TREE DOMESTICATION IN SOUTHEAST ASIA

Results of a Regional Study on Institutional Capacity for Tree Domestication in National Programs

H.P.M. Gunasena
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ICRAF

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3. *Acacia* hybrid nursery in Phutho, Vietnam (James Roshetko)
4. Incorporating high value timber species (*Melia dubia*) onto upland farms in Mindanao, Philippines (James Roshetko)

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Preface

Southeast Asia has an enormous range of economically useful species of indigenous trees. There is an abundance of timber, fruit, fodder, and industrial trees that have potential for further domestication. This makes it very difficult to identify priority species, and to focus enough resources on them to ensure good returns on research investment. As ICRAF began its efforts to support tree domestication in the region, we recognized the need to better understand what the various organizations engaged in tree domestication were already doing, what their priorities were, and what their capacity was to meet their objectives. In particular, we wondered what the gaps were that could most profitably be filled by regional collaboration.

The regional study reported in this volume was initiated to evaluate the current capacity of the various organizations in conducting tree domestication activities, particularly those directed to benefit smallholder farmers. The study followed a workshop that we convened on the 'Domestication of Agroforestry Trees in Southeast Asia' that attempted to set a regional agenda for domestication work. In the course of this study, the authors visited some 49 institutions in four countries: The Philippines, Indonesia, Thailand, and Vietnam. The particular countries that were selected where those where ICRAF currently has its strongest regional presence. The institutions visited were most of those that we observed to be involved with tree domestication work of benefit to smallholder farmers, or to have the potential to influence or conduct work in this area. It was not possible to visit every organization involved in some way with tree domestication, but those that were included offer a fair representation of the tree domestication capacity at the country and regional levels.

The information contained in this report was compiled from the inputs of the staff of the concerned organizations. It provides a picture of where current domestication efforts are focussed, and where the gaps may be. I want to convey our gratitude to Professor Gunasena and Mr James Roshetko for their exhaustive efforts in assembling and interpreting for us this unique base of information on tree domestication efforts in Southeast Asia.

Dennis Garrity
Coordinator
ICRAF Regional Programme for Southeast Asia

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TREE DOMESTICATION IN SOUTHEAST ASIA

Results of a Regional Study on Institutional Capacity for Tree Domestication in National Programs

1. Introduction

Tree domestication is human-induced evolution to bring species into wider cultivation through a farmer-driven or market-led process (Simons 1997). Tree domestication is a relatively new concept that represents a paradigm shift away from a focus on 'improving tree species' to 'accelerating species cultivation' to serve the needs of smallholder farm families. It is an iterative process that includes a wide range of activities - exploration and collection of natural populations; evaluation and selection of suitable species and provenances; breeding to develop superior cultivars; development of propagation techniques; multiplication and dissemination of germplasm; development of management techniques; utilization and tree product marketing; and the development and dissemination of relevant technical information. Strategies for individual species vary according to their functional use, biology, the target environments and the involved domesticator - researcher or farmer (Simons 1996). In an applied sense, tree domestication is the 'naturalization' of a species to improve its use by humankind.

The program on Domestication of Agroforestry Trees of the International Centre for Research in Agroforestry (ICRAF) has evolved since 1993 from its former program, Improvement of Multipurpose Trees. From its regional office in Bogor, Indonesia, and in collaboration with Winrock International, ICRAF initiated a program on agroforestry tree domestication for Southeast Asia in 1997. Southeast Asia is a diverse region containing various natural ecosystems in which many organizations and farmers are engaged in various domestication activities with a large number of trees and other plant species. In this context, it may be inappropriate for ICRAF to focus on a few 'priority' tree species in Southeast Asia. Instead ICRAF's regional domestication program will engage in a range of activities across species focusing on areas for which it has strategic advantages. The regional program will work in collaboration with regional partners. Partners may include other CGIAR centers or international research organizations, universities, private companies, international non-government organizations (NGOs) and development organizations, national government agencies, local NGOs, community organizations, farmer groups and individual farmers, as well as ICRAF's own program initiatives in: Natural Resources Strategies and Policy; Ecosystem Rehabilitation; Systems Evaluation and Dissemination; and Capacity and Institutional Strengthening. A synergistic combination of staff and resources will enable these partners and the domestication program to increase the impact of joint domestication activities to benefit regional smallholder farmers.

The procedure to set a longer-term agenda for the regional domestication program began in August and September 1997 at ICRAF's regional and global planning meetings where staff and partners shared ideas and insights. These meetings were followed by the Regional Workshop on the *"Domestication of Agroforestry Trees"*, held in Yogyakarta, Indonesia November 3 - 7, 1997. The workshop was sponsored by ICRAF, Winrock, and the Australian Centre for International Agricultural Research (ACIAR), and hosted by the University of Gadjah Mada (UGM) in Yogyakarta. It provided an opportunity for a larger group of partners to provide in-depth input to the agenda setting process for a regional domestication thrust.

Sixty partners, representing the groups listed above, attended the workshop. During the workshop the participants summarized the current status of domestication in the region and identified priority topics. They agreed that 'tree domestication' includes a broad array of activities as represented by the domestication continuum in Figure 1.

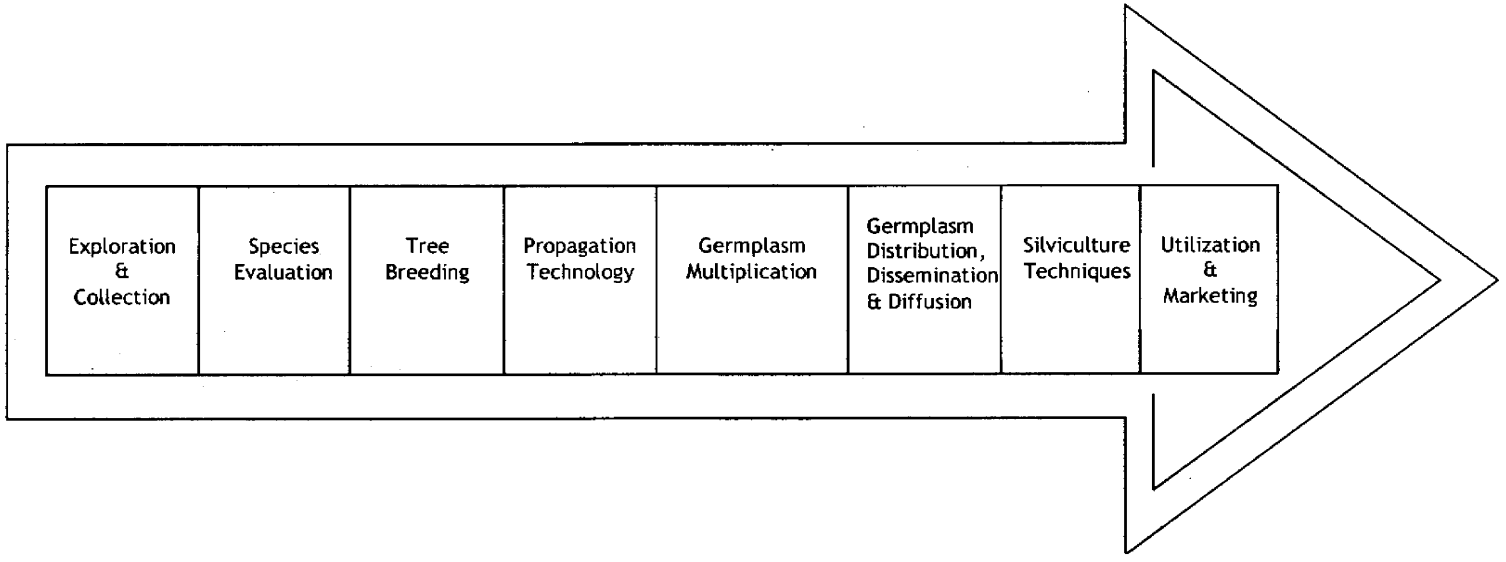

Figure 1. Tree Domestication Continuum. The various activities within the domestication continuum represent a general progression from the wild to genetically transformed state. However, the domestication of any given species will not necessarily follow a sequential flow from left to right. Some steps (activities) in the continuum maybe by-passed during the domestication process. Similarly, progress may flow back to earlier steps in the continuum as interest in or the economic value of a species develops further (Harwood et al. 1999).

The activities in which workshop participants are involved cover all aspects of the continuum. While individually separate activities may seem independent, they are all directly or indirectly related. At the workshop there was strong consensus concerning tree domestication priorities. Smallholder tree production systems, with special emphasis on timber and fruit species, were clear priorities across the region. It was confirmed that both indigenous and exotic species have important roles to play in these systems. Germplasm production, quality and dissemination were also identified as priorities, as were both seed-based and vegetative propagation methods. Concern was also expressed to address the marketing problems and policy disincentives that hamper domestication in many countries. An all-encompassing priority was additional training in relevant tree domestication topics and the dissemination of information in forms appropriate for various audiences involved in tree domestication - researchers, field workers and farmers. Regional priorities identifid at the workshop are listed in Table 1.

Table 1. Priority Tree Domestication Topics for Southeast Asia identified at the Regional Workshop (adapted from Roshetko, 1999).

Smallholder Agroforestry Systems

- incorporating timber and fruit trees
- incorporating multipurpose species which produce marketable commodities
- assessing both indigenous and exotic species
- evaluating silviculture and tree farming techniques for smallholders
- integrating indigenous knowledge into research on smallholder systems

Germplasm and Propagation

- germplasm quality and quantity
- germplasm production, collection and dissemination, and the involvement of smallholders and community groups in these activities
- production and marketing of improved seed, and the involvement of smallholders or community groups in these activities
- seed-based and vegetative propagation methods appropriate for smallholders or community groups, particularly for indigenous species
- nursery techniques for smallholders

Marketing and Policy

- demand analysis for both market and subsistence level products
- marketing and product pricing analysis
- farmer access to pricing and marketing information
- legislation which discourages or encourages tree domestication activities
- national tree or land tenure policy and land-use policy

Training and Information Dissemination

- training and information needs
- information production and dissemination
- mechanisms to link research institutions, development institutions and farmers
- accelerating the impact and uptake of domestication research

Although the domestication workshop was well attended, 60 participants represent only a small number of the organizations involved in regional domestication activities. Many of ICRAF's current and potential partners were not able to attend the workshop. To assess the accuracy of the regional priorities at the workshop with a larger audience, expand the contact network of the domestication program, and evaluate the tree domestication capacity of regional organizations, a field study was conducted by an independent agroforestry professional with assistance from ICRAF staff.

The target of the study was to visit and evaluate approximately 20-25 key partners (twice this number were actually visited) in 4 countries: Indonesia, the Philippines, Thailand and Vietnam. These countries were chosen because ICRAF has its strongest regional presence in those countries and is thus best able to make an effective contribution there. The study was undertaken in two stages, visits to Indonesia and the Philippines were completed in October 1998 and those Thailand and Vietnam in December 1998. The study concentrated on organizations that were thought to have a high potential as collaborators with the tree domestication program. Most of these organizations were not able to attend the Yogyakarta workshop.

Assessment of the partner organizations focused on the following:

- Identify their on-going research activities and institutional interest, with particular reference to the priority topics identified at the Yogyakarta workshop (See Table 1).
- Evaluate their institutional and staff capacity to conduct research and development activities related to the five priority topics.
- Identify their current collaborators, associated organizations and network affiliations, as well as sources of funding. This information is required to accurately evaluate the level of partnership possible with each organization.
- Identify staff member/s who can serve as contact persons and key collaborators.
- Complete the 'tree domestication' matrix (Figure 1) developed at the Yogyakarta workshop for each organization and collect relevant information on the organizations for input into a database.

This report is intended to explore and identify the capacity of individual institutions in different countries in the Southeast Asian region for undertaking farmer-oriented tree domestication research. It specifically identifies the capability of the institutions visited, their on-going tree domestication activities, the species emphasized in their activities and those factors constraining farmer-oriented tree domestication efforts.

2. Overall Synthesis of Domestication in the Southeast Asia Region

Deforestation has accelerated during the recent past in the Southeast Asian region leading to severe soil erosion and land degradation. All countries have been subjected to this inevitable consequence at varying levels, with disastrous environmental problems and widespread poverty among the rural populations. Agriculture, in various forms from shifting to permanent cultivation, is the means of subsistence livelihood for most of these rural populations. Attempts are being made both nationally and globally to counteract land and environment degradation to sustain these fragile ecosystems, while meeting the basic needs of farmers. In response ICRAF has initiated the tree domestication program specifically aimed at improving farm family incomes and diversify production through the incorporation of high value trees into their farming systems.

The countries in Southeast Asia have diverse ecosystems where various timber, fruit and other species are thriving on smallholdings actively cultivated by farmers. Many indigenous species have been moved from the forest to the farm, or are protected as natural regeneration by farmers. These actions initiate the domestication process. Some of these indigenous species, but more often exotics, have been targeted for improvement by national, regional or international researchers. Smallholders are commonly a secondary target group, infrequently the primary target group, of these improvement activities. These simple examples illustrate that tree domestication is occurring in Southeast Asia. However, the potential of tree domestication is not being fully exploited in the region due to various constraints. Information or knowledge on species and management systems appropriate for smallholders is lacking. Germplasm of priority species and potentially valuable species is not available in sufficient quality or quantities. Training opportunities and materials to expand the domestication capacity of smallholders, extension agents and researchers are limited. Marketing channels and mechanisms for smallholder-produced tree products are not well understood. There is little productive collaboration between regional institutions regarding tree domestication. These constraints are a major challenge. Fortunately, the institutional strengths of ICRAF, Winrock and their regional partners are well-matched to these challenges. Hence, the opportunities for domestication in the region are very high.

An analysis of the countries visited (chapter 4) show the abundance of organizations that are actively engaged in tree domestication work. The focus of each institution differs according to its mandate. Most of the institutions are involved in finite components of the tree domestication continuum; few of them have a major focus on tree domestication. A summary of institutional and country strengths and needs is presented in annexes VI through IX. An institution's current tree domestication activities are indicated by hash marks. The domestication priorities that were identified by each institution are indicated with a P. Specific strengths of each institution are indicated in annex X.

The organizations visited in Indonesia differ considerably in their domestication focus (Annex VI). The Research and Development Center for Forest and Nature Conservation has a broad mandate and array of activities covering most of the domestication continuum. The Faculty of Forestry, Bogor Agricultural Institute, also has a broad capacity but is currently focused on propagation, medicinal plants and training and information activities. The ICRAF/Winrock joint-program currently has activities in germplasm, smallholder timber production systems, training and information activities. The other institutions are focused on specific activities of the continuum. Across the country, combined efforts of the institutions visited are strong in species evaluation, plant propagation, germplasm multiplication and training. There was strong agreement that to advance smallholder domestication additional attention should be focused on germplasm (both multiplication and distribution), silvicultural/smallholder tree management systems, tree product marketing and information distribution.

In the Philippines, the organizations visited have similar and overlapping strengths, with a strong bias towards information and training activities and considerable experience in networking (Annex VII, networking capacity not indicated). The ICRAF field projects in Claveria and Lantapan and the Institute of Agroforestry at University of the Philipines at Los Banos (IAF-UPLB) have broad capacity

and on-going activities related to tree domestication. The Ecosystems Research and Development Bureau (ERDB) and Philippines Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) have broad mandates and experience in natural resource management, research and extension - areas of clear importance to smallholder domestication issues. The other organizations have experience in specific areas of the domestication continuum or geographic areas of the country. In addition to training, information production and distribution, and networking national strengths in tree domestication include species exploration, collection and testing and plant propagation/nursery management. Major gaps in domestication work, or areas where additional focus is required, are similar to those identified in Indonesia - germplasm multiplication and distribution, plant propagation/nursery management, silvicultural/smallholder tree management systems and marketing of tree products. The current efforts pursued by various organizations are highly fragmented. The institutions visited recognize the need to develop a national inter-institutional agenda/program on smallholder tree domestication.

Thailand has strong independent agriculture and forestry development institutions, which are active with various aspects of the tree domestication continuum (Annex VIII). With the exception of the Faculty of Forestry (Kasetsart University), which is engaged in all aspects of the continuum, the organizations visited are involved with a limited number of domestication activities. As with most of the institutions in the other three countries, none of the Thailand-based organizations have dedicated 'tree domestication' programs. Domestication activities are integrated into their other work. Aggregated at the national level the institutions are strong in species exploration, collection and testing; training and information activities; propagation/nursery management; and germplasm multiplication and distribution. There is a bias towards indigenous species, particularly timbers and fruits, however similar to Vietnam, industrial exotic species - specifically *Acacia, Eucalyptus* - are also priorities. Areas in which the institutions feel smallholder domestication activities should be focused mirror those in the other three countries: germplasm multiplication and distribution, followed by propagation/nursery management, silvicultural/smallholder tree management, and marketing.

In Vietnam the potential for domestication is high (Annex IX). Vietnamese Agricultural Science Institute (VASI), College of Agriculture and Forestry (CAF) and Xuan Mai Forestry University are active with smallholder-oriented domestication activities. Forest Inventory and Planning Institute (FIPI), Forest Science Sub Institute of South Vietnam (FSSIV), Institute of Agricultural Science of South Vietnam (IAS) and Research Centre for Forest Ecology and Environment (RCFEE) conduct activities or have strong interests in domestication, however smallholder appropriate tree farming systems is not a main interest. Unlike in Indonesia and the Philippines, exotic industrial species - specifically pines, *Eucalyptus, Acacia* and their hybrids - are strongly promoted to and popular with smallholder farmers. Smallholders are seen as minor partners in the industrial sector, that can augment the national wood supply. The strengths of the organizations visited are complementary and spread-out evenly across the domestication continuum (with the clear exception of the ancillary topic of policy). Thus, no clear national domestication strengths were identified. The gap topics requiring additional smallholder-oriented tree domestication work are broader than in the other three countries and cover most of the domestication continuum. In order of priority, these topics are germplasm multiplication and distribution, propagation/nursery management, marketing, training and information distribution, silvicultural/smallholder tree management systems, and species testing. Because of the prominence of hybrids across the country, it is important that smallholder tree domestication activities acknowledge the segregation effect of F2 hybrid seed and emphasize appropriate clonal propagation.

Priority topics for smallholder tree domestication identified in the four countries visited are summarized in Table 2. Values in the table represent the number of times each component of the tree domestication continuum was mentioned by institutions as an appropriate focus for smallholder domestication efforts. Bold values indicate priority components as determined by frequency mentioned. Components mentioned by less than 25% of institutions were not considered priorities. The last column provides a total of the number of times each component was mentioned as a 'priority'. 'Germplasm multiplication and distribution' was the salient priority in all four countries. 'Silvicultural/smallholder tree farming systems' and 'marketing of tree products' were strong priorities in all countries. 'Propagation and nursery management' was a strong priority in three of four countries. 'Information' was specified in two countries, and 'training' and 'species

evaluation and testing' were specified in one. These priorities solidly cover the central portion of the domestication continuum, incorporating those activities where strong smallholder participation is advocated. There is strong agreement between the priorities described during the four-country study and those identified at the Regional Tree Domestication Workshop held in Yogyakarta, Indonesia in 1997. This consistency confirms the exactitude of the priorities for Southeast Asia. It also indicates that there is a strong common agenda and ample opportunity for collaborative tree domestication activities between the organizations visited, their partners, and the ICRAF/Winrock regional tree domestication program.

Table 2. Priority topics for Tree Domestication in the region by country. Number of organizations that cited a given component of the tree domestication continuum as requiring more focus. **Bold numbers** indicate priority topics as determined by frequency mentioned. Components mentioned by more than 25% of the national organizations were considered priorities. The last column totals the number of times each component was mentioned as a priority.

Components of the Domestication Continuum	Indonesia	Philippines	Thailand	Vietnam	TOTAL
1. Species exploration & collection	-	2	-	-	-
2. Species evaluation & characterization	-	2	1	4	4
3. Tree breeding	-	-	1	2	-
4. Propagation & nursery techniques	3	8	2	6	16
5. Germplasm multiplication	5	10	2	6	23
6. Germplasm distribution	7	12	4	8	31
7. Silviculture	6	5	2	4	17
8. Marketing	5	6	2	6	19
9. Training	2	1	1	5	5
10. Information	5	2	1	3	8
11. Policy issues	2	-	-	-	-

The study identified a number of organizations in each country aware of each other's activities and some cases where organizations collaborate. However, it was more common that there was little productive communication between institutions. Institutions may be working on related issues, but they do not benefit from each other's experience and knowledge. Thus, a major constraint to regional tree domestication efforts is a lack of direct inter-institutional linkages. A network-type arrangement at the national and regional levels could effectively address these shortcomings. It could provide a framework to expand domestication efforts through collaborative activities and facilitate progress through information sharing and dialogue. Such an arrangement would be best as an informal consortium, utilizing preexisting networks and linkages. This would avoid the time and costs of a 'new' or 'centralized' structure. Currently each country has existing networks and linkages that could be utilized. Listed below, these networks might be strenthened by developing or augmenting institutional internet access or websites so institutes can commuicate efficiently.

- In the Philippines, the IAF and PCARRD have extensive networks of local, national, grassroots and technical organizations, in which both ICRAF and Winrock are closely involved. Additionally, the ICRAF field research programs in Mindanao are well placed to assist in domestication activities in the southern part of the country.
- In Indonesia, ICRAF and Winrock's current relationships with many organizations and their long experience in the country, 50 years combined, gives the ICRAF/Winrock domestication program

a strong base for operation. When necessary, these relationships can be augmented with linkages through other key organization, particularly Indonesian National APAN Secretariat (INDO-NAS) and Research and Development Center for Forest and Nature Conservation.

- In Thailand, the ICRAF program in Chiang Mai could facilitate national linkages, particularly through Kings Project operating under the Royal Project Foundation.
- In Vietnam, ICRAF currently operates an agroforestry capacity building program ideal for facilitating additional support for tree domestication activities. The technical and administrative experience of VASI, CAF and Xuan Mai, all active in the capacity building program, would further facilitate tree domestication efforts.
- At the regional level ICRAF operates two projects to 'strengthen agroforestry training and education'. Both projects have extensive networks and see tree domestication as a priority.

Figure 2. Limited access to, multiplication of and distribution of germplasm - particularly high-quality germplasm - are constraints to smallholder tree domestication activities across the region (Photo: James Roshetko)

Figure 3. Improving the nursery skills - including vegetative propagation techniques - of smallholders and the organizations that assist them is a priority in all the countries visited during the study (Photo: James Roshetko)

optimum manner. The focus here should be on adapting known propagation and nursery management techniques to smallholder conditions. Successful community and smallholder nursery systems from the Philippines, or other parts of the region, may be evaluated as models for the program's research sites in Indonesia where community and smallholder nurseries are still not common. The development of propagation techniques will likely focus on indigenous species where information is limited, species with recalcitrant seed, and vegetative techniques for superior specimens of high-value species. Vegetative techniques could range from simple cuttings to more advanced budding/grafting techniques (Harwood et al 1999). Vegetative propagation methods will be particularly important for the multiplication of hybrids. It would also be important to look for indigenous propagation methods that may be adapted to other species or locations.

- **Training and information dissemination.** Efforts under this priority should focus on expanding training opportunities and information resources on relevant tree domestication topics using forms and channels appropriate for various target groups - smallholder, community groups/NGOs, extension agents and researchers. Key partners in this endeavor will be ICRAF's regional program in training and information and Winrock's regional and international forestry networks. The ICRAF program has extensive experience in conducting and facilitating training and developing and disseminating information sources. Winrock's networks have produced and distributed abundant amounts of smallholder appropriate information on tree management systems and species. Activities could include the compilation, publication and translation of appropriate information. As mentioned in the previous section of this report, support to strengthen or develop institutional internet access and web sites might also be appropriate.
- **Marketing of smallholder tree products.** The marketing of smallholder tree products is a crucial issue. Many smallholders have increased their tree crop productivity without improving their marketing capability. Thus, enhanced productivity has not always positively affect farmers' incomes. As a result, interest in tree farming has reportedly diminished in some locations. The study indicated that little research had been conducted regarding the marketing of smallholder tree products, and that general market information and channels are often not accessible to smallholders. Additionally there is a lack of expertise regarding this topic among the institutions visited. Participants at the Yogyakarta workshop recommended that marketing and economic issues focus on: demand analysis at both the market and subsistence level; analysis of future and potential demand; marketing systems analysis; product pricing; and farmer access to price and demand information. Workshop participants acknowledged that there exist opportunities in the areas of tree product quality enhancement, value-added processing, product development and market expansion. However, these areas are dependent on favorable marketing and economic conditions as well as on the entrepreneurial capacity of smallholders. Thus activities related to product development and processing are relegated to secondary importance (Arocena-Fransisco et al. 1999). Until strong regional partners with relevant skills and experience can be identified efforts under this priority may be best addressed by engaging graduate students with assistance from ICRAF's Regional Natural Resources Policies and Strategies Program. Activities should focus on major tree products relevant to the socioeconomic conditions of individual locations and farmers' preferences. Smallholder produced timber in Indonesia and the Philippines would be an appropriate initial focus.

Institutional tree domestication capacity building could be effectively implemented through an informal networking arrangement to foster information sharing and institutional collaboration at the national and regional level, as discussed in the last paragraph of the preceding section of this report. A key function of the informal network would be to channel research funds and other resources to institutions involved in tree domestication. The joint ICRAF/Winrock program might assist to facilitate this to ensure that the topics supported were appropriate and had a regional application, information was shared, and promising collaborative linkages were established. Both ICRAF and Winrock have extensive experience with this type of program. From the beginning it would be important for the capacity building approach to take advantage of current and past ICRAF and Winrock activities and relationships in the region. Particularly those of ICRAF training and information program, and Winrock's regional forestry network. The networking arrangement would assume a different form in each country, conforming to existing linkages and opportunities, avoiding the establishment of a formal centralized structure. In order to increase development impact, network grant support should be concentrated on sub-topics within the domestication

continuum or on inter-related topics within a specific geographic zone. This way, results from each grant will have direct impact beyond the recipient. In Indonesia and the Philippines the network could have a broad base, reflecting the strong relationships that ICRAF and Winrock have throughout the countries. Grant support would be concentrated on ICRAF's current sites or on topics related to the work at those sites. This will make it possible to expand the current number of active partners. In Vietnam and Thailand grant support could be linked to on-going activities, but the network would be largely focused on institutional capacity building. In Vietnam a linking issue might be domestication systems or species for rehabilitating degraded lands. In Thailand the issue could be domestication of species appropriate for the rehabilitation or enhanced productivity of watersheds. Across the region it may also be possible to have common topics linking some or all of the countries. For example, land rehabilitation through 'smallholder tree domestication' activities, specifically mentioned as a goal in Vietnam and Thailand, has recognized potential in Indonesia and the Philippines also.

In order for 'smallholder tree domestication' efforts to have positive impact on smallholders, and not simply be conducted which the intention to benefit smallholders, it is imperative that smallholder farmers be full participants from the planning stage through implementation of activities at the local, national and potentially regional levels. Effective farmer participation already occurs, or has been initiated, at the local level in a number of places. However, farmer participation at the national and regional levels is not yet apparent and offers a number of challenges ranging from farmers' discomfort with official forums, to the tendency of such forums to become conjectural and administrative. Mechanisms that facilitate effective farmer participation with institutions at all three levels should be promoted. An appropriate starting point is to copy and adapt models where farmer participation has been effective, and to seek the assistance of other professionals or disciplines that specialize in participatory methods.

Figure 4. Participatory on-farm trials are needed to identify viable tree farming options that meet smallholders' land, intercropping, environmental and economic restrictions. Field days to such sites can demonstrate tree-farming options to larger groups of smallholders and organizations (Photo: Kurniatun Hairiah)

Figure 5. Institutional and farmer knowledge concerning the marketing of smallholder tree products is insufficient and needs to be enhanced through research focused on the tree products relevant to the socioeconomic conditions of smallholder farmers. (Photo: James Roshetko)

4. Countries and Organizations Visited

A. INDONESIA

COUNTRY SUMMARY

Fourteen institutions were visited in Indonesia, of which ten were government agencies; two were university organizations, one a private joint venture company, and the other ICRAF's tree domestication program. Of these, eleven are currently involved in smallholder domestication related activities to varying degrees. Excluding the ICRAF program, the institutes involved in tree domestication can be summarized by their level of involvement and capacity as follows. The Research and Development Centre for Forest and Nature Conservation is engaged in all activities of the tree domestication continuum throughout the country. The Forestry Seed Technology Center focuses on practical germplasm issues, species exploration and collection, vegetative propagation, and some smallholder extension work. The Directorate of Rehabilitation and Soil Conservation is identifying species and technologies for land rehabilitation that meet farmers needs. The Research and Development Centre for Biotechnology (RDCB) is focused on the micro-propagation of forest trees, species conservation, rhizobia production and the improvement of both species and systems with a smallholder focus. The Directorate of Forest Tree Seed is focused on germplasm supply and related issues. PT. Monfori is a source of high-quality germplasm of selected timber cultivars. The Research Institute for Spice and Medicinal Crops (Balitro) is active in species trials and germplasm issues (conservation, multiplication, processing, distribution and utilization) of medicinal plants. The Faculty of Forestry, Bogor Agricultural University has capability to work on all areas of tree domestication, but currently is focused towards plant propagation and smallholder domestication of medicinal plants. The Center for Tropical Fruit Studies, Bogor Agricultural University, has strong capacity in fruit species for smallholder farmers. Indonesian National APAN Secretariat (INDO-NAS) is a good source of information and extension documents for smallholder domestication and a potential consultant and networking agency. All of these institutions are potential partners for the joint ICRAF/Winrock tree domestication program which is currently involved with tree-farming systems for smallholders in Lampung, Sumatra; seed orchard work with researchers in Indonesia and the Philippines; and training/information activities across the region. The other institutions are less involved or accessible to smallholders, but could be partners for specific domestication activities. The species on which institutional tree domestication activities are focused include timber, fruit, medicinal plants and other multipurpose species. These species are summarized on an institutional and Indonesia basis in Annex I and V. Institutional tree domestication capacity and the primary institutional strengths for Indonesia are summarized in Annex VI and X.

Reviewer's note: In Indonesia, the government institutions most involved with smallholder tree planting programs are the Directorate General of Reforestation and Land Rehabilitation (renamed the DG of Land Rehabilitation and Social Forestry - LRSF) and the Forestry and Soil Conservation Service (FSCS, a district level institution under the Ministry of Interior). Land rehabilitation is conducted on both state forestland and private land. 'Regreening' is a national program for land rehabilitation and soil conservation on private lands through the promotion of village nurseries and local tree planting activities. The LSRF and the FSCS program relate closely to the ICRAF program in several steps of the continuum tree domestication. These two institutions could be important key partners since they manage a national program on land rehabilitation that involves a lot of planting materials and smallholders.

LIST OF ORGANIZATIONS VISITED

1. Center for Tropical Fruit Studies, Bogor Agricultural University
2. Department of Microbiology, Indonesian Institute of Sciences
3. Department of Phytochemistry, Indonesian Institute of Sciences
4. Directorate of Forest Tree Seed
5. Directorate of Rehabilitation and Soil Conservation
6. Faculty of Forestry, Bogor Agricultural University
7. Forestry Seed Technology Center
8. ICRAF/Winrock Domestication of Agroforestry Trees Program
9. Indonesian National APAN Secretariat (INDO-NAS)
10. Perum Perhutani
11. PT. Monfori Nusantara
12. Research and Development Center for Biotechnology (RDCB)
13. Research and Development Center for Forest and Nature Conservation
14. Research Institute for Spice and Medicinal Crops (Balitro)

PROFILES ON ORGANIZATIONS

1. Center for Tropical Fruit Studies, Bogor Agricultural University

The Center for Tropical Fruit Studies focuses on under-utilized fruit species. Activities target smallholder farmers and consider ethnobotanical, management and production aspects of both species and systems. The Center collaborates with other faculties and centers in the university to develop multi-disciplinary solutions to farmers needs. They also have on-going collaboration with National Plant Genetic Resources Laboratory in Los Banos, Philippines. Species improvement and breeding activities are not currently implemented but could be in the future. Species of interest include *Gnetum gnemon, Arenga pinnata, Phyllanthus acidus, Antidesma bunius* and *Syzygium* sp.

Center for Tropical Fruit Studies
Faculty of Agriculture
Bogor Agricultural University
Jl. Raya Pajajaran, Bogor
Tel/Fax: (62-251) 326429
Contact Person : Prof. Dr. Sjafrida Manuwoto (Director)

2. Microbiology Department, Indonesian Institute of Sciences

The Microbiology Department is a research center of the Indonesian Institute of Sciences (Lembaga Ilmu Pengetahuan Indonesia, LIPI). Its focus is in the fields of basic microbiology, environment microbiology, mycorrhizal research, nitrogen fixation and mushroom production. The center is equipped with basic laboratory facilities and a staff of 37 scientists. It has training capacity in microbiology and nitrogen fixation. Activities have focused on the following nitrogen fixing genera *Acacia, Albizia* and *Calliandra.*

Microbiology Department
Research and Development Centre for Biology
Indonesian Institute of Sciences
Jl. Ir. H. Juanda 18
P.O. Box 208
Bogor 16002
Tel.: (62-251) 321040/321041/324006
Fax: (62-251) 325854
Contact Person : Dr. Arie Budiman (Director)

3. Phytochemistry Department, Indonesian Institute of Sciences

The Phytochemistry Department of the Indonesian Institute of Sciences works on the phyto-chemistry of plant species. It concentrates on the biologically active components of medicinal plants (such as *Gonoderma* mushrooms used for curing cancerous growths of humans) and herbs (such as *Sonchus avensis* and *Pogostemon cablin*). The division has a staff of 7 biochemists who are capable of phyto-chemical characterization of tree and other plant species selected for domestication. The staff has training capacity. They could assist with smallholder domestication activities by identifying appropriate processing methods for the farm-level.

Phytochemistry Department
Research and Development Centre for Biology
Indonesian Institute of Sciences
Jl. Ir. H. Juanda 18
P.O. Box 208
Bogor 16002
Contact Person : Dr. Chairul (Head)

4. Directorate of Forest Tree Seed

The Directorate concentrates on seed production in 6 regional seed centers (Balai Perbenihan Tanaman Hutan) in Palembang, South Sumatra; Bandung, West Java; Ujung Pandang, South Sulawesi; Banjar Baru, South Kalimantan; Denpasar, Bali and Ambon, Maluku. Priority species include *Pinus merkusii, Paraserianthes falcataria, Acacia mangium* and *Swietenia macrophylla.* The focus on species for domestication are *Leucaena glauca, Pinus merkusii, Acacia mangium, Gmelina arborea, Santalum album, Artocarpus heterophyllus, Artocarpus altilis, Dyera costulata, Gliricidia sepium, Calliandra calothyrsus, Anacardium occidentale,* rattans, bamboos and *Manilkara kauki.* There are over 27,500 hectares of seed production areas registered with the Directorate. These areas are under the jurisdiction of various government agencies or private concerns. Most are independent of the Directorate. The management of most of these seed prooduction areas is low. In the past the Directorate concentrated on industrial forestry species. They would like to expand their activities to include timber and non-timber species of interest to smallholders. A near-term objective would be to develop seed orchards/production areas that contain timber, fruit, multiple purpose and medicinal species. The Directorate could facilitate domestication program in propagation techniques, and training in seed production, processing and storage. The major constraint to smallholder domestication is the production and distribution of quality germplasm and information to the farmers.

Microbiology Department
Research and Development Centre for Biology
Indonesian Institute of Sciences
Jl. Ir. H. Juanda 18
P.O. Box 208
Bogor 16002
Tel.: (62-251) 321040/321041/324006
Fax: (62-251) 325854
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Phytochemistry Department
Research and Development Centre for Biology
Indonesian Institute of Sciences
Jl. Ir. H. Juanda 18
P.O. Box 208
Bogor 16002
Contact Person : Dr. Chairul (Head)

4. Directorate of Forest Tree Seed

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Directorate of Forest Tree Seed
Ministry of Forestry and Estate Crops
Gedung Manggala Wanabakti, Block 1, Floor 13 Jl. Gatot Subroto Senayan
Jakarta 10270
Tel.: (62-21) 5730179
Fax. : (62-21) 5737092
Contact Person : Dr. Suharisno (Head of Sub-Directorate of Forest Tree Seed Development);
Ir. Singgih M. Sasongko, MS (currently Head of Regional Seed Center Bandung)

5. Directorate of Rehabilitation and Soil Conservation

The main aim of this agency is to identify tree species and technologies for reforesting denuded/degraded state and private lands; and to convert denuded/degraded lands into environmentally sustainable land use systems. The reclaimed lands should benefit both the nation and smallholder farmers. While the program does not have a list of 'focus species' those more widely used or promoted include *Calliandra calothyrsus*, *Ceiba* sp., *Shorea* sp., *Albizia* sp., *Anacardium occidentale*, *Artocarpus heterophyllus* and bamboos. The program feels that there needs to be regulatory paradigm shift away from restricting farmers options to encouraging management practices that service both the government's rehabilitation/protection objectives and farmers' livelihood objectives. Restrictive regulations are the main policy disincentive hindering smallholder domestication. The main technical constraints are inadequate species diversity, in adequate germplasm supply/distribution and limited examples of smallholders systems that meet the objectives of smallholders. For example, there are over 40,000 species in Indonesian forests, but germplasm is available for only a small number of these. Additional seed orchards and production areas of the 'over-looked species' should be developed. Many 'social forestry' models do not work, because they are 'top-down creations' promoted as 'grass-roots systems'. Smallholders need to be given the freedom to create their own viable dynamic systems.

Directorate of Rehabilitation and Soil Conservation
Ministry of Forestry and Estate Crops
Directorate General of Land Rehabilitation and Social Forestry
Manggala Wanabakti, Block 1, Floor 11, Jl. Gatot Subroto
Jakarta Pusat 10270
Tel.: (62-21) 5730118/5730604
Fax. (62-21) 5700263
Contact Person : Dr. Hadi Pasaribu (Director, RRL Program at the time of the study)

6. Faculty of Forestry, Bogor Agricultural University

The main activity of the faculty staff is teaching and supervision of students' research projects. Their teaching, research and development activities cover all aspects of the domestication continuum. The expertise of the Faculty's 120 member is focused in nursery management, field establishment of forest species, and forest resource management and conservation. A central objective of their activities is to improve forest and tree management for smallholders. Currently the faculty is implementing a research project on smallholder domestication of medicinal plants as an income generating option for residents on the periphery of a national park in Java. The project is funded by the MacArthur Foundation. The project experience strengthens the faculties view that more work is needed on developing appropriate smallholder 'tree farming systems', including access to germplasm, and the marketing of products from these systems. The Faculty's combined activities have focused on the following species: bamboos, rattans, *Shorea javanica*, *Parkia speciosa*, *Acacia mangium*, *Pinus merkusii*, *Alstonia scholaris*, *Artocarpus heterophyllus*, *Dalbergia latifolia*, *Swietenia macrophylla*, *Paraserianthes falcataria*, *Tectona grandis*, *Santalum* sp. and medicinal plants. The faculty periodically conducts project-funded

training course for farmers. They are interested in collaborating on further smallholder domestication activities.

Faculty of Forestry
Bogor Agricultural University
Kampus IPB, Darmaga
P.O. Box 168, Bogor 16680
Tel.: (62-251) 627129
Fax.: (62-251) 627130
E-mail: manhut@bogor.wasantara.net.id
Contact Persons : Prof. Dr. Yusuf Sudo Hadi (Dean); Prof. Dr. Zahrial Coto (Dean at time of study); Mr. Didik Suhardjito

7. Forestry Seed Technology Center

This center was established in 1984. Its main objective is to develop methods for seed and plant material production and handling that can be adopted by seed producers. Major activities are: forest seed testing, storage, and production; refining vegetative propagation methods; species and provenance screening trials; and tree breeding. They collaborate with other government agencies, state forest enterprises, and some universities.

The Center's focus for tree domestication is on 'high value timber species': *Acacia mangium, Gmelina arborea, Swietenia macrophylla* and *Eucalyptus* sp.; and 'superior indigenous species': such as *Dyera* sp., *Eusideroxylon zwageri, Duabanga moluccana* and *Octomeles* sp. These are locally important species utilized for wood and multiple purposes. Other focal species are fruits - *Durio zibethinus, Artocarpus heteropyllus* and *Artocarpus altilis* - and species for fodder and fuelwood production. Species that have been included in screening or provenance trials by the center include: *Acacia mangium, Gmelina arborea, Swietenia macrophylla, Eucalyptus tereticornis, Eucalyptus urophylla, Eucalyptus pellita, Eucalyptus deglupta, Acacia crassicarpa, Acacia aulacocarpa, Duabanga moluccana, Intsia bijuga, Alstonia scholaris, Eusideroxylon zwageri, Homalium tomentiosa, Palaquium* sp., *Toona sureni* and *Pericopsis moonianan.* The center is well equipped for seed collection, conducting species and provenance trials and vegetative propagation techniques. Their main concerns are in distribution/exchange of germplasm, refinement of vegetative propagation techniques, and information development/distribution. The center has a staff of 19 qualified technical specialists and a total of 52 staff. They have some experience with smallholders, and feel that a lack of useful information and germplasm limit smallholders' domestication abilities.

Forestry Seed Technology Center
Jl. Pakuan Ciheuleut
Bogor 16001
Tel/Fax.: (62-251) 327768
Contact Person : Mr. Djoko Wasono (Director)

8. ICRAF / Winrock Domestication of Agroforestry Trees Program

The ICRAF/Winrock Tree Domestication Program was initiated in mid-1997. It recognizes the priorities identified at the Yogyakarta workshop (mentioned in the 'introduction' of this report) as being relevant throughout the Southeast Asia region. In summary those priorities are: propagation and nursery management; germplasm multiplication and distribution; slivicultural and tree farming techniques for smallholders; marketing of smallholder produced tree products; training and information production/distribution; and policy issues that limit the smallholder domestication. In its first 18 months the program initiated activities in the establishment and management of farm-level seed orchards, characterization of farmer-level germplasm pathways, the production and distribution of relevant tree domestication publications, the establishment of smallholder timber

production trials, a carbon and species inventory of homegarden systems in Lampung, a survey of tree fodder resources in Nusa Tenggara (in collaboration with a local NGO), evaluation of vegetative propagation methods for *Artocarpus heterophyllus* (in collaboration with a university). Other species currently involved in program activities are *Gliricidia sepium, Paraserianthes falcataria, Alstonia scholaris, Peronema canescens, Swietenia* sp., *Tectona grandis, Acacia mangium* and *Eucalyptus* sp. Other ICRAF programs are interested in testing horticultural methods for i) vegetative propagation of superior *Shorea javanica* (damar) specimens and ii) flower/fruit induction of fruit species associated with damar agroforest systems - particularly *Lansium domesticum* (duku) and *Durio zibethinus* (durian).

Domestication of Agroforestry Trees Program
ICRAF Southeast Asia Regional Research Programme
PO Box 161
Bogor 16001
Tel.: (62-251) 625415
Fax: (62-251) 625416 or 418
E-mail: J.Roshetko@cgiar.org
Contact Person: Mr. James Roshetko (Training and Tree Domestication Specialist)

9. Indonesian National APAN Secretariat (INDO-NAS)

Formerly the Asia-Pacific Agroforestry Network of the FAO, the Indonesian National APAN Secretariat (INDO-NAS) aims to promote agroforestry in Indonesia. It is organized under the Research and Development Center for Forest and Nature Conservation, an institution under the Forestry Research and Development Agency (FORDA). INDO-NAS has three seconded staff. It is currently involved in promoting agroforestry networks, disseminating agroforestry technologies, facilitating training, and serving as a consultant on agroforestry issues. Its major strength is in networking, information dissemination and training of farmers and NGOs in agroforestry technologies. Priority species with which INDO-NAS is currently involved or interested are *Sandoricum koetjape* (sentul), *Paraserianthes falcataria* (sengon), *Artocarpus heterophyllus* (nangka), *Parkia speciosa* (petai), *Durio zibethinus* (durian) and *Artocarpus altilis* (syn. *Artocarpus communis*, breadfruit).

Indonesian National APAN Secretariat (INDO-NAS)
Gunung Batu 5, P.O. Box 165
Bogor 16001
Tel.: (62-251) 315222
Fax: (62-251) 325111
Contact Person : Dr. Taulana Sukandi (General Coordinator)

10. Perum Perhutani

A government owned forest industry company operating on Java. (Inhutani, another government owned forest industry company, operates outside of Java.) Perum Perhutani produces seed of *Swietenia macrophylla* (mahogany), *Tectona grandis* (teak), *Shorea* species (including damar), *Gmelina arborea, Pinus merkusii* and many other species. Perum Perhutani enterprises that could be of interest to smallholders, are the production of honey and *Pogostemon cablin* oil. Farmers are collaborators in the establishment phase of many of Perum Perhutani's enterprises. Collaboration with smallholders is organized through several social forestry programs. Most commonly, farmers intercrop plantations during the early establishment period. Perum Perhutani provides farming inputs, farmers maintain and protect the trees.

Perum Perhutani
Manggala Wanabakti Building, Block 7, Floor 11, Jl. Gatot Subroto
P.O. Box 19/JKWB
Jakarta Pusat
Tel.: (62-21) 5721282 (Hunting) ext. 1126
Fax.: (62-21) 5732451/5733616
Contact Person : Dr. H. Moch Muslich (Head, Seed Division)

11. PT. Monfori-Nusantara

This company produces superior timber and pulp tree species using conventional and micropropagation techniques. Products include *Tectona grandis*, *Eucalyptus urophylla* x *E. grandis* hybrids, *Acacia mangium*, *Acacia auriculiformis* and *Acacia crassicarpa*. Within the company there is a production and development section and a marketing and sales section. They have several species trials in Kalimantan and Sumatra jointly conducted with private timber companies. The company's major activity is micro-propagation of the above species. Their production capacity is about 10 million plants per year through micropropagation alone. The company also has a network of regional satellite nurseries throughout Indonesia for growing-on and distribution of conventionally and micro-propagated trees. This company has excellent tissue culture laboratories and about 20 technically qualified staff who could provide training in tissue culture techniques and hardening of plants.

To expand their product lines to include other species, Monfori would have to be confident that the potential volume would justify the research and production investment. Monfori is interested in expanding its smallholder-focused activities. They would be interested in collaboration and could provide seedlings for testing and demonstration under smallholder conditions. This would help them establish a potential market with smallholders. From feedback received, Monfori feels that smallholders are most interested in teak and eucalyptus species. The constraints to smallholder use of their germplasm are i) an inadequate distribution system to reach the thousands of communities where farmers are growing trees and ii) 'smallholder timber farming systems' have not been adequately developed. They have been able to improve the former through establishment of a regional distribution network, but would welcome wider support in developing and socializing smallholder tree crop management practices to enable these communities to realize the full economic value of their products.

PT Monfori Nusantara
Plaza Permata, 9th Floor
Jl. MH Thamrin 57
Jakarta 10350
Tel.: (62-21) 3903280
Fax: (62-21) 3903147
Contact Person : Dr. Timothy D. Roche (Technical Business Manager)

12. Research and Development Center for Biotechnology (RDCB)

Established in 1986, presently the center is under the Ministry of Science and Technology and was formerly part of the Indonesian Institute of Sciences. Its major function is to enhance the national capacity in the field of biotechnology. It is a center of excellence engaged in microbial and genetic engineering, cell and tissue culture, conservation of microbial germplasm, *in-situ* conservation of crop germplasm, rhizobium production and distribution, and improvement of plant propagation methods (for recalcitrant species). The 150 qualified staff of this center have experience in species exploration and collection, seed studies, germplasm conservation and plant multiplication. Many of their activities are project-operated. They have been involved in the following projects related to smallholder domestication: information compilation on Indonesian agroforestry systems; establishment

of species and provenance germplasm gardens; tree improvement and genetic conservation; fodder species in Nusa Tenggara; and underutilized species. Species on which the Centre has focused or is interested include: *Acacia mangium, Paraserianthes falcataria, Peronema canescens, Pometia pinnata,* various *Shorea* species, *Dyera* sp. (native rubber species), *Sandoricum koetjape, Dalbergia latifolia, Ficus deltoidea,* and *Eurycoma longifolia.* They also have a general interest in domestication of under-utilized species. They would be interested in collaborating on smallholder domestication issues, but would need funding.

Research and Development Center for Biotechnology (RDCB)
Jl. Raya Bogor KM 46
Cibinong, Bogor 16161
PO Box 422 Bogor 16004
Tel.: (62-21) 8574627/8754583/8754587
Fax.: (62-21) 8754588
E-mail: esukara@indo.net.id
Contact Person : Dr. Endang Sukara (Director)

13. Research and Development Center for Forest and Nature Conservation

The largest research center of the Ministry of Forestry and Estate Crops operates throughout the country undertaking research on forestry and plantation crops (plantation crops have been assigned to this center only recently). Its current activities involve all the steps of tree domestication continuum from species exploration to silvicultural techniques and marketing. Seed production of *Acacia mangium, Eucalyptus urophylla* and *Paraserianthes falcataria* is currently underway. The Centre also publishes information that is applicable to smallholders through extension bulletins and similar documents.

Tree domestication is actively pursued by introducing species from various parts of the country to other areas where they have economic potential. The species with high potential for domestication are fruits and timbers. Priority fruit species include: *Annona* sp., *Artocarpus heterophyllus* (nangka), *Artocarpus altilis* (breadfruit), *Garcinia mangostana* (manggis), *Durio zibethinus* (durian), *Persea americana* (avocado), *Lansium domesticum* (duku), and *Nephelium lappaceum* (rambutan). Priority timber species, which may have multiple uses, are *Alstonia, Swietenia, Eucalyptus, Ceiba, Parkia,* bamboo, *Acacia mangium* and *Cinnamomum burmanii.* The major constraints to domestication identified are inadequate training, information exchange, and mechanism for production and distribution of improved germplasm to farmers.

Research and Development Center for Forest and Nature Conservation
Ministry of Forestry and Estate Crops
Jl. Gunung Batu, P.O. Box 165
Bogor 16001
Tel.: (62-251) 315234/315567
Fax. : (62-251) 325111
Contact Persons : Dr. Boen Purnama (Director); Mr. Dwiatmo Siswomartono, Ir. (Director at time of study)

14. Research Institute for Medicinal and Spice Crops (Balitro)

Established in 1984, this institute is responsible for research on various aspects of medicinal, spice, essential oil and other industrial crops. With a staff of 421 scientists, the center is fully equipped for industrial research. The main crops in the research agenda are *Eugenia aromatica* (clove), *Piper nigrum* (pepper), *Vanilla planifolia* (vanilla), *Curcuma longa* (turmeric), *Zingiber officinale* (ginger), *Cinnamomum* sp (cinnamon), *Elettaria cardamomum* (cardomum), herbal medicinal crops, *Vetiveria zizanioides* (essential oil crops vetiver), *Andropogon nadus* (citronella), *Pogostemon cablin* (patcholi) and the industrial tree crops *Anacardium occidentale* (cashew), *Macademia integrifolia* (macadamia),

Pyrethrum sp., *Gnetum gnemon* (melinjo), *Aleurites moluccana* (candlenut), *Amorphophallus campanulatus* (amorphophallus) and *Uncaria gambir*. Balitro publishes research publications that have an extension application.

The focus species for smallholder tree domestication include *Azadirachta indica* (neem), *Tamarindus indica* (pohon asam), *Tephrosia vogelii*, *Paraserianthes falcataria* (sengon), *Gliricidia sepium* (gamal) and other plants with pesticidal and nematocidal properties. The tree domestication needs across the nation are in propagation, conservation, germplasm multiplication and distribution. These are not adequately addressed by the research institute. Specifically for Nusa Tenggara Balitro sees a domestication need focused on *Anacardium occidentale* and *Tamarindus indica*. Balitro feels extension activities should be implemented through Research and Development Center for Forest and Nature Conservation. However, they would be interested in collaborative smallholder domestication activities focused on indigenous species. They would expect the partner organization to handle the extension work. They would provide capacity building input related to propagation, management and utilization of the crops included in their mandate.

Research Institute for Medicinal and Spice Crops (Balitro)
Jl. Tentara Pelajar 3
Bogor 16111
Tel.: (62-251) 321879/327010
Fax.: (62-251) 327010
Contact Person : Mr. Sofyan Rushli (Physiologist)

B. PHILIPPINES

COUNTRY SUMMARY

In the Philippines 15 institutions were visited of which two are government agencies, one a government-owned forest industry, one a UNDP-FAO Project, seven university or college departments, two NGOs and two ICRAF research sites. The two ICRAF sites and Institute of Agoroforestry (IAF) at University of the Philippines at Los Banos (UPLB) have full tree domestication capacity and are engaged in many such activities. They collaborate closely on both tree domestication and other issues. The Ecosystems Research and Development Bureau (ERDB) and Philippines Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) have broad mandates and experience in natural resource management, research and extension. Specific collaboration with these organizations could benefit the regional domestication agenda. The Seed Science Division, Department of Agronomy, UPLB is well staffed, equipped and capable of making significant contributions in germplasm related matters. The National Plant Genetic Resources (NPGR) offers similar capacity and potential in fruit/nut tree propagation and management. The College of Economics and Management, UPLB could provide assistance and guidance in marketing and economics aspects of domestication activities. Misamis Oriental State College of Agriculture and Technology (MOSCAT), the Biology and Forestry Departments at Central Mindanao University (CMU) and the Kitanglad Integrated NGO Consortium (KIN) all have capacity in certain components of the domestication continuum that could complement on-going activities. Information generated by UNDP-FAO Regional Forest Tree Improvement Program (FORTIP) and Bukidnon Forests Incorporated (BFI), both entities now closed, could benefit regional domestication efforts in the area of species/provenance selection, propagation and germplasm. International Institute for Rural Reconstruction (IIRR) offers to be a useful collaborator in the areas of germplasm, fruit trees and information on production and distribution. There are many activities and programs being conducted in the country related to smallholder tree domestication, however these efforts are highly fragmented. There is a need, recognized by the institutions visited, to craft a national inter-institutional agenda/program on tree domestication. Because of their positions, linkages and mandates both PCARRD and IAF should play a key role in setting an agenda. A summary of organizational skills for the Philippines is provided in Annex VII and X. Focal species are summarized on an institutional and Philippines basis in Annex II and V.

LIST OF ORGANIZATIONS VISITED

1. Bukidnon Forests Incorporated (BFI)
2. College of Economics and Management, UPLB
3. Department of Agronomy, UPLB
4. Department of Biology, Central Mindanao University (CMU)
5. Department of Forestry, CMU
6. Ecosystems Research and Development Bureau (ERDB)
7. Forest Tree Improvement Project (FORTIP, UNDP-FAO Regional Project)
8. ICRAF, Claveria Research Site
9. ICRAF, Lantapan Research Site
10. Institute of Agroforestry (IAF), UPLB
11. International Institute for Rural Reconstruction (IIRR)
12. Kitanglad Integrated NGOs
13. College of Agriculture, MOSCAT
14. National Plant Genetic Resources Laboratory, UPLB
15. Forestry and Environment Division, Philippines Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD)

PROFILES ON ORGANISATIONS

1. Bukidnon Forests Incorporated (BFI)

A Government owned forestry industry assisted by the New Zealand government that was established in 1992. BFI is now closed. It had provenance and species elimination trials and timber production areas of industrial timber species. The company operated orchards to produce seed for their own needs and for sale to other companies and organizations. Total area under plantations was about 6,500 hectares. BFI had some minor activities with smallholders. These activities were difficult to operate because BFI was not geared towards extension or community development. Their activities that were valuable to smallholder domestication are simple micro-propagation methods (particularly important with hybrids to avoid F2 segregation), nursery methods, seed orchards, and species/provenance trials. They had conducted training in these areas for researchers, extension agents, NGOs, community groups, and smallholders. Their focal species were *Acacia mangium, Eucalyptus deglupta, Eucalyptus pellita, Eucalyptus robusta, Eucalyptus urophylla, Eucalyptus grandis, Eucalyptus* hybrids (*deglupta x pellita* and *robusta x grandis*) and *Pinus caribaea.* BFI felt that most of the *Eucalyptus* were appropriate for smallholders.

BFI Compound
Sumpong, Malaybalay, 8700 Bukidnon
Tel.: (63-88) 8132037
Fax.: (63-88) 2212115
E-mail: hheath@mozcom.com
Contact Person : Mr. Harold Heath (Senior Project Advisor)

2. College of Economics and Management, UPLB

The main activities of the college are in the area of economic assessment of agroforestry techniques, natural resources management and policy issues. They favor participatory methods that consider indigenous knowledge and management systems in order to gain an accurate assessment of smallholder conditions. They have relations with researchers throughout the country and are very capable of analyzing economic aspects of domestication activities. Lack of appropriate germplasm distribution pathways and marketing are considered major constrains to smallholder tree domestication.

College of Economics and Management
University of the Philippines at Los Banos (UPLB)
College, Laguna 4031
Tel.: (63-49) 5363241/5363097
Fax.: (63-49) 5362341
Contact Person : Prof. Herminia A Francisco (Head)

3. Seed Science and Technology Division, UPLB

The Seed Science and Technology Division, Department of Agronomy helps to promote the local seed industry through education and extension programs. It also provides information on seed sources, value of quality seed, and seed dissemination and exchange pathways. To facilitate the above activities the division collects information related to seed, genetic resources, biodiversity, sustainable agriculture, etc. and develops it into databases, extension materials and other publications on seed related issues. On-site training courses are conducted for the farmers, NGOs and development workers. The division undertakes practical and basic research on seed production, handling and genetic conservation. It views multipurpose trees as the best avenues through which domestication could help smallholders raise their incomes and improve their lives. For this reason they have a strong focus on indigenous and non-industrial trees. The division has an associate in the Department of Forestry, UPLB who specializes in indigenous tree seed management.

The forestry seed industry in the Philippines is not well organized. Industrial forestry companies and the government have little access to quality seed, unless they produce the seed themselves. In general, smallholder farmers, NGOs and community organizations have even less access to quality seed. The development of community- or farmer-level seed orchards or production areas could improve this situation. Currently, few smallholders, NGOs or community groups have the skills required to do this. These skills could be developed through functional partnerships with researchers and extension agents. The division feels this is possible, but cautions that farmer- and NGO-level seed production areas will remain uncommon exceptions, until the national seed market, mainly the government and industry, starts to pay more attention to seed quality. When a premium is paid for quality, it will be no longer be necessary to convince people to produce or collect quality seed. The market will guarantee the process.

Seed Science and Technology Division
Department of Agronomy
University of the Philippines at Los Banos (UPLB)
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4. Department of Biology, Central Mindanao University

The Department of Biology at CMU is implementing a research project on forest biodiversity in the Kitanglad National Park under the Sustainable Agriculture and Natural Resources Management (SANREM) Project with ICRAF as the principle investigator. The project attempts to inventory all plant species - trees, shrubs, mosses, ferns, etc - in the park. The project has produced useful information on the park's rare species. The staff plans to work on rapid propagation techniques for endangered species. They are capable of multiplying some of these species by tissue culture. This information could be useful for the domestication of forest plants with economic value to smallholders' areas.

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5. Department of Forestry, Central Mindanao University

The College of Forestry at CMU has broad capacity and experience in forestry and natural resource management. However they have little international or regional experience and no specific tree domestication program. They are keen to collaborate on national or regional domestication issues. The following is a summary of the college's domestication related strengths and affiliated staff: Agroforestry - Dr. Austral, Dr. Amado E. Exile, Prof. Robert Monoy; Germplasm - Prof. Buena Golosino, Prof. Pedro Ylagan; Forest Ecology - Prof. Deolito F. Clavejo; Training & Information - Prof. Marina Segumpan, Prof. Jupit Casas; Nursery Establishment - Prof. Policarpio Sedeño; Natural Resources Management - Dr. Jose Arances, Prof. Antonio Ecuasion; Watershed Management - Prof. Antonio Ecuasion.

Dr. Austral also operates a private enterprise that markets seed and seedlings of tree species. He has identified a high or steady demand for the following species: *Melia dubia* (bagalunga), *Dipterocarpus grandiflorus, Dillenia philippinensis, Acacia mangium, Acacia auriculiformis, Gmelina arborea, Eucalyptus* species, *Swietenia macrophylla* and *Paraserianthes falcataria.*

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6. Ecosystems Research and Development Bureau (ERDB)

This research division is under the Department of Environment and Natural Resources (DENR) and currently implements 47 ecosystem related research projects across the country. The ERDB has a staff of 300 in Los Banos plus another 250 assigned to the country's 13 regions. It has a strong network across the country with its own staff and outside collaborators including universities, NGOs, community groups and farmers. Two major divisions in ERDB are research and technology transfer. ERDB implements a wide range of activities and programs, which cover the full spectrum of domestication activities, with the exception of 'utilization and processing'. (Those types of activities are undertaken by Forest Products Division of DENR). ERDB likes its activities to have farmer involvement and an on-farm basis. The Bureau publishes a number of publications aimed at researchers, extension agents and farmers.

In the past there has been an 'exotics are better' mentality in the Philippines. Now ERDB, many other government agencies and outside organizations want to include a strong focus on indigenous species, particularly those that are underutilized. Some priority species (both exotics and indigenous) identified through ERDB work include bamboos, *Morus* sp.

(mulberry), *Swieteniea* sp., *Gliricidia sepium, Leucaena* sp., *Melia dubia,* mangrove species, endemic fruit trees, *Shorea* and other Dipterocarps. The problems faced by the farmers in domestication are due to inadequate knowledge of: seed storage techniques, vegetative propagation for rapid multiplication, nursery practices, plant material distribution systems, and utilization and marketing.

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7. Forest Tree Improvement Project (FORTIP, former UNDP-FAO Regional Project)

Dr. Naptale Q. Zabala, forester of the former UNDP-FAO Regional Forest Tree Improvement Project (FORTIP Project), described the success of the vegetative propagation technique developed for *Shorea* species using nodal cuttings. According to him this method may be useful for the propagation of damar (*Shorea javanica*). He feels that to popularize high value trees on farms it is necessary to establish seed orchards to produce quality germplasm of assured genetic and physiological quality. It is also important to focus on species diversity. As reliable high-quality germplasm pathways are virtually non-existent in the Philippines, a community-based network will be needed to disseminate information, produce seed and distribute them among farmers. In collaboration with the DENR and various forest industry companies, FORTIP established species trials, provenance trials and seed orchards of the species listed below. These stands were established with the long-term intention of providing high-quality seed (or vegetative material for the multiplication of hybrids) and should now be in production. *Acacia aulacocarpa, Acacia auriculiformis, Acacia crassicarpa, Acacia mangium, Acacia mearnsii, Acacia hybrids (auriculiformis x mangium), Azadirachta indica, Eucalyptus camaldulensis, Eucalyptus urophylla, Gmelina arborea, Paraserianthes falcataria, Swietenia macrophylla,* and tropical pines.

8. ICRAF Claveria Research Site

A primary focus of ICRAF Claveria is the Landcare approach, used to diffuse inexpensive effective agroforestry technology among farmers. The approach is well structured and involves a broad scope of people interested in conservation farming methods that protect the land and provide viable income generation options for farmers. The people involved with the landcare approach include farmers, local and regional government officials and technical staff, and international researchers. Landcare Association chapters are organized at the municipal, village and sub-village level with devolved authority empowering groups to operate independently. A main reason for landcare's wide success is its farmer-driven and farmer-operated mode. The continuity of activities is ensured by the apolitical involvement of the municipal office, providing continued support even through changes in administration.

Key technologies promoted in Claveria through the Landcare model are: natural vegetative strips (NVS) a simple soil and water conservation method; stream conservation methods; incorporation of perennials (timber, fuelwood, fruit species etc.) to diversify farming systems and improve farm incomes; market oriented smallholder timber production systems; and farm-level tree nurseries to produce the required planting materials. Additionally, training of local and outside personnel is a very strong component of Clavaria activities as is the production and distribution of smallholder appropriate extension material. These activities provide a foundation for participatory tree domestication activities. The close involvement of farmers guarantees activities are evaluated according to smallholder needs. Income generation is a key objective to smallholder domestication activities. Smallholder plantations of *Gmelina arborea* are already common in the area. This has resulted in an increased supply of wood of this species and a reduction in its price. Diversification to include other species is necessary. Trials of *Eucalyptus robusta* and other

Eucalyptus species have been established. There is interest in further diversifying tree plantings to include more high-value species, particularly fruit/nut and indigenous timbers species. Fruit/nut species currently present in the area include: *Durio zibethinus* (durian), *Nephelium lappaceum* (rambutan), *Artocarpus odoratissima* (marang), *Artocarpus heterophyllus* (jackfruit), *Anacardium occidentale* (cashew), *Theobroma cacao* (cacao), *Mangifera indica* (mango), *Lansium domesticum* (lanzones), *Psidium guajava* (guava), *Chrysophyllum cainito* (star apple, caimito), cati-e, *Sandoricum koetjape* (santol), *Averrhoa carambola* (balimbing), *Syzygium aqueum* (tambis), *Persea americana* (avocado), *Castanopsis philipensis* (chestnut), *Castanopsis javanica* (chestnut), and *Macadamia integrifolia* (macademia nut). However, there is little propagation/management information or planting material available for most of these fruit/nut species or for indigenous timbers. Key constraints to smallholder domestication are: inadequate propagation and nursery practices; poor availability or distribution of planting materials; lack of proactive management to increase the value of timber trees or productivity of systems; and a poor understanding of the market structure for smallholder produced timber. Farmers, local collaborators and researchers are interested in pursuing these issues.

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9. ICRAF Lantapan Research Site

As part of the USAID-funded Sustainable Agriculture and Natural Resources Management Collaborative Research Support Program (SANREM-CRSP), ICRAF is working in the buffer zone of the Kitanglad National Park, Lantapan. The work includes the following domestication activities: species/provenance trials; some species exploration; propagation techniques; germplasm collection, multiplication and distribution; silvicultural techniques; and an interest in timber marketing. Training is a major effort towards enhancing local agroforestry capacity for farmer groups, government technicians, and school children. There are 6 farmer-operated nurseries and a central nursery across the project area that supply the seedlings for researcher-managed and farmer-managed trials of which there are over 30. Most trials contain fast growing exotic or indigenous timber species. Farmers and researchers are interested in expanding trials to include: i) indigenous fruits, nut and medical plants - inclusive of propagation studies; ii) spacing and mixed timber trials (of short, medium and long rotation species); iii) pruning and thinning trials; iv) mixed timber and fruit trials; v) weed control trials to determine options for increasing tree growth and decrease management inputs; and vi) fertilizer trials. The most popular species are fast growing timbers, fruits and medicinal plants. Evaluation of 14 exotic and indigenous timber species in farmers' fields shows that there is potential to expand the tree cover in the buffer zone area. Species included in the timber trials are: *Acacia mangium, Albizia lebbekoides, Eucalyptus deglupta, Eucalyptus grandis, Eucalyptus robusta, Eucalyptus tereticornis, Eucalyptus torelliana, Eucalyptus pellita, Eucalyptus urophylla, Gmelina arborea, Grevillea robusta, Maesopsis eminii, Paraserianthes falcataria, Pterocarpus indicus,* and *Swietenia macrophylla.* Other species of interest to smallholder domesticators include: *Artocarpus heterophyllus, Mangifera indica, Castanopsis javanica, Castanopsis philipensis, Dillenia philippinensis, Lithocarpus ilanosii, Syzygium nitidum, Cinnamomum mercadoi, Discocalyx cybianthiodes, Podocarpus philippinensis* and *Eusideroxylon zwagari.*

A notable innovation at the site is the tree seed collection and distribution efforts of a group of 63 farmers, who have organized themselves into the Agroforestry Tree Seed Association of Lantapan (ATSAL). The farmers are knowledgeable in tree selection, seed collection, seed processing and short-term seed storage. ATSAL requires its members to collect seed according to technically sound guidelines. Their seed is primarily sold and

traded locally, including to the project, NGOs and development projects. Some seed orders are now being received from across the country. In spite of some shortcomings, the association is developing into a reliable field-level delivery mechanism of good quality germplasm. The association is a low-cost and effective seed supplier, which could be improved with the minimal investment of further training, and the input of some harvesting and storage equipment. It could provide a model for community-level seed production organization in other parts of the Philippines or Southeast Asia.

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10. Institute of Agroforestry (IAF), UPLB

The Institute of Agroforestry established in 1998 functions under the College of Forestry and Natural Resources, University of the Philippines at Los Banos (UPLB). It was formerly called the UPLB Agroforestry Program (UAP). The Institute undertakes research and extension activities, develops curricular programs for the promotion of agroforestry education and disseminates information on agroforestry technologies concerning both system productivity and sustainable development. The Institute or its members conduct research on germplasm collection, nursery propagation techniques for indigenous species, micropropagation, evaluation of local and exotic species for fodder production and socio-economic research. It is fully capable of implementing activities across the domestication continuum and has been involved with numerous species through various domestication activities. The Institute has access to well-equipped laboratory and field facilities and links with other research institutes (both national and international), NGOs, community groups and farmers. Fifty-four scientists are engaged in agroforestry research and development. Tree domestication is of primary interest of IAF. An interdepartmental tree domestication project has been planned with bias towards prioritization of indigenous tree species, and technology transfer to popularize high value trees among farmers. Technology transfer focuses on propagation, silviculture, processing and marketing. IAF is the focal organization for smallholder tree domestication activities in the Philippines.

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11. International Institute for Rural Reconstruction (IIRR)

The International Institute for Rural Reconstruction (IIRR) is a non-profit NGO dedicated to improving the quality of life of the rural poor in developing countries of Africa, Asia and Latin America. IIRR develops the capacity of the rural institutions through training, technical support and sharing of information. Training relates to household food security, rural development management, indigenous knowledge, the environment and participatory approaches. IIRR has major projects in the Philippines, India, Ethiopia, Guatemala and Uganda. In the Philippines, IIRR's tree domestication activities are based on species with high market value or potential. IIRR has learned that farmers prefer small canopy trees of

species that produce marketable products such as *Durio zibethinus* (durian), *Mangifera indica* (mango), *Nephelium lappaceum* (rambutan), *Garcinia mangostana* (mangosteen), *Artocarpus heterophyllus* (jackfruit), and *Lansium domesticum* (lansoneum). Already in the Bicol region IIRR programs have established nurseries that produce 'small-canopy' varieties of these fruit species. Non-fruit species include in IIRR's other smallholder activities include: *Acacia mangium, Acacia auriculiformis, Swietenia macrophylla, Albizia saman* (syn. *Samanea saman*), *Leucaena leucocephala, Leucaena diversifolia, Erythrina variegata, Senna siamea* (syn. *Cassia siamea*), *Calliandra calothyrsus* and *Zapoteca tetragona* (syn. *Calliandra tetragona*). IIRR has a strong capacity for germplasm multiplication and distribution among farmers. Previously, over a period of 6 years, IIRR operated a germplasm bank that included more than 1000 species appropriate for smallholder cultivation. They sent out thousands of seed packets to smallholders and NGOs all over the world for farm level trials. The program had to close because it became too expensive to operate. IIRR also produces large amounts of extension material appropriate for smallholders, NGOs, community groups, extension agents, and even researchers. This is probably the set of activities for which IIRR is best known.

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12. Kitanglad Integrated NGOs

Kitanglad Integrated NGOs was formed in 1996 to promote agroforestry as an alternative livelihood for buffer zone dwellers of the Mount Kitanglad Range Natural Park. The consortium participates in the World Bank-funded Conservation of Priority Protected Area Project (CPPAP), which is implemented by a management board of Government officials, technical experts and the consortium. The consortium is interested in how tree domestication can be used in buffer zone management, particularly in developing 'non-destructive livelihood options' for local residents. It promotes i) coffee agroforestry systems on land in the buffer zone that has already been converted from its natural ecosystem, ii) 'alternative income generation' schemes and iii) 'assisted natural regeneration'. The species focus is on indigenous timber, fruit and medicinal plants. The following species were identified as having potential for buffer zone dwellers *Albizia lebbeck, Albizia procera, Artocarpus heterophyllus, Musa textilis* (abaca, a fiber plant), *Podocarpus imbricatus* (igem), *Podocarpus philippinensis* (malakanyon), *Calophyllum inophyllum* (bitaog) and *Rapanea apoensis*. The member organizations of Kitanglad are: Green Mindanao (GM), Apu Agbilin Community, Inc. (AACI), Diocesan Ecological Desk (DED)-Social Action Center of Malaybalay Diocese, First Community Credit Cooperative (FICCO), Bukidnon Association for National Development (BAND), Associated Workers Aimed to Rehabilitate the Environment (AWARE) and Northeast Hilltribes Development Foundation, Inc. (NHDFI)

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13. College of Agriculture, MOSCAT

The College of Agriculture, Misamis Oriental State College of Agriculture and Technology (MOSCAT) offers a diploma in Agroforestry Technology (2-year program) and a degree in Agroforestry (4-year program). Besides education, the College also focuses on extension and development activities. The staff has experience in propagation and management techniques for fruit trees. These activities target local farmers. As farmers prefer fruit species, the College's domestication efforts focus on *Durio zibethinus* (durian), *Mangifera indica* (mango), *Nephelium lappaceum* (rambutan), *Garcinia mangostana* (mangosteen), *Artocarpus heterophyllus* (jackfruit), and *Lansium domesticum* (lansoneum). There is also a strong emphasis on fast growing timber species, mainly *Gmelina arborea* and *Eucalyptus deglupta*. The College would like to expand its farmer-based domestication activities to include: i) mixed plantations - fruit, timber and multipurpose species in the same plantation; ii) silvicultural management of timber stands - some of this work is currently being implemented by local ICRAF staff; and iii) diversification of timber species to include indigenous species. Seed collection, handling and storage are major constraints, as is the lack of a viable germplasm distribution system. Proactive management of smallholder tree systems is also needed. MOSCAT has extensive field facilities for research and staff, hence it is a suitable partner for ICRAF.

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14. National Plant Genetic Resources Laboratory, UPLB

The laboratory has a collection of 120 indigenous fruit species, plus numerous provenances and cultivars, which are all characterized and catalogued. They also have thorough information on exotic and naturalized fruit species in the Philippines. The institute has experience in collecting and storing germplasm. The staff of the institute are nationally and regionally recognized experts on fruit and nut species. The institute has a working relationship with the Center for Tropical Fruit Studies, Bogor Agricultural University in Indonesia, with whom they are developing a program on under-utilized fruit species. They are able and willing to collaborate on domestication activities with IAF or other agencies.

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15. Forestry and Environment Division, PCARRD

The Philippines Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) created in 1972, is under the Department of Science and Technology (S&T). The Council is responsible for: i) formulating policies, plans, strategies, programs and projects for science and technology development; ii) monitoring projects; and iii) allocating funds for research and development. The main focus of the Forestry and Environment Division of PCARRD is the study of indigenous knowledge systems implemented through a network of national agricultural research organization, commercial organizations (producers, manufacturers and traders), NGOs, community organizations and smallholders.

The division intends to develop a database on biodiversity and indigenous knowledge, which will enable the farmers to select high value species for cultivation. They feel indigenous knowledge is under-recognized and under-utilized, and that the collection and understanding of indigenous knowledge is a perquisite to planning and implementing a successful smallholder domestication program. Information (both indigenous and scientific) and training should be the foundation of a domestication program. The food security and income generation needs of smallholder participants should be the primary objective of tree domestication. Activities should take a systems approach over a species approach. The division considers the following groups as species priorities: threatened species (such as ebony or ironwood), timbers used for furniture, sedges and grasses for basket weaving, bamboos/rattans, and sago and sugar palm. Germplasm delivery pathways are not effective nor accessible to the farmers. The establishment of local seed orchards or production areas is required. The formation of a regional network will be necessary to create an awareness of tree domestication issues among farmers.

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