



ICRAF

**Regional Workshop on the
Domestication of Agroforestry Trees
in Southeast Asia**

Working Group Reports (Draft)

James M. Roshetko

Regional Workshop on the Domestication of Agroforestry Trees in Southeast Asia

Working Group Reports

Compiled by James M. Roshetko

These reports were submitted by the working groups that met during the *Regional Workshop on the Domestication of Agroforestry Trees in Southeast Asia* held in Wanagama, Yogyakarta, Indonesia, November 4–7, 1997. Working group topics were determined from pre-registration forms and correspondence submitted by participants prior to the workshop. Eighty-five percent of the participants provided input to this process, enabling the workshop planning staff to compile and organize recommendations for preliminary working group topics and membership, which were reviewed and discussed on the first day of the workshop. Working group members are listed at the beginning of each report. Working group topics were

1. External factors affecting the domestication of agroforestry trees (economic and policy)
2. Agroforestry tree species for domestication
3. Domestication process and strategies
4. Linkages for training and information dissemination

Working Group 1

External factors affecting the domestication of agroforestry trees (economics and policy)

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Most forestry and agroforestry activities focus on tree or system productivity. Less attention is given to the policy issues that affect product movement and utilization off the farm. Even less attention has been focussed on the economics of agroforestry products. This situation is not a surprise, considering that much of the early attention in agroforestry centered on species and systems targeted for subsistence-level farmers. Many of the products in these systems (fuelwood, fodder, green manure) by their nature fall outside the market structure. Agroforestry has evolved. Current paradigms acknowledge that agroforestry species and systems should address both farm families' income and household production needs. It is now timely that external factors receive due attention.

The working group identified three external factors requiring further research: policy, economics, and the status of existing forests. Key policy issues include

- legislative restrictions on the sale of tree products
- national land-use policy
- tree and land tenure
- incentive systems encouraging or discouraging the planting and management of trees
- effective enforcement of forest policies
- technical information exchange

Key economic issues include

- demand analysis at both the market and subsistence levels
- analysis of future and potential demand
- marketing systems analysis
- product pricing
- farmer access to price and demand information.

The “status of the existing forest cover” was also identified as an important external factor affecting the domestication process. This factor was listed to acknowledge that the existence or scarcity of natural forests greatly effects the potential for local tree domestication activities.

The relative importance of the research issues under each external factor was ranked in regard to key steps of the tree domestication continuum (Table 1). The issues under each factor are listed in order of importance on a relative scale as determined by working group members. The tree domestication continuum was addressed in more detail by Working Group 3.

The group recognized that farmers are often unaware of marketing opportunities and channels for their products and that they need better access to advice on marketing strategies. The group also acknowledged that considerable opportunity exists to create new markets, improve postharvest practices and value-added processing, and build access to lucrative international or specialty markets. However, the success of such endeavors depends greatly on the sophistication of the farmers, farmer groups, local organizations, and the markets in question. Before such endeavors are undertaken, it is imperative that the entrepreneurial capacity of the farmers and the institutional capacity of local organizations be thoroughly assessed.

The last issue addressed by the working group was “the economics of germplasm production.” It was agreed that this issue is important because a shortage of seed often hampers tree planting programs and that seed “quality” greatly influences tree growth and survival, and thus project success. Future investigation is justified to determine how farmers can benefit from “the economics of germplasm production.” Working Group 3 dealt with some aspects of this issue.

Working Group 2 Agroforestry tree species for domestication

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Table 1. External factors affecting the domestication of agroforestry trees in Southeast Asia.

External factors	Identification, evaluation, and selection of species	Tree breeding and genetic management	Propagation and management techniques	Germplasm multiplication	Germplasm distribution, dissemination, and diffusion	Score
A. Policy factors						
Restrictions on the sale of tree products	H	H	H	M	H	15
Incentive systems related to tree planting	M	M-L	H	H	H	13-12
Land use policy	H	M	H	L	H	12
Technical info exchange	L	H	M-L	H	H-M	11-10
Tree and land tenure	H-M	L	H	M-L	H	11-9
Effective enforcement of forest policies	H	M-L	M-L	M-L	M	10-8
B. Economic factors						
Demand analysis at the market and subsistence levels	H	H	H	H	H	15
Product prices	H	H	H	H	H	15
Access to price and demand information	M	H-M	M	H	H	13-12
Future demand analysis	H	H-M	L	H	M	12-11
Marketing systems	M	L	M	H	H	11
C. Status of existing forest cover	H	M-L	M	H	L	11-10

Note: H = high, M = medium, L = low

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Southeast Asia is a diverse ecological region in which international research organizations, private companies, international non-government organizations (NGOs) and development organizations, regional projects, government agencies, universities and colleges, national and local NGOs, community organizations, farmer groups, and individual farmers are all involved with tree domestication activities. The economic and social objectives under which these various domesticators operate are often drastically different. Within this context, Working Group 2 was asked to discuss which species or types and related agroforestry systems hold potential for expanding tree domestication with in the region. Discussions identified the following topics:

- timber species for both smallholder and commercial production
- tree farming and silvicultural techniques for smallholders
- fruit and other species that produce commodities for household use and markets
- integration of indigenous knowledge into the domestication process
- emphasis on both exotic and indigenous species

In Southeast Asia, the remaining area of natural forest is decreasing and being degraded. There are moves throughout the region to improve protection of these remaining areas. Simultaneously, as the regional population increases and gains affluence, the demand for tree products is increasing. Farmers are responding to this situation by planting more trees to meet household needs as well as market demands for wood products. Some commercial forest companies have noticed this trend—and its potential—and are looking for partnering opportunities with smallholder farmers. A regional domestication program can assist these developments by focussing some attention on appropriate species and systems. Obviously, timber or pulp species would fit this category. To meet smallholders' needs, *timber species* are the more promising. There is potential to market these crops locally and regionally or even internationally through partnerships with companies or middlemen. Pulp species would also hold significant promise for smallholders living within a serviceable distance of an established pulp mill.

Smallholder timber production systems should receive attention. Smallholders usually grow timber crops in small block plantations or in rows between crops. Currently, management in these systems is minimal. Trees are planted at final spacing and harvested when they reach a marketable size. Farmers are reluctant to thin stands because the removal of trees is seen as future income foregone. They do not recognize the improved growth associated with better management practices. There should be an emphasis on *tree farming and silvicultural techniques for smallholder farmers*.

Within these systems, there is vast opportunity to focus on *species that provide products for both household use and sale*. Priority species will depend very much on the people, culture, and location in question. Appropriate tree products would include fruit, food, fuelwood, fodder, medicines, and resins. Of these, *fruit species* are particularly promising. Most farmers are interested in expanding fruit tree cultivation, particularly since fruit serves

both household needs and market demands. In addition, there are many indigenous fruit species in Southeast Asia that are not fully explored. The propagation and management techniques for these and other indigenous species are often unknown or unrecorded in the literature. Investigating these propagation and management techniques would be a good focus for regional work. Compilation of *indigenous knowledge* would be an important first step.

It was specified that regional domestication efforts should focus on both *exotic and indigenous species*. The deciding factor concerning species choice should not be the species' origin but rather farmers' needs, market opportunities, and environmental conditions. Other factors that will assist the process of species selection are the clarification of national policies affecting the propagation or utilization of certain species, the availability of quality germplasm, and access to information and training.

Working Group 3 Domestication strategies and process

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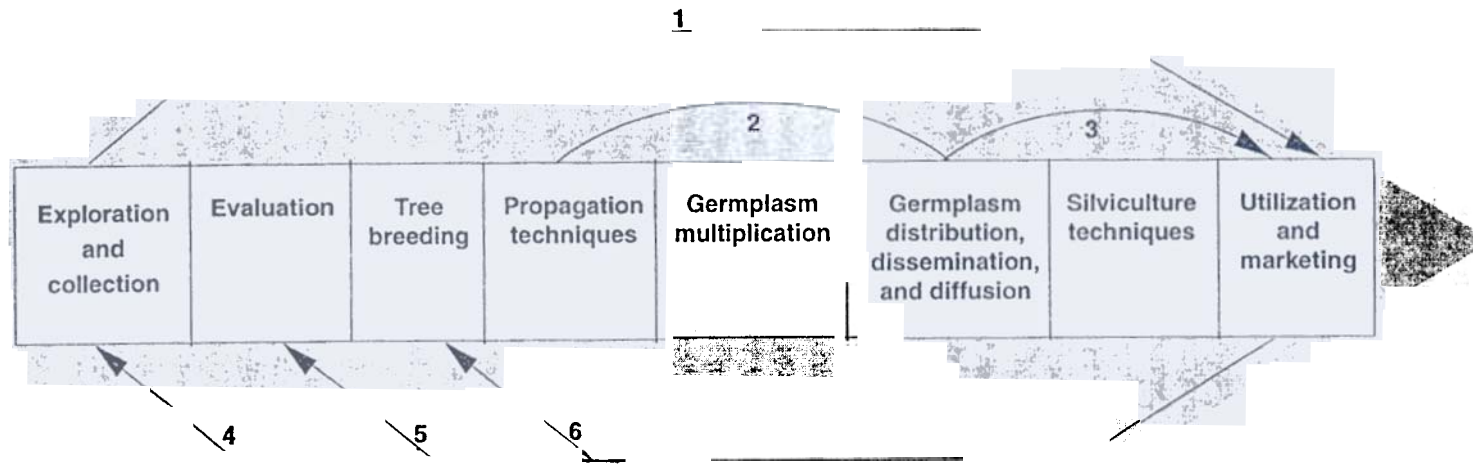
The process of tree domestication involves the identification, production, management, and adoption of desired germplasm to meet farmer-driven or market-led needs. The domestication strategies used for individual species vary according to their functional use, biology, target environment, and the domesticator-researcher or farmer (see Simons 1997). In layman's terms, tree domestication is the "naturalization" of a species to improve its use by human-kind. A key input to the process is germplasm and its quality. Working Group 3 was asked to address the following points:

- the "agroforestry tree domestication continuum" in Southeast Asia
- priority-setting for tree domestication activities in Southeast Asia
- general germplasm pathways operating in Southeast Asia
- the potential for marketing improved germplasm to and through smallholders
- other germplasm-related issues that affect tree domestication

The "agroforestry tree domestication continuum" in Southeast Asia

The group developed Figure 1 to depict the "agroforestry tree domestication continuum" in

Figure 1. Tree domestication continuum. The various activities within the domestication continuum represent a general progression from the wild to a 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 may be 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.



Southeast Asia. The various domestication activities, from left to right, represent a general progress. A species is first explored and evaluated. Breeding methods and propagation technologies are determined. Germplasm is multiplied and distributed. Tree farming and silvicultural technologies are identified. Tree products are developed and marketed. However, the domestication process for any given species may not flow sequentially from left to right. Activities often occur in parallel; some steps in the continuum may be by-passed or deferred. The entire process is iterative. Information and results gained at any point along the continuum may progress back to earlier steps. For example, farmers may select a "wild" fruit species for home utilization or marketing (arrow 1). Improved propagation methods (arrow 2) may increase the demand for germplasm and thus increase supply and marketing (arrow 3). Marketing opportunities may instigate renewed exploration of natural populations (arrow 4), re-evaluation of known genetic material (arrow 5), or interest in breeding (arrow 6). For a species with high economic value or many products, domestication activities may be almost continuous, while for less valuable or useful species, activities will be less intense.

It was discussed that the domestication continuum provides a good illustration of the relationships among the workshop working groups. External factors (Working Group 1) mainly affect the furthest-right step in the continuum, utilization and marketing. Species choice (Working Group 2) enters the continuum from the left. Training and information linkages (Working Group 3) provide input to all steps of the continuum.

Priority-setting for tree domestication activities in Southeast Asia

In the past, the priority-setting process for agroforestry tree domestication in the Southeast Asia region has been dominated by organizations, working independently or in collaboration with a few other organizations. In the recent past, some collaborative efforts were begun through international initiatives, including the regional Forestry/Fuelwood Research and Development (F/FRED) Project, the Australian Tree Seed Center (ATSC), and the UNDP/FAO Regional Forest Tree Improvement Project (FORTIP). The process by which species and domestication activities have been selected has been largely undocumented and, it appears, random. Selection was made according to internal organizational interests, popularity generated by various channels, or the potential value to national economies. Farmers, engaged in their own domestication activities for centuries, have been largely overlooked by the formal domestication process. Since our definition of "agroforestry tree domestication" identifies the farmer as a key player, it is important to incorporate farmers' objectives into regional domestication activities.

The role of researchers, extension agents, and farmers

It was agreed that domestication activities contain appropriate roles for researchers, extension/development organizations (NGOs), and farmers. However, it was also acknowledged that the classic model of "researcher-generated technology" being delivered to "farmers" through a local "extension apparatus" had proven to be unsuccessful in Southeast Asia. New, dynamic relationships are required among researchers, extension agents, and farmers that allow each player to contribute its strengths to the domestication process and improve its weaknesses through collaboration. *Researchers* should retain their role in developing and testing hypotheses and technologies, *extension agents* in providing access to training and new information, and *farmers* in testing and adapting new technologies.

The change required is for each player to step beyond traditional roles and become involved across all research-extension-adoption activities to achieve a mutual goal: ad-

vancing tree domestication. *Researchers* need to become more involved with extension to ensure that the correct message is being delivered. *Farmers* should provide input and evaluation to research design to ensure that the right question is being asked. *Extension agents* and organizations have the crucial role of facilitating communication and interaction between the field and research station. These changes will not be easy. It will require time and a concerted effort to establish these new relationships, but the efforts will improve the suitability of domestication activities and bridge the gap between research and the field.

Another significant role that extension-development organizations fill is to facilitate linkages to international and national networks that provide access to information resources and build personal and organizational contacts. The potential of network linkages is addressed in more detail by Working Group 4.

It is also important to realize that the different objectives of researchers and farmers are not a hindrance but rather an opportunity. Parallel trials, on-station or on-farm, can be established to address these different objectives simultaneously. Researchers can design rigorous scientific trials to maintain research standards, and farmers should establish trials that address the realities of the field. In both cases, it is important for farmers and researchers to share input at the planning stage to improve the suitability of their trials and the applicability of the results. In this way, "best-bet" technologies or species can be recognized from the beginning without either partner "re-inventing the wheel." While the methodologies employed by farmers and researchers will be different, but both types of trials will provide useful information.

Domestication organizations in Southeast Asia

In Southeast Asia, numerous international research organizations, private companies, international non-government organizations (NGOs) and development organizations, regional projects, government agencies, universities and college, national and local NGOs, community organizations, farmer groups, and individual farmers are involved with tree domestication activities. Given the large number of diverse organizations involved, it is almost impossible for any one person or organization to be fully informed concerning regional tree domestication efforts.

To address this shortcoming, the group developed the matrix in Table 2, which requests information concerning individuals and organization involved with domestication activities. Information is also sought on "training and information services" offered by organizations and the involvement of farmers or farmer groups in domestication activities. Figure 1 is a diagrammatic representation of the information sought. Full details concerning each item can be provided on an expanded matrix form containing additional space for information. From the information collected through the matrix it will be possible to develop databases of regional organizations and individuals involved in domestication, country-specific databases of organizations and individuals, and species being domesticated in the region.

In addition to collecting relevant information in a centralized source, these databases will also serve two important purposes. They will identify research gaps and opportunities in regional tree domestication activities and identify potential collaborators. During this workshop, all participants were requested to complete a copy of the matrix for their organization and close collaborators. This was an obvious first step. But although the workshop was well attended, only about 60 individuals from roughly 45 organizations were present. This is a tiny representation of the vast number of organizations currently involved with domestication in the region. To expand the number of organizations to be included in the forementioned data-

Table 2. Tree Domestication Matrix.

Please complete the matrix for your organization and close collaborators. For each of the three sections below, provide the information requested for each of the domestication continuum steps. Under Section 1 list the names of organizations and staff members working on the various steps of the tree domestication continuum. Indicate each organization's focuses as research (R), extension (E), or development (D). Also list priority species that are part of current or past activities. Under Section 2 list "training and information services" offered by your organization or collaborators under each domestication step. List the names of relevant staff. Under Section 3 indicate the level of farmer involvement in the respective domestication activities. Specify their role as client or collaborator and provide a short description. List contact names if appropriate.

Section 1. Organizations and staff members and priority species

Section 2. Farmer Involvement

Section 3. Training and Information Services

Domestication continuum steps:

Species exploration and collection

Species evaluation

Tree breeding

Propagation atechnology

Germplasm multiplication

Germplasm distribution, dissemination, and diffusion

Silviculture techniques

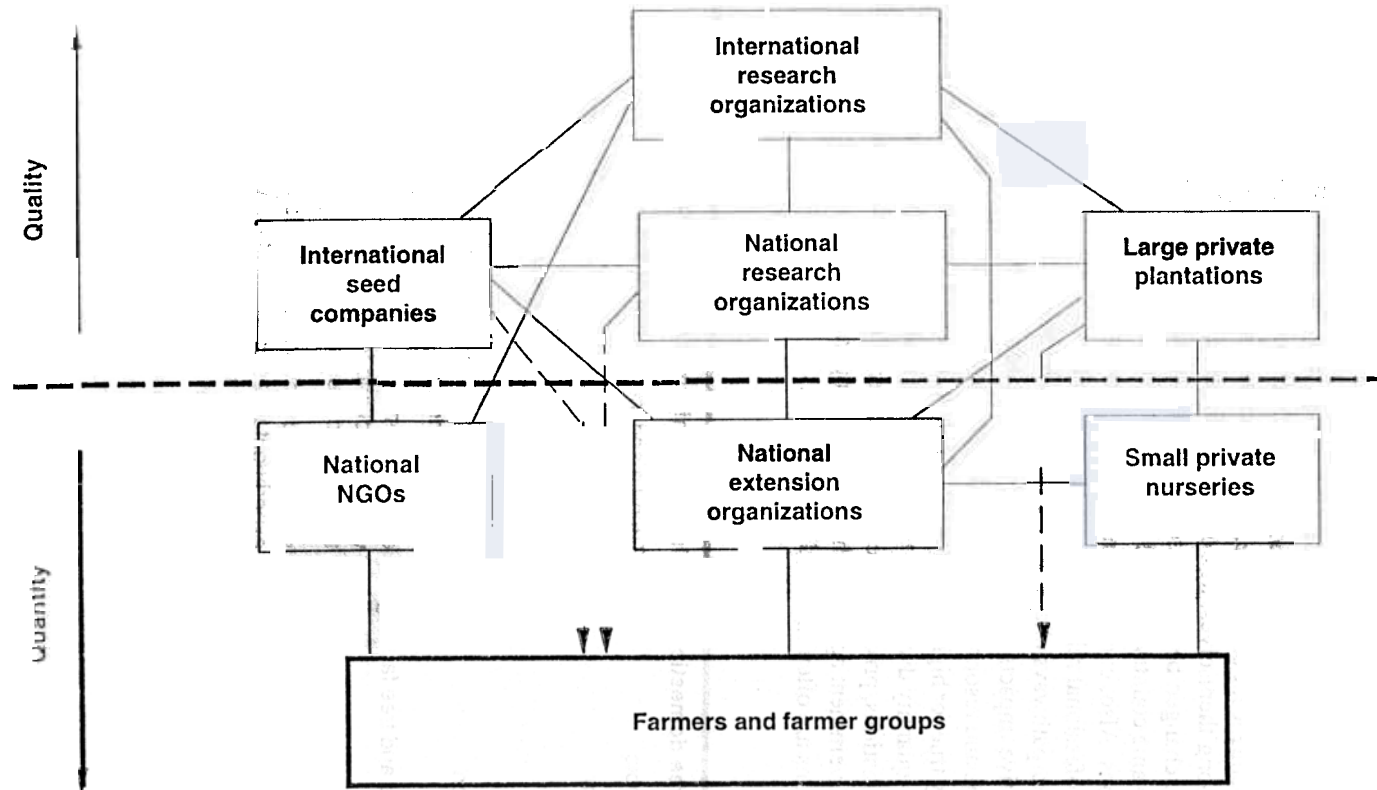
Utilization and marketing

bases, the working group recommended that a consultant be employed to visit some countries in the region and meet with the more prominent organization active in tree domestication. ICRAF staff agreed to investigate possible avenues to achieve this recommendation.

Common germplasm pathways in Southeast Asia

The group developed Figure 2 as an idealized model of germplasm pathways operating in Southeast Asia. The model depicts international research organizations, international seed companies, national research organizations, and large private plantations as closely linked and primarily concerned with seed quality. National NGOs, national extension organizations, small private nurseries, and farmers and farmer groups are depicted as closely linked and more concerned with seed quantity. Quality-focused organizations are concerned with identifying the best germplasm available for a specific situation. Among the strengths of these organizations are the evaluation of species and provenances and the development of protocols for commercial timber plantation. Quantity-focused organizations are very con-

Figure 2. Model of general germplasm pathways operating in Southeast Asia
 Unless otherwise indicated by arrowheads, movement along lines connecting boxes is bidirectional.



cerned with meeting the seed demand for the programs. They are good at promoting new species or provenances and at developing "tree planting cultures" among local communities. The movement of seed resources is generally lop-sided from the top to the bottom of the figure; information flows in both directions. If linkages are adequate, these organizations form a good partnership to develop, evaluate, and promote selected species and provenances.

While this model found general acceptance in the group, it was acknowledged that pathways vary greatly with location and are often broken into sub-pathways that operate in semi-independence. For example, quality-focused organizations often have a propensity to interact among themselves, as do quantity-focused organizations. Similarly, seed may be regularly exchanged between research organizations, extension organizations, and NGOs within the same country (or local area), with periodic infusions of germplasm from outside organizations. Also, exchange linkages may develop between organizations based on personal or professional relationships of their members.

The sub-pathways characteristic of the model strengthen individual linkages but have some negative impacts on the seed-supply function of the pathway. All organizations have limited time and resources, which tend to be concentrated within the sub-pathways. This is particularly true for high-quality seed, which is always in short supply. Sub-pathways across the quality-quantity divide tend to be weaker than those on either side. Thus NGOs, extension organizations, private nurseries, and farmers have less access to quality seed. In addition, the government agencies charged with supplying quality seed to NGOs and extension organizations are often ill-suited for the task.

Table 3. Tree domestication training and information needs in Southeast Asia.

General Topic	Training and information needs
Germplasm	seed distribution, collection, and production techniques seed certification programs genetic diversity and improvement reproductive biology
Propagation	seed-based and vegetative propagation nursery techniques
Silviculture and tree farming	establishment weed control and fertilization thinning and pruning
Research methodology	species and provenance selection and trials experimental design for on-station and on-farm trials data collection and analysis incorporation of farmer's objectives into the research strategy
Socio-economic aspects	participatory research methodologies community organizing methodologies extension methodologies
External factors	policies affecting tree domestication economics and marketing of products postharvesting and value-added processing

Farmers and farmer groups generally have the weakest links to germplasm pathways. This is indicated in the figure by the dotted lines connecting farmers and farmer groups with quality-focused organizations and the bold box farmers and farmer groups occupy. Even linkages with NGOs and extension organizations may be weak for a number of reasons: remote location of farms, lack of information, or paucity of capable organizations. Farmers most often acquire seed from informal sources—collection from local forest, woodlots, and farms or exchange with family, friends, and acquaintances. These local germplasm pathways operate in recurrent isolation. Some quality seed enters the systems, but access is infrequent and uncontrolled. The quality germplasm is planted locally, where it interbreeds with local varieties, diluting its superior traits. Because farmers are generally unfamiliar with seed collection protocol and management, local pathways are often sub-optimal. Seed is commonly collected from only a few trees, resulting in seedlots with a narrow genetic base. Generally, appropriate handling techniques are not observed, resulting in reduced seed viability and longevity.

There is ample room to improve the germplasm pathway described above, particularly at the farmer level where the number of individuals interested in planting trees is high and access to quality seed is low. A primary way of solving this problem is to improve farmer linkage to germplasm pathways that distribute quality seed. How this can be accomplished is a question deserving attention. Also, realizing that most farmers will continue to meet their own seed requirements, there is also a need to improve the seed “collection, production and handling” skills of farmers and local organizations.

The potential of marketing improved germplasm to and through farmers

The question of marketing improved seed to and through smallholder farmers is directly related to the inefficiencies of the regional germplasm pathways, specifically, the weak links between farmers and quality germplasm. Based on their experience, most working group members agreed that many farmers would be willing to pay a premium for “improved” seed. However, there is a caveat: farmers must be convinced that the improved seed is also improved for their objectives. This can be partially accomplished by establishing demonstration trials under local conditions. Farmers should be involved in the trial design to ensure that it addresses their needs. Many farmers will be glad to be involved in demonstration trials if the results will be useful to them.

The group felt that the second part of the question—can improved seed be marketed through farmers or farmer groups?—was more dubious. As indicated earlier, tree germplasm management is a new activity; most farmers lack the skills and experience required for this activity. However, in many communities there are individuals or groups of individuals who cultivated an interest in tree planting before it became a popular activity. Out of necessity and self-motivation, these individuals have developed the skills necessary to manage tree germplasm successfully. It is reasonable to believe that these individuals might be interested in expanding their activities to supply the community. In addition, it might be possible to link with local agricultural seed supply pathways. In either case, it will be necessary to provide training in seed collection, handling, and storage to the would-be entrepreneur.

If such an arrangement is to be considered, it will be important to determine where along the seed production pathway the entrepreneur will enter the picture. Will they serve as a middleman, be required to collect seed, or be asked to set up and manage seed production areas? Each level of intensification would require additional training and access to resources.

Other germplasm and propagation issues that affect tree domestication

The group recognized and provided summary comments concerning the following issues as having an important affect on tree domestication efforts in the region:

- seed storage and handling
- recalcitrant seed
- hybrids
- quarantine
- symbiotic organisms
- propagation skills for smallholders

Because tree growing is a new activity to most farmers, the importance of proper *seed storage and handling* is not yet appreciated. At the farmer level, seed storage is usually in open containers kept in a corner of the house or nursery hut. This situation leads to fluctuations of moisture content, temperature, and light intensity. These fluctuations result in reduced physiological quality of seed and the resulting seedlings. As domestication activities intensify at the local level, it is important to provide seed storage skills to relevant individuals, particularly seed collectors, seed suppliers, and nursery operators. The need for local training in seed storage and handling will be even more relevant when access to quality seed is established.

There is a strong interest in the domestication of indigenous species in the region. Many of these species have *recalcitrant seed*, which in effect has excluded them from past domestication efforts. There is a need to initiate research in seed collection and handling techniques for these species as well as propagation and management techniques. Appropriate techniques may vary greatly by species.

Hybrids have proven to be better adapted to some environments than individual species. Hybrids are commonly used in government and commercial plantations. Increasingly, there is interest in planting hybrids from NGOs, extension agencies, local nurseries, and farmers. This is encouraging, and the demand should be met by developing local access to germplasm pathways as described above. It will also be important to educate local domesticators concerning the dynamic of hybrid genetic characteristics.

As an interest in tree planting at the local level has increased over the past 20 years, the number of shipments and amount of seed crossing international borders has greatly increased. Much of this seed, whether shipped or carried, eludes national *quarantine* channels. This is a dangerous situation that can lead to the introduction of pests and diseases, or weedy and inferior germplasm. While we are not able to tackle this global problem alone, as individuals and organizations we can contribute by (1) acknowledging the importance of this issue in our dealings with collaborators and the public, and (2) always following appropriate quarantine procedures.

Many of the species that are the focus of local domestication efforts are able to fix atmospheric nitrogen through a *symbiotic* relationship with *Rhizobium* bacteria or *Frankia* actinomycete bacteria. These relationships enable trees to grow on degraded sites and achieve their productive potential. The importance of these relationships is widely known, but often tree planting programs and projects pay minimal attention to symbiosis. Much the same can be said about mycorrhizal fungi, which form a symbiotic relationship with many tropical plants to improve root access to soil nutrients and moisture. Inoculants of these symbionts are available in many countries. Costs are minimal. The working group recommends that

use of these inoculants be intensified.

Most agroforestry tree species are propagated by seed. While seed propagation and nursery management knowledge is thought to be ubiquitous, it is not uncommon for local nurseries to operate at a sub-optimal level. *Nursery skills for smallholders* need to be emphasized. Also, there is wide opportunity for agroforestry activities to benefit from the utilization of vegetative propagation techniques, ranging from simple cuttings to more advanced budding and grafting techniques. These methods are widely used for fruit propagation in horticulture and may be used to multiple species with recalcitrant seed. Working group members noted that farmers generally express interest in these methods.

Working Group 4

Linkages for training and information dissemination

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Relevant training in and the dissemination of information concerning tree domestication were identified as regional priorities before and during the workshop. To examine this question in more detail, a questionnaire addressing training and information needs was distributed to all participants at the beginning of the workshop. The questionnaire focused on four topics:

- training needs
- information needs
- information dissemination channels
- tree domestication linkages and networks

The results from the questionnaire provided a starting point for working group discussions.

Training and information needs

There was a strong correlation between training and information needs. These needs can be summarized in six topics: germplasm, propagation, silviculture and tree farming, research methodology, socio-economic aspects, and external factors. Major needs under each topic are specified in Table 3. Some of these identified needs are currently being addressed in Southeast Asia through ICRAF's Capacity and Institutional Strengthening Program.

Information dissemination materials and channels

Questionnaire results and working group discussions specified that training and information dissemination efforts should be developed in forms appropriate for various target audiences: researchers, technicians and field workers, non-government organizations, and farmers.

The *world wide web* and *email* were identified as excellent cost-effective channels for providing information to researchers and organization. However, many technicians and field

workers and most farmers do not have access to these resources. The best channel to reach all target audiences remains newsletters or similar periodic publications. While these publications are time consuming to produce and require a centralized organization, these responsibilities and related costs can be reduced through linkages with networks. (Regional networks are discussed below.) *Videos* or *television programs* are seen as a channel that effectively reaches all target audiences, if the appropriate equipment and electricity are available. The shortcoming of this channel is the cost in time and money to produce a high-quality product. Information channels that are more effective at reaching field workers and farmers include simple "how-to" leaflets and brochures, group meetings, and radio broadcasts. *Field days*, *cross-farm visits*, and *on-farm training courses* were also identified as very effective ways to provide field workers, local organizations, and farmers with opportunities to gain practical information, training, and hands-on experience in domestication activities.

It was acknowledged that materials targeted for researchers would include emphasis on theoretical foundations and research methodologies. For technicians and field workers, materials should emphasize practical management. Materials for farmers also should emphasize practical management and should be simple, with a lot of pictures or diagrams. This is important to address the low literacy skills that may be common in some rural areas. Materials for researchers and some technicians and field workers can be in English. However, materials for remote field workers and farmers are most useful in local languages.

It was also stated that efforts to translate research results into materials useful to field workers and farmers must be intensified. *Presently much information developed through research never makes it to the final end-users.* This final step in disseminating results should be incorporated into the research process. An effective way to accomplish this goal would be to (1) have researchers and field workers collaborate on the production of the farmer-targeted materials mentioned above, and (2) incorporate research results and research staff in field days, cross-farm visits, and on-farm training courses.

This would provide field workers, NGO staff, and farmers with access to research staff and results and also give researchers and technicians a better appreciation of real field conditions. It was noted that the Mindanao Baptist Rural Life Center in the Philippines receives 20,000 visitors and trains 3,000 farmers each year. Improving linkages between researchers and this type of organization would help bridge the communication gap between research and farms.

Linkages and networks

Currently in Southeast Asia, there is a great array of international, regional, and national networks that provide information or assistance with agroforestry. None of these networks specifically focuses on tree domestication, although their activities often cover some domestication topics. The great advantage of these networks is facilitating linkages between organizations that provide mechanisms to exchange information, including training opportunities, and conduct joint activities on a cost-effective or cost-savings basis.

However, networks come and go. Very often networks are project-related, which limits their lifespans. Often new networks are begun without benefit of the experience and relationships gained by their predecessors. Initial progress can be a replication of previous accomplishments. To avoid this re-occurrence, new initiatives should be associated with existing partner institutions rather than with projects themselves. This approach has been successful with the national multipurpose tree species networks initiated through the re-

gional F/FRED Project managed by Winrock and the national secretariats established by FAO's Asia-Pacific Agroforestry Network (APAN). It is also important for networks to link with the existing agencies, NGOs, and field personnel active in the region and not create a parallel structure of organizations and individuals. Networks should not only emphasize technical assistance but also develop the planning, implementation, and organizational capacity of partners so they can assume responsibility when the network passes into local hands (assuming that the network did not start with or from local hands).

It was also mentioned that while most networks have an objective of working with and meeting the objectives of farmers, most often this objective is not achieved. Because of their structure, networks normally work best with other organizations—universities, government agencies, international and national NGOs, local organizations. Networks depend on their partners, mainly national or local organizations, to provide access to farmers and community groups. In most cases, if there is no active organization at the local level, networks cannot reach the community. Working effectively with local communities requires a grass-roots presence, time, and experience. While networks cannot be expected to work effectively with the community in numerous locations, they should assist their partners to gain the skills required for effective local community work. Appropriate training and information needs related to effective community work are mentioned in Table 3 under “socio-economic aspects.”

Working Group Sessions Summary

The working group sessions showed that the four topics are closely interrelated. Discussions and presentations by each group incorporated the topics of at least two groups. Efforts in one topic area will benefit from and complement progress and inputs related to the other topics. The workshop working group sessions identified the following list of tree domestication priorities for Southeast Asia.

Economic and policy

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

Agroforestry species and systems

- timber species for both smallholder and commercial production
- tree farming and silvicultural techniques for smallholders
- fruit and other species that produce commodities for household use and markets
- integration of indigenous knowledge into the domestication process
- emphasis on both exotic and indigenous species

Domestication process and strategies

- more collaboration between researchers, extension agents, and farmers in domestication activities

development of databases identifying domestication organizations and priority species in Southeast Asia

Germplasm and propagation

- improved linkages in the regional germplasm pathways, particularly improved access to quality seed for farmers
- improved seed collection, production, and handling skills for farmers and local organizations
- improved seed-based and vegetative propagation methods for farmers and local organizations

Training and information dissemination

- expanded training opportunities and information resources in relevant tree domestication topics (see Table 3) using forms and channels appropriate for researchers, extension agents, NGOs, and farmers
- improved linkages among research institutions, extension organizations, and farmers

Literature cited

Simons, A. J. 1997. Tree domestication—better trees for rural prosperity. *Agroforestry Today* 9:4–6.