however, that most upland development projects did not usually include markets as a consideration in the planning phase. If it was considered at all, the projections were either overly optimistic or downright unrealistic. The results of such an oversight are manifested by complaints among upland farmer-cooperators of absence or inadequacy of markets and marketing infrastructure, low output prices and high input costs.

The following is a fairly common example of marketing problems faced by upland farmers. In Capalonga, Camarines Norte, farmers worry about markets for ipil-ipil leaves and charcoal should they participate in the agroforestry project of the Peace Corps

Volunteers. There are no feed mills to buy the ipil-ipil leaves in the province and fuelwood is plentiful and would remain so for the next five years. The low market price for ipil-ipil leaves (P0.50 per kilo) and charcoal coupled with high transportation costs make transporting of the ipil-ipil products to markets outside the province prohibitive (Kennedy and Fowler 1980).

SUMMARY AND SUGGESTED RESEARCH AGENDA. Available literature on Philippine upland development focusing on tenure issues, available upland development technology and productivity of agroforestry schemes reveal the following:

1. Many of the upland areas currently provide common access resources to present occupants. Environmental degradation represents a "tragedy of the commons" in which resources are overutilized and otherwise mismanaged by local residents given that they are available to all but owned by no one.

2. Soil conservation and slope stabilization technologies often used in combination with

agroforestry projects include: strip cropping of fast-growing species, bench terracing, contour ditching, contour planting and wood lot establishment.

3. Social forestry projects and programs provide opportunities for involving communities in the effort to rehabilitate and develop the uplands as well as test the applicability of available technologies. As of yearend 1981, 255 ssocial forestry projects covered 500,000 hectares or 2.7% of the public domain.

4. The government, through the BFD, tries to avert the on-going tragedy of the commons by granting upland cultivators rights over their upland farms. These rights include two year renewable leases granted to FOM participants, 25 year renewable leases to CTF participating communities and legally incorporated organizations and 25 year renewable stewardship contracts to ISF participants.

5.Tenure insecurity is generally thought of as biasing land use practices in favor of crops that yield immediate returns but, unfortunately, cause environmental degradation. However, there are no studies investigating the direct quantitative effects of tenure on the environment, productivity of the farm system and intensification of upland cultivation.

6. Data on technical and economic productivity of different upland production/agroforestry systems are few and where available, are (a) usually based on controlled experimentation, (b) limited to short term, i.e., one season or one year estimates, and (c) usually based on combinations of ipil-ipil and other crops. The last is a reflection of the predominance of ipil-ipil based technologies in upland development projects.

7. The literature tends to overestimate productivity and profitability of agroforestry systems. The discrepancy between projected estimates and actual figures derives from differences in resource quality and availability in ideal experimental conditions and in farmers' fields. Constraints to high agroforestry yield include: lack of material, cash, capital and labor inputs; stray animals and pest infestation; and inappropriate technology.

8. Although programs and projects aim for community participation in the development effort, "real participation" has yet to be defined and operationalized. Participation has so far been mostly in terms of contributing labor, attending seminars and meetings. Upland communities have not had much say in project decision-making.

9. A number of reports on experiences with the use of ipil-ipil based agroforestry technologies point to the need for further fine tuning and/or scrutiny of these technologies. Questions revolve around the technical viability, economic feasibility and suitability to site specific bio-physical conditions.

10. In addition to the factors constraining agroforestry yields, thereby reducing the attractiveness of agroforestry to upland farmers, small size of landholdings and insecurity of tenure on the land are two oft-mentioned obstacles to adoption of agroforestry technology. However, cases where agroforestry has been practiced despite the absence of tenure security can also be noted.

11. Studies on the economic returns from agroforestry systems deal mostly with specific short term cropping combinations; long term studies have been limited to the PICOP agroforestry program. In general, studies of long term economic returns yield favorable results; short term studies show less profitable, sometimes unprofitable results. Markets for output from agroforestry systems and cost of inputs are the most commonly cited economic problems.

The following issues have not been addressed by existing literature and are therefore suggested as areas for further socio-economic research:

1. The relationship between tenure status, actual productivity and environmental protectiveness of upland production systems, i.e., are upland production systems with secure tenure more productive and less environmentally destructive than those with insecure tenures?

2. Upland farmer decision-making concerning the practice of agroforestry, i.e., what is the relative importance of which factors in deciding whether or not

to do agroforestry?; to what extent is the practice/ non-practice of agroforestry a response to market prices and economic policies?

3. The technical and economic viability of existing agroforestry technologies given current farming practices and available farm inputs, i.e., would the farmer be better off if he adopts the technology?

4. The income distributional impact of agroforestry technology in upland communities, i.e., whether upland households have equal access to the technology and whether they will be equally benefitted by it.

5. Costs of and returns to agroforestry relative to costs and returns of alternative upland production systems reckoned from both the individual upland farmer's and society's points of view.

TABLE 1: SOME AGROFORESTRY TECHNOLOGIES AND PROJECTS

TECHNOLOGY OR PROJECT	BENEFITS/FEATURES
1. Strip cropping of fast-growing trees along contour liines.	1. Natural terracing over time, soil conservation, water retention, fuelwood, fodder.
2. Traditional bench terracing.	2. Creation of paddy fields with control of water and soil; heavy labor inputs and favorable micro conditions required.
3. Contour ditching	3. Natural terracing over time, soil and water conservation.
4. Reforestation	4. Replacement of forest cover
5. Tree lots	5. Fuelwood, fodder, dendrothermal use.
6. Intercropping and multiple cropping	6. Both traditional and introduced cropping systems characterized by cultigen diversity, protection of soils with resulting canopy, continual nutrient recycling, continual harvesting; often low tillage.
7. "Taungya" system	7. Eventual evolution of farmed area from cropped to forest through initial planting of both crop and forest species.
8. BFD "Forest Occupancy Management"	8. Encourages permanent, more intensive land use than traditional kaingin farm-

	ing: granted renewable two year use permits for up to seven hectares.
9. BFD "Communal Tree Farming"	9. Tree and crop production on lands allocated to communities for renewable 25 year periods.
10. BFD "Integrated Social Forestry"	10. 25-year renewable "stewardship contracts": agroforestry, participatory approaches, other inputs.
11. AUDP's "Self Sufficient Small Time Farmer" strategy	11. Division of two hectare lots into homelot, farmlot, pasture, woodlot: introduction of cash crops, livestock, credit scheme, erosion control techniques.
12. US Peace Corps Mangyan Project	12. Incorporation of local group, securing of 25-year lease: wide set of upland development strategies.
13. The Kalahan KEF	13. Another 25 year lease from the BFD: fire control, environmental protection measures, reforestation, cottage industries, orchard, nursery development, land use regulation.
14. BRBDP-Buhi	14. Agroforestry, training, bench terracing, nursery development, subsidies to "primary cooperators", demo farms; project employment.
15. Sloping Area Land Technology (SALT)	15. Combination of strip cropping contour methods and mixed agroforestry.
16. PICOP	16. Farmers raise fast growing trees for sale to paper plant.

TABLE 2: LAND TENURE LAWS, REGULATIONS, AND DECREES

LAW/REG/DECREE	TENURE POLICY
1. BFD: Forest Occupancy Management	1. Two year renewable use permits
2. BFD: Communal Tree Farm	2. Renewable 25 year lease to communities
3. BFD: Integrated Social Forestry	3. Renewable 25 year "Stewardship Contract"
4. Public Land Act	4. Cultivators of Public Domain since July 4, 1945 entitled to certificate of title.
5. PD 389 (1974)	5. Lands cultivated by ethnic minority citizens since 1964 are alienable and disposable.
6. Revised Forestry Code of 1975: PD705	6. No prosecution of forest occupants provided they do not increase size of holdings: for those entering prior to 1975
7. LOI 1260	7. "Cutoff" date extended to Dec. 31, 1981.
8. Ancestral Land Decree of 1974	8. Lands settled by ethnic minorities since 1964 are A and D.
9. PD 1414	9. Prohibits BFD from giving land without PANAMIN certification that no tribal Filipinos live in the area.
10. BFD proclamation, 1983	10. Grants 1.5 million hectares of public lands to Ministry of Human Settlements.

TABLE 3: PRODUCTIVITY AND PROFITABILITY FIGURES CITED IN THE PHILIPPINE AGROFORESTRY LITERATURE

SPECIES/CROPPING SCHEME	PRODUCTIVITY	PROFITABILITY	SITE	SOURSE
GIANT IPIL-IPIL	FUELWOOD YIELD 208-312 CU.M./ HA./3 YR. ROT ROTATION			
K-28 PURE STAND	TRUNK YIELD: 45 CU.M./HA./YR. BRANCH YIELD: 4-10 CU.M./HA./YR.		CANLUBANG,SUGAR ESTATE, CALAMBA LAGUNA	BAWAGAN AND SEMANA, 197 CITED BY GENERALAO, 1
		$300/HA./YR. FROM IPIL-IPIL FUELWOOD SALE AT $0.15/BUNDLE ROADSIDE PRICE	U.P. AT LOS BAÑOS	GENERALAO,
		$250/HA./YR. FROM IPIL-IPIL FUELWOOD SALE AT $0.15/BUNDLE ROAD-SIDE PRICE	U.P. AT LOS BAÑOS	BENGE AND CURRAN, 197 AS CITED BY GENERALAO,
		$320/HA. CHARCOAL SALE AT $26.50/MT WHOLE-SALE PRICE	PICOP	
DIOSCOREA UNDER FOREST TREES	ROOT CROP YIELD 30 MT./HA.	$2000/HA./YR FROM ROOT CROP ALONE		LUGOD, 1975 CITED BY GENERALAO,
ALBIZIA FALCATARIA TREE PLANTATION	PULPWOOD FROM THINNING: 50 CU.M./HA AT THE FIFTH YEAR	COST-PRICE/CU.M. OF WOOD USING 1977 COST DATA FOR DIF-FERENT INDICES AND AGES RANGING FROM 2-15 YRS. DISCOUNTED AT 16% INTEREST RATE VARIES FROM ₱7.62 TO ₱115.15/CU.M.	NASIPIT LUMBER COMPANY BISLIG, SURIGAO DEL SUR	MINDAJAO, 1

TABLE 3. Continuation

SPECIES/CROPPING SCHEME	PRODUCTIVITY	PROFITABILITY	SITE	SOURCE
WOODLOT		₱3350 AT 1977 PICOP BUYING PRICE OF ₱67.00/CU.M. DE- lIVERED TO THE MILLSITE ₱14,500/HA. NET INCOME FROM HARVESTED WOOD ON THE EIGHT YEAR		AVELINO VERACION, 1979
NATIVE IPIL-IPIL	6-10 CU.M. STAKES PER YR. ON 2-5 YRS. ROTATION			AGPAOA ET.A 1975

TABLE 4: MEAN TOTAL OVEN DRY WEIGHT (GM) OF SIX REFORESTATION SPECIES SUBJECTED TO FERTILIZER AND WATER STRESS TREATMENT.

SPECIES	NO FERT. ADDED		FERTILIZER ADDED		MEAN
	WATER STRESSED	NO STRESS	WATER STRESSED	NO STRESS	
GMELINA ARBOREA	171.08	153.43	253.55	426.15	246.55
WRIGHTIA LANITI	32.88	38.68	65.30	26.53	40.85
GLIRICIDIA SEPIUM	135.85	166.96	150.38	208.85	165.52
ALBIZZIA PROCERA	91.60	126.18	102.73	130.98	113.37
L. LEUCOCEPHALA	86.18	101.10	56.88	94.58	84.69
SAMANEA SAMAN	105.10	114.30	144.13	187.19	137.68
MEAN	103.78	117.11	125.33	179.04	131.44

ANOVA:

SOURCE OF VARIATION	F-VALUE
FERTILIZER TREATMENT	12.62 **
WATER STRESS	6.34 *

SOURCE: SAMSON, B.K. 1981. EFFECT OF FERTILIZATION AND SOIL MOISTURE STRESS ON THE WATER RELATIONS OF SOME REFORESTATION SPECIES. UNPUBLISHED MSC. THESIS. UPLB.

TABLE 5: IPIL-IPIL YIELD, LABOR REQUIREMENT AND GROSS INCOME FOR THREE SUCCESSIVE HARVESTS IN EASTERN BOHOL.

	FIRST	SECOND	THIRD
LEAF PRODUCTION			
YIELD (KG/HA)	3080.0	1214.0	1672.0
GROSS INCOME (P/HA)	985.6	388.6	535.0
LABOR REQUIRED (MANDAYS/HA)	125.4	50.6	85.8
NUMBER OF PLANTS			
FIREWOOD PRODUCTION			
YIELD (KG/HA)	43.4	0.0	16.1
GROSS INCOME (P/HA)	1736.0	0.0	644.0
LABOR REQUIRED (MANDAYS/HA)	44.0	0.0	8.8
TOTAL PRODUCTION			
GROSS INCOME (P/HA)	2721.6	388.6	1179.0
LABOR REQUIRED (MANDAYS/HA)	169.4	50.6	93.6

GROSS INCOME FOR LEAF MEAL AT P0.32/
GROSS INCOME FOR FIREWOOD CT P40.00/

SOURCE: DURST, P.1980. A CLOSER LOOK AT IPIL-IPIL INCOME IN EASTERN BOHOL: A POSSIBLE LESSON FOR OTHER AREAS. FINAL REPORT ON AGROFORESTRY GROUP 120. PEACE CORPS PHILIPPINES.

TABLE 6: RODENT INFESTATION IN K-8, K-28 AND NATIVE IPIL-IPIL VARIETIES IN NSDB-FORI IPIL-IPIL PROJECT IN AGUSAN, MINDANAO.

	IPIL-IPIL VARITIES		
	K-8	K-28	NATIVE
% OUTPLANTED SEEDLING ATTACKED	79.00	19.00	19.00
% ATTACKED BUT CAN SURVIVE	32.00	8.00	12.00
% MORTALITY THRU NATURAL CAUSES	0.56	2.00	6.00

SOURCE: BALMOCENA, R. 1979. "RODENTS THREATEN IPIL-IPIL PROJECT IN MINDANAO. CANOPY.

TABLE 7: GROWTH AND PRODUCTIVITY OF UPLAND RICE IN IPIL-IPIL AND KAKAWATE STRIPPED AND NON-STRIPPED PLOTS, MT.MAKILING, CALAMBA,LAGUNA,1982

	STRIPPED	NON-STRIPPED	F-VALUE
HEIGHT (CM)	51.28 +/- 20.45	61.69 +/- 21.61	8.80 **
WEIGHT (GM)	3.60 +/- 4.03	6.88 +/- 5.50	16.61 **
NUMBER OF PLANTS PER HILL OF RICE	5.42 +/- 2.13	7.05 +/- 2.94	14.46 **
RICE GRAIN WEIGHT (KG.)	9.30	47.8	11.34 **

** SIGNIFICANT AT 0.01 LEVEL

FIGURES TAKEN DURING 4 SAMPLING DATES-33,64,93 AND 122 DAYS AFTER PLANTING

SOURCE: SAMSON,B.K. AND CAPISTRANO,A.D.N. 1983. THE EFFECT OF IPIL-IPIL CONTOUR STRIPS ON GROWTH AND ECONOMICS OF UPLAND RICE IN MT.MAKILING. ANNUAL REPORT OF THE MT. MAKILING CROPPING RESEARCH TEAM UPLB-PESAM.

TABLE 8: VOLUME AND VALUE OF RICE OUTPUT PER UNIT INPUT WITH AND WITHOUT IPIL-IPIL CONTOUR STRIPS

	STRIPPED	NON-STRIPPED
TOTAL RICE OUTPUT (KG)	3.5	9.0
TOTAL VALUE AT P4.00/KG.	P14.00	P36.00
VOLUME/UNIT INPUT		
KG.RICE/MANDAY LABOR	0.50	1.25
KG.RICE/KG.SEED SOWN	1.67	2.57
KG.RICE/P LABOR COST	0.02	0.06
KG.RICE/P MATERIAL COST	0.35	0.60
KG.RICE/P TOTAL COST	0.02	0.05
VALUE PER PESO INPUT COST		
P RICE VALUE/P LABOR COST	0.09	0.23
P RICE VALUE/P MATERIAL COST	1.41	2.41
P RICE VALUE/P TOTAL COST	0.09	0.21

SOURCE: SAMSON AND CAPISTRANO. 1983. THE EFFECT OF IPIL-IPIL CONTOUR STRIPS ON THE GROWTH AND ECONOMICS OF UPLAND RICE ON MT.MAKILING. IN: 1982 ANNUAL REPORT OF THE MT. MAKILING CROPPING RESEARCH TEAM. UPLB-PESAM.

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