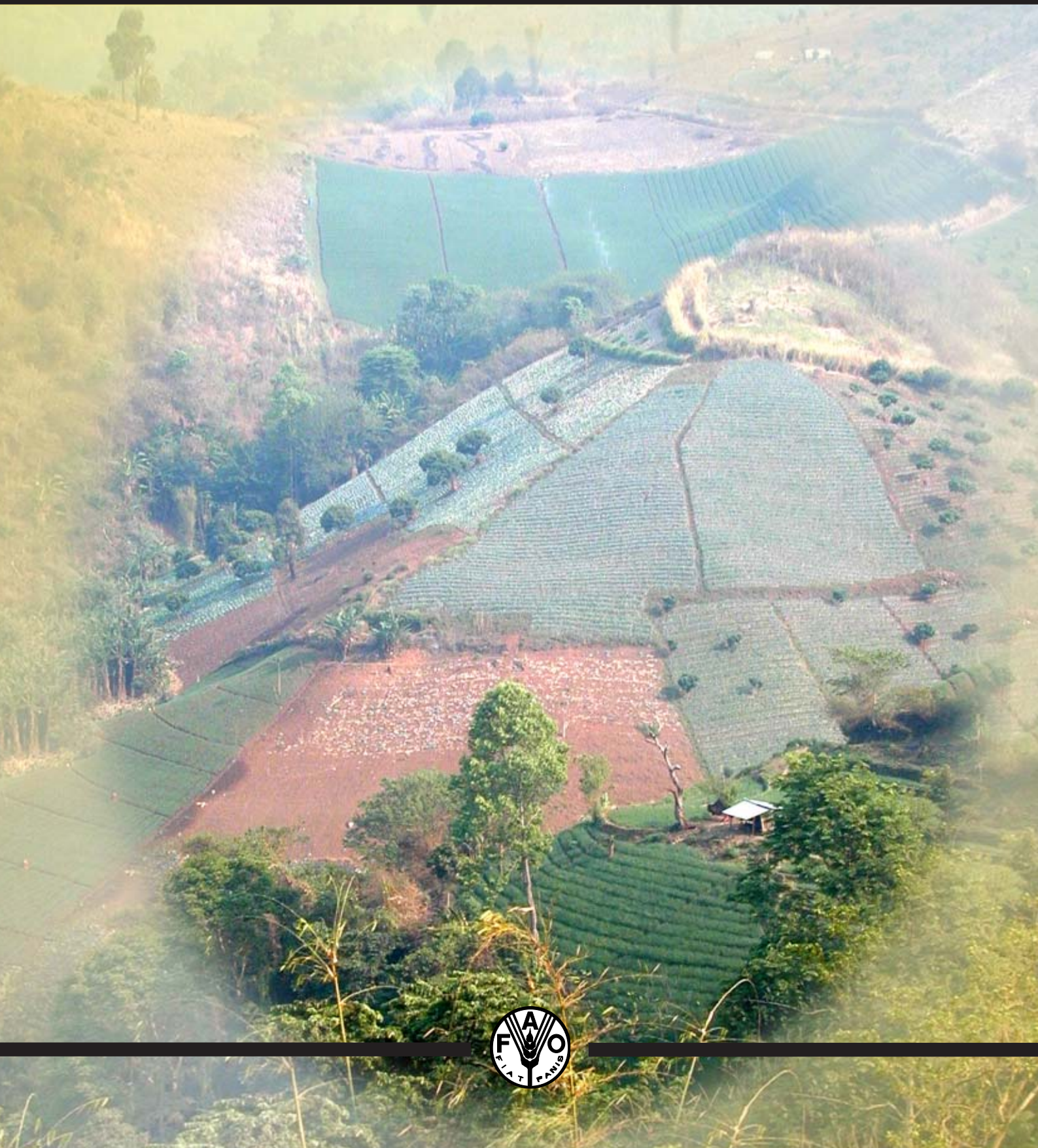
APANews

ASIA-PACIFIC AGROFORESTRY NEWSLETTER

NO. 27 ● DECEMBER 2005 ● ISSN 0859-9742



dear readers

As we are closing the first five years of the new millennium, we are pleased to present to you the 27th issue of APANews! In this issue, we have quite a number of articles from our fellow agroforestry practitioners in India. We are sure that you will enjoy reading about the crop diversification efforts in Punjab and how understorey crop growth can be maximized by regulating photosynthetic active radiation (PAR) as studied by the Indian Grassland and Fodder Institute. In addition, the successful integration of bamboo in the same Indian state, has provided yet again additional knowledge on the capability of agroforestry for crop diversification.

Research efforts of the World Agroforestry Centre and its partners also revealed the need for collaboration among farmers' groups, nongovernmental organizations, local government institutions and national government agencies to enhance local germplasm exchange in Indonesia and help sustain the supply and access to improved and high-quality tree seeds and seedlings.

In addition, the impacts of agroforestry practices on wildlife diversity, habitats and niches and mammal diversity will surely contribute to the much needed knowledge on the link between agroforestry and biodiversity conservation.

Another interesting article shares the experiences of farmers in Myanmar in adopting the "taungya" system of agroforestry to reforest some of their degraded teak forests. But, as the article emphasizes, proper management should still support this reforestation strategy to sustain Myanmar's teak forests and ensure the country's supply of natural teak timber.

Valuable lessons and insights into the successful practice of agroforestry in Western Ghats, India, include the integration of upland paddies, foliage hillocks and multistoried horticulture. It is indeed an example of an ecologically sustainable agroecosystem as you will learn from the article. The collective efforts of private individuals and farmers made an agroforestry farm successful enough to serve as a learning field laboratory for students, researchers and other farmers in Haryana, India.

We have included interesting training opportunities and conferences in this issue as they are, as always, still good venues for

agroforestry practitioners to update and share agroforestry information with one another.

You may also choose from a variety of information sources and websites, including some interesting publications from FAO-RAP, that would surely help you in your various agroforestry undertakings.

Indeed, we have a good lineup of articles for this issue. We would like to thank all the contributors who have shared their various agroforestry research and extension projects to make this issue possible. We look forward to more of what you can share about agroforestry in next year's issues of APANews. Enjoy your reading! ■ ***The Editors***

OUR ADDRESS. FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; Website: http://www.fao.org and http://www.fao.or.th; E-mail fao-rap@fao.org.

PRODUCTION. Patrick B. Durst, Philip J. McKenzie, Kenichi Shono and Wilfredo M. Carandang (Editorial Consultants); Leah P. Arboleda and Eileen Calaycay-Cardona (Editors); Rowena D. Cabahug (Editorial Assistant); Perseveranda G. Tubig and Reinelen M. Reyes (Production Assistants)

COVER PHOTO. Preliminary studies have shown that agroforestry can indeed contribute to biodiversity conservation as the integration of various trees, crops and animals provide potential habitats and niches of many species of birds and mammals. Although the close proximity of agroforestry landscapes to human settlements pose risks to the mortality of animals and may involve crop loss, studies have shown that human and mammal residents in agroforestry landscapes can indeed co-exist successfully. *(See story on p. 9)*

PRINTER. Craftsman Press Co., 487/42 Soi Wattanasilp, Rajprarob Road, Maddasan, Rajthevee, Bangkok 10400, Thailand

Toward agroecological health: diversifying traditional crop rotation through agroforestry in Punjab, India

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Experiments across the country have shown significant soil improvements under agroforestry systems. Carbon sequestration and recycling of nutrients through litterfall help restore some of the natural ecologial processes, making agroforestry a sustainable system.

In the Punjab state of India, farmers grow a very limited spectrum of crops, leading to some serious problems. The most common crop rotation (rice-wheat) is over-exploiting the water resources, with the water table receding at an average rate of over 42 cm yearly. Excessive resource exploitation, unbalanced withdrawal of minerals, widespread application of pesticides and environmental degradation are some of the consequences of the existing land management strategies.

There is a need to plan and make intelligent investments in farming and diversify the traditional crop rotations. Adopting management practices that increase biomass production and/or reduce soil disturbance can increase the amount of soil carbon. A self-made or self-sustainable system has to be developed by the farmer as an individual or as a member of a cooperative.

Limited availability of land, low returns from traditional crops and the ever-increasing demand for fuelwood, fodder and timber are the main reasons compeling farmers to integrate multipurpose tree species into the farmland. As a result, agroforestry is emerging as a promising diversification option for Punjab farmers.

Fig. 1. Poplar-based agroforestry system.

Fig. 2. Dek-based agroforestry system.

In the future, the timber needs will largely be met from farm forestry or agroforestry. At present, poplar (*Populus deltoides*), eucalyptus (*Eucalyptus tereticornis*), dek (*Melia azederach* and *M. composita*), leucaena (*Leucaena leucocephala*), kadam (*Anthocephalaus cadamba*) and teak (*Tectona grandis*), among other trees, are grown by Punjab farmers on a commercial scale.

Poplar has become the most preferred tree for farmlands in Punjab and its adjoining states. Almost any crop (cereals, pulses, vegetables, forage, fruit crops, etc.) can be grown with it during the dry season. It is one of the world's fastest-growing industrial softwoods and it can be harvested within a reasonably short period of 5–7 years. Poplar intercropping is a highly profitable venture as there are good markets for poplar.

Eucalyptus, another fast-growing species, has also gained popularity because of the falling prices of poplar. Farmers prefer it over other trees because it has a self-pruning habit, light canopy cover, fast growth, multiple uses and straight bole. It is quite hardy in nature, but being evergreen, intercropping is not profitable.

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Germplasm exchange among farmer groups: a way to improve the genetic quality and market chain

Fransiskus Harum (f.harum@cgiar.org)

It has been said that the wood supply for domestic consumption or export in the future will come from farms. Thus, farmers in Indonesia, especially those in Java and Nusa Tenggara, grow trees on their farms through agroforestry.

On-farm tree planting has been increasing for the last five years. Trees growing on farms provide fuelwood, building materials, food and fodder. They also provide shade, shelter, erosion control, watershed protection and soil enrichment. Hence, access to quality tree planting material is important.

Unfortunately, smallholder and individual farmers do not have access to improved seed sources or germplasm. Those who do have access simply cannot afford the high cost. Good-quality planting materials are only distributed among research agencies, big private companies and donor agencies. This is where germplasm exchange comes in as an easy and effective way for smallholder farmers to gain access to tree germplasm.

Germplasm exchange among farmers or farmer groups

Germplasm exchange helps improve the quality of genetic materials for smallholder farmers. This has been done since the time of the barter trade of agricultural crops and other goods. The exchange can take place within the farmer groups in a village, between villages in a sub-district or between sub-districts within an island or across the islands. It is important, however, that germplasm exchange be done in areas that have similar geographic and ecological conditions (elevation, soil type, rainfall, etc.), i.e. farmers in the highlands should not exchange germplasm with farmers in the lowlands.

What are the benefits of tree germplasm exchange?

- Tree seed needs are fulfilled.
- Tree seeds collected from different land races will broaden the genetic base, thereby ensuring prodution of good-quality seeds.
- Points of exchanges can also serve as market channels.
- Points of exchanges can also serve as channels for information exchange.

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Toward agroecological health...

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Punjab farmers have recently realized the benefits of growing indigenous, fast-growing dek and kadam under agroforestry systems. Both species can yield high economic returns within a 10–12-year rotation and can partly provide the raw material requirements of the industry. Dek is mainly used in making furniture and panels while kadam is used in making plywood. However, under Punjab conditions, the economic returns from kadam systems are lower than poplar because of its slow growth, evergreen nature and lower price in the market.

Leucaena, a fast-growing, thornless, evergreen, leguminous woody perennial, has been found very useful on sloping lands. It is specifically raised in silvipastoral systems on the lower *shiwalik* hills of the state. A number of new leucaena varieties have been introduced for their fodder value.

Teak/sagwan and Australian acacia (*Acacia* spp.), though encouraged by private nurseries for use in agroforestry systems (agri-silvicultural and horti-silvicultural models) in Punjab, has a long rotation period.

Punjab farmers are experimenting with various agroforestry models. Their agroforestry systems aim to conserve and optimize the utilization of land and water for production of food, fodder, fuelwood, and timber. Scientists at the Punjab Agricultural University are working to provide farmers with the latest technologies for different agroforestry systems. They have been concentrating more on wood technology, and the biophysical and socioeconomic processes of the system.

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Fig. 3. Teak-based agroforestry system.

Germplasm exchange between...

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In Indonesia, successful models of tree germplasm exchange exist in some farmer groups in West Java and Nusa Tenggara:

Farmer groups in Cibugel, Sumedang, West Java. These farmers grow suren (*Toona sureni*), a popular tree species whose timber is in high demand for building houses, making furniture and other products. However, existing plantations are not performing well due to poor tree management and low-quality genetic material. The farmers normally collect seeds locally from a single tree or collect wildlings surrounding the trees.

To improve the growth and performance of suren trees in this village, the BPTH (Regional Tree Seed Centre) in Bandung, in collaboration with the Indonesia Forest Seed Project (IFSP), financed by DANIDA (the Danish International Development Agency), provided technical assistance through trainings on seed technology, nursery techniques and seed source establishment and management.

The project helped address the lack of improved seed sources of suren and manglid (*Magnolia* spp.) in the greater Sumedang area. The farmers were provided with seeds and seedlings of suren, manglid, sawo (*Manilkara zapota*) and sengon (*Paraserianthes falcataria*).

As a result of this project, the *Arisan Benih,* or seed exchange, was established between two farmer groups from Tasikmalaya, two farmer groups from Cianjur and four farmer groups from Sumedang.

Based on the mother tree selection and seed collection plan prepared by IFSP and supervised by the BPTH staff, each farmer group collected seeds from 10 or more trees growing on their land, with each group collecting an average of 2 kg of seeds. The BPTH staff assembled the seed lots from each farmer group and mixed them to form a bulk seed lot. Three-fourths of the bulk seed lot was equally divided and redistributed to each farmer group. The remaining one-fourth was used to establish a one-hectare seed orchard.

The bulk seed lot, containing seeds from six provenances (land races) has a broader genetic base than seed collected by farmers through traditional methods. The use of seed collection guidelines and visual comparison by the farmer groups indicated that the bulk seed lot was genetically and physiologically superior to previous collections. The seed orchard is expected to produce good-quality seeds to supply local seed needs and increase tree productivity and land productivity.

Seed exchange in Nusa Tenggara. Since the early 1990s, Winrock International, a US-based development organization, has been providing small grants, information materials and training to help non-governmental organizations (NGOs) and farmer groups in developing agroforestry innovations in Nusa Tenggara and Java. In 2000, the World Agroforestry Centre (ICRAF) joined Winrock and its partner government agencies to raise tree seed awareness and technical capacity of NGOs and farmer groups in Southern Sumatra, West Java and Nusa Tenggara.

ICRAF and its partners provided trainings, distributed high-quality seeds of selected species and supported the establishment of farmer seed orchards and NGO/ farmer-operated tree seed supply enterprises. More than 100 NGO staff are now well-trained in seed technology and seed source management, and more than 1 000 farmers are now knowledgeable in seed technology and are receiving small amounts of high-quality seeds.

Moreover, the number of farmers (individual or group) collecting tree seeds for their own use or for sale is increasing. Most farmer groups annually collect about 100 kg of tree seeds of various species. Some of the groups sell seeds locally while most entrust the seeds to NGOs, which in turn find markets for them. A network, called KMPNT (Consortium of Farmer Community in Nusa Tenggara), enables NGOs to exchange information, products, tree seeds and seedlings between the farmer groups.

The NGO-based tree seed exchange has been very effective in East Nusa Tenggara. For example, the Yayasan Mitra Tani Mandiri (YMTM) in Kefa has six farmer groups in five villages who are actively collecting and supplying species such as gamal (*Gliricidia sepium*), lamtoro (*Leucaena leucocephala*), sandalwood (*Santalum album*), jambu mete (*Anacardium occidentale*), kayu merah (*Pterocarpus* spp.) and teak (*Tectona grandis*).

Two farmer groups serve as seedling suppliers for species such as mahogany (*Swietenia macrophylla*), teak, kayu merah, *Gmelina arborea*, jambu mete and orange. Small quantities of seedlings are planted on their own lands, while the remaining seedlings are sold to various buyers from local government agencies, projects, NGOs and government institutions from Timor Leste.

Farmer groups exchange seeds or seedlings with other villages or sub-districts. The NGO usually distributes information on the seeds and seedling stocks to other NGOs or government agencies by distributing brochures and letters and serving as the facilitator between buyers and the sellers (farmers).

There is a big potential to market

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Germplasm exchange between...

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tree seeds to Indonesia's neighbor, Timor Leste (East Timor). Another big market for tree seedlings is the local government agencies who use tree seeds in their national land rehabilitation and reforestation programs.

Meanwhile, the YMTM in Bajawa, Flores, is operating a similar system for its farmer groups. It links closely with YMTM Kefa, especially when there is a need for seed stocks. YMTM Bajawa, for instance, exchanges its surplus gamal seeds with the surplus mahogani seeds of YMTM Kefa. A similar system is used by Yayasan Tananua operating in Timor, Sumba and Flores. ■*The author is a tree germplasm specialist at the World Agroforestry Centre-Southeast Asia.*

Toward agroecological health...

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The state will witness the real "green revolution" when it is covered with greenery consisting of trees. Punjab's new socioeconomic policies have brought forestry and agriculture closer than ever.

Moreover, support from different donor agencies to strengthen the research and extension base is encouraging farmers to try agroforestry. The Punjab State Forest Department has been giving financial support to agroforestry adopters (an incentive of US$225 per hectare for the first three years) to diversify the present land use system and to conserve the state's natural resources. ■*The authors can be contacted at the Department of Forestry and Natural Resources, Punjab Agricultural University, Ludhiana-141 004, India.*

Photosynthetically active radiation affects tree-crop growth and productivity in semi-arid, rainfed agroforestry

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Tree-crop intercropping has the potential to increase biomass production per unit area, but tree shade can inhibit crop growth. The Indian Grassland and Fodder Research Institute (IGFRI) conducted a study to help improve farming techniques by studying the effects of availability of photosynthetically active radiation (PAR) diffused through different tree canopies in tree-crop intercropping.

The study was carried out in Jhansi (25°272' N, 78°352' E and 271 m asl), central India. The area is semi-arid with an mean annual rainfall of 900 mm, most of which falls from July-September. It has adverse agroclimatic conditions and undulating soil with poor fertility.

In the study, chickpea (*Cicer arietinum*) and barley (*Hordeum vulgare*) were grown under the tree canopy of siris (*Albizzia lebbek*), neem (*Azaderachta indica*), sisam (*Dalbergia sissoo*) and babul (*Acacia nilotica*) during the winter seasons of 2004 and 2005. A succeeding crop of cowpea (*Vigna ungiculata* L.) was raised during the monsoon season.

Height, collar diameter, diameter at breast height (DBH) and crown diameter were recorded for the canopy trees prior to the sowing of cowpea (Table 1). Observations were recorded on green and dry biomass production and crude protein yield of the understorey cowpea (Table 2). Under-canopy PAR and specific leaf weight (SLW) of cowpea were recorded.

The trees' growth parameters such as tree height, collar diameter, DBH and crown area were influenced by the preceding winter crop (barley and chickpea). *Albizzia* showed a significant increase in height when chickpea was grown under the tree canopy. The collar diameter was

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Table 1. Growth data of trees prior to the sowing of cowpea (June 2004).

Treatments	Tree height (m)	Collar diameter (cm)	DBH (cm)	Crown area (m^2)
Siris (solo)	6.33	22.85	18.5	41.93
Siris + barley	7.35	18.4	14.25	43.74
Siris + chickpea	8.6	22.95	17.5	51.24
Neem (solo)	7.05	17.45	13.6	19.14
Neem + barley	7.1	17.95	15.3	20.99
Neem+ chickpea	6.1	17.65	15.35	25.91
Sisam (solo)	9.35	25.3	18.95	37.02
Sisam+ barley	8.2	20.1	15.95	26.14
Sisam + chickpea	8.85	21.15	18	28.94
Babul (solo)	7.9	22.35	18.45	41.16
Babul + barley	8.05	21.6	18.4	41.9
Babul+ chickpea	7.95	21.8	17.7	41.59
CD (5%)	2.33	4.66	3	9.09

Photosynthetically active radiation...

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also influenced positively in *Albizzia*, with chickpea indicating its beneficial effect (Table 1).

The cowpea green and dry matter yield increased under the preceding crop of chickpea, with the combination of *Albizzia* and chickpea having the highest yield of green and dry matter. The crude protein (CP) yield data did not exhibit any specific trend; however, the highest CP yield of cowpea was recorded in the *Dalbergia* + barley combination, followed by the *A. indica* + barley combination (Table 2).

The highest cumulative PAR value was recorded under *Dalbergia* canopy throughout the day, followed by *A. indica*, *Acacia* and *Albizzia* canopies.

SLW was influenced by the total availability of PAR under the canopy. The SLW of cowpea showed a maximum value under *Dalbergia*, followed by that of *A. indica.* Under shaded environment, the leaves were thinner due to an expansion in size to capture the limited PAR.

The study showed that undercanopy PAR availability varies with the tree species, and this in turn affects the understorey crop growth and productivity. ■ *The author can be contacted at the Indian Grassland and Fodder Research Institute (IGFRI), Jhansi-Gwalior Road, Jhansi (UP) 284 003, India.*

Fig.1. Dalbergia sissoo intercropped with cowpea (Vigna unguiculta L.).

Table 2. Plant population count and forage yield of cowpea under various treatments.

Treatments	Plant population count/m row	Yield (kg/ha)		
		Green matter	Dry matter	Crude protein
Siris (solo)	7.63	8745	1321	171
Siris + barley	10.38	9575	1526	244
Siris + chickpea	9.25	9990	1463	198
Neem (solo)	7.38	9160	1322	193
Neem + barley	7.75	10405	1657	281
Neem+ chickpea	7.5	12090	1735	221
Sisam (solo)	8.88	10405	1577	209
Sisam+ barley	7.13	12490	1911	314
Sisam + chickpea	7.13	13325	1970	260
Babul (solo)	8.88	10405	1537	196
Babul + barley	8.13	11660	1586	218
Babul+ chickpea	8.13	11655	1698	209
Barley (solo)	8.6	16235	2526	314
Gram (solo)	8.75	14990	2398	415
CD (5%)	NS	3254	559	90

(Barley and gram are the preceding rabi crops.)

New Forests Project (NFP) offers reforestation packets

The New Forests Project (NFP) is offering free packets of tree seeds, technical information and training materials to groups of small farmers and civil society organizations who are interested in starting reforestation projects with fast-growing, multi-purpose trees that can be used for firewood, charcoal, furniture and shipbuilding.

These trees can also provide fodder, and are used as living barriers against shifting soil.

Among these trees are nitrogen-fixing legumes which are better suited for temperate climates and higher elevations. These properties make them extremely useful for alley cropping. The high-quality seeds available for distribution are as follows:

1. *Acacia auriculiformis*
2. *Acacia mearnsii* (Black waddle, tan waddle)
3. *Acacia nilotica* (Egyptian thorn, red-heat, barbar)
4. *Acacia tortilis* (umbrella thorn, Israeli babool, seyal)
5. *Albizzia lebbek* (East India walnut, kokko, woman's tongue)
6. *Cajanus cajan* (pigeon pea, gandul)
7. *Cassia siamea* (Bombay blackwood, yellow cassia)
8. *Dalbergia sissoo* (sisu, nelkar, shewa, yette)
9. *Grevillea robusta* (silky oak, Silver Oak)
10. *Gliricidia sepium* (madre de cacao)
11. *Gleditsia tricanthos inermis* (honey locust)
12. *Leucaena leucocephala* (ipil-ipil, leadtree)
13. *Prosopis juliflora* (mesquite)

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New Forests Project...

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14. *Robinia pseudoacacia* (black locust)
15. *Sesbania sesban* (Sesban, Egyptian rattle pod, suriminta)
16. *Moringa oleifera*

NFP is a people-to-people, direct-action program established in 1982 by the International Center to help curb deforestation in developing countries. Since then, it has assisted more than 4 400 villages in over 120 countries.

For more information, contact: The New Forests Project, 731 Eighth Street, SE Washington, DC 20003, USA, TEL: 1-202-547-3800 ext 110, FAX: 1-202-546-4784
E-mail WSP@newforestsproject.com, Website: http://www.newforestsproject.com.

For those who wish to receive a reforestation packet, kindly provide information on the environmental description of the area, including elevation, average annual rainfall, length of dry and wet seasons, average temperatures, and how the trees would be used (fuelwood, lumber, forage, soil conservation, soil enhancement, etc). ■

NFP Press Release

Agroforestry landscapes: their potential for conserving biodiversity

Veronika Areskoug (veronikaa@icraf-cm.org)

Biodiversity may be a bonus benefit provided by agroforestry systems. Preliminary studies have shown that they are able to support a complex and rich community of wildlife. But just how significant a role do these agricultural practices play in biodiversity maintenance? Are the very practices that provide these benefits to conservation under just as much threat as the wildlife populations they harbor?

The importance of protected areas in wildlife conservation is unquestioned. But let's face it, the majority of wild animal populations exist outside of protected areas systems. Even the largest protected area systems may not be able to sustain wildlife populations over longer time periods. This is why researchers are increasingly focusing attention on the importance of what is happening to animal and plant populations outside of protected areas.

Agroforestry landscapes in particular, have attracted attention for their biodiversity conservation potential. The inclusion of trees in the landscape adds an extra dimension of potential habitat that many species may be able to take advantage of.

The potential to provide habitat for birds and primates by adding shade or fruit trees to agricultural lands has long been recognized. The Smithsonian Institute has launched its bird-friendly coffee certification program in recognition of the benefits provided for bird species by shade coffee, an agroforestry practice.

Several projects around the world have targeted the use of agroforestry to increase the mobility of primate populations.

Non-arboreal species can also benefit from agroforestry. In fact, ongoing researches in Southeast Asia are showing the potential benefits for most mammal species if land is managed at a less intensive level which leaves room for some natural forest cover and fallow areas.

The current study undertaken by the World Agroforestry Centre in northern Thailand (Fig. 1) is focusing on traditional shifting cultivation and its ability to maintain mammal biodiversity. Of the 117 species naturally present in the area, 79 have been found to co-exist with the agricultural practices, including

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Fig.1. Traditional agricultural landscape showing mosaic of crop and forest patches in Mae Chaem District of northern Thailand.

Agroforestry landscapes...

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22 IUCN red-listed species[1]. Not only are these animals living in the resting fallows and fragments of community forests, but also in less expected land use areas such as crop fields, orchards and rice paddies. Although these species could not survive in an extensive stretch of intensive agriculture, when these land uses are combined with forest patches, the mosaic of an agroforestry landscape may actually enrich the habitat value for many mammal species by providing resource heterogeneity.

However, such land uses are not all positive for the mammal residents. The close proximity to human settlements also brings higher risks of mortality. The lure of resource-rich environments may attract animals out of natural forest habitats and expose them to the dangers posed by hunters, domesticated animals and their accompanying diseases; and perhaps even higher predation rates by natural predators. The effect may be a drain of individuals from protected areas who would otherwise have contributed to a stable or increasing population within protected park areas. Several species[2] have already been lost from the studied agroforestry landscape.

Interviews with local farmers and hunters (Fig. 2) have revealed that almost all species are currently believed to be declining and several species have suffered extinction from village agricultural lands. If these populations die out, the individuals left in protected areas will be isolated with much reduced chances for population survival. The fate of animals in on-farm settings will have significant implications for the long-term survival of the species and health of the ecosystem as a whole. The implications are too important to be ignored by conservationists.

Although the cohabitation of farmers and native fauna does involve conflicts and crop loss to pests, there are also significant benefits which the people working in the fields of northern Thailand feel greatly outweigh any disadvantages. Namely, the animals are able to provide a source of food that is considered to be both more nutritious and delicious than meat from domesticated animals, and are an important component of the cultural identity. However, the motivation for land use management, which encourages the continued presence of animal populations, is under threat. Traditional lifestyles are becoming increasingly difficult to continue with restrictions on hunting and the government policy pushing for non-shifting, intensive agricultural practices. But the reality is that most local people have not yet abandoned the traditional diet, which incorporates wild plants and animals.

Although the laws are intended to slow the decline of animal populations, they take away the benefits provided by traditional low intensity agriculture and may inadvertently contribute to the disappearance of habitat and prevent locals from contributing to sustainable wild animal population management.
The situation is complicated with all stakeholders feeling that their hands are tied. The dialogue between government officials and local traditional hunters and farmers cannot begin as long as the existing laws ban traditional livelihood activities practiced by the communities.

The contribution of agricultural areas in maintaining wildlife biodiversity is still not well understood. We know there is potential for both local people and conservationists to benefit from good agricultural practices, including agroforestry. We also know that the fate of wildlife populations on agricultural lands will have significant implications on long-term population survival and biodiversity maintenance on both local and global scales. But we do not know where the critical threshold from positive effect to negative impact lies along the continuum of natural landscape to intesive agriculture. Continued interest from researchers and land managers is a must. ■ *For more information, the author can be contacted at the World Agroforestry Centre. P.O.Box 267, CMU Post Office, Chiang Mai 50202, Thailand*

Fig.2. Locals being interviewed on their knowledge of wildlife distribution.

[1] Asian golden cat (*Catopuma temminckii*), Asian wild dog (*Cuon alpinus*), Asiatic black bear (*Ursus thibetanus*), Assamese macaque (*Macaca assamensis*), Chinese pangolin (*Manis pentadactyla*), clouded leopard (*Neofelis nebulosa*), common otter (*Lutra lutra*), Fea's mintjac (*Muntiacus munjtjak ssp. feae*), fishing cat (*Prionailuruss viverrinus*), goral (*Naemorhedus caudatus*), hair-footed flying squirrel (*Belomys pearsoni*), Malayan pangolin (*Manis javanica*), Malayan porcupine (*Hystrix branchyura*), Malayan sun bear (*Helarctos malayanus*), marbled cat (*Pardofelis marmorata*), northern slow loris (*Nycticebus bengalensis*), northern pig-tailed macaque (*Macaca leonine*), serow (*Capricornis sumatrensis*), smooth-coated otter (*Lutrogale perspicillata*), stump-tailed macaque (*Macaca arctoides*), tiger (*Panthera tigris*), white-handed gibbon (*Hylobates lar*)

[2] Asian elephant (*Elephas maximus*), banteng (*Bos javanicus*), gaur (*Bos frontalis*), Javan rhinoceros (*Rhinoceros sondaicus*), wild water buffalo (*Bubalus bubalis*).

Toward sustainable *taungya* teak reforestation in Myanmar

Suzuki Reiji (rsuzuki@asafas.kyoto-u.ac.jp)

In Myanmar, teak (*Tectona grandis* Linn.) is an important timber species. Since the 1980s, teak plantations have increased dramatically with more than 10 000 ha per year planted through reforestation projects financed by the Asian Development Bank and the World Bank. Less than a decade earlier, before the mid-1970s, only about 1 000 ha were planted per year with teak.

History of *taungya* teak reforestation in Myanmar

The *taungya* method has been used for teak reforestation for more than a century in Myanmar. In *taungya*, one of the most well-known agroforestry systems, farmers plant trees and are allowed to cultivate intercrops for the first few years after the establishment of a new plantation.

The first attempt at *taungya* teak reforestation in Myanmar was in 1856. From 1918 onwards, *taungya* reforestation became the standard practice in teak plantation forestry in Myanmar. These plantations were established to complement natural forests and not to replace them.

Second rotation problem in *taungya* reforestation

Compared to shifting cultivation, where the nutrients in vegetation recovered during the fallow period are returned to the soil for the next cultivation, the *taungya* teak reforestation eliminates a large volume of biomass from the forest ecosystem when teak is harvested at the end of each rotation. Thus, the soil deteriorates after successive rotations, due to nutrient loss. The potential decrease in soil productivity is often termed as the "second rotation problem," which affects not only teak growth, but also the yields of intercrops.

Due to the fact that most of the original teak plantations have been managed as natural teak forests after the final thinning at 40 years, the "second rotation problem" has not yet become an issue. However, extensive teak plantations established after the 1980s will be harvested by clear-felling. Consequently, a large-scale second rotation of taungya teak reforestation will be undertaken.

To mitigate the second rotation problem, it is important to preserve soil productivity during the teak-tending period. Conservation of soil organic matter (SOM) is fundamental to sustainable forest soil management as it contributes to improving the chemical, physical and biological properties of soil.

Present situation of teak plantations in Myanmar

To assess the long-term dynamics of SOM, experimental plots were established in teak plantations of different stand ages (0–96 years) in the Kabaung and Bondaung reserved forests (18°42'–18°57' N, 95°51'–96°21' E) in Oktwin Township, Myanmar. According to field observations and soil analysis, accretion of SOM in teak plantations did not occur even 96 years after the reforestation.

One of the main factors that prevented the buildup of SOM was the combustion of forest floor litter, the main source of SOM, by forest fires. The fire-hazardous period in Myanmar usually lasts from mid-January to mid-May. Fires frequently break out at the end of the dry season, which coincides with the main defoliation period for teak, January to March, when approximately 80 percent of the annual teak litter is produced. Since the forest fire period overlaps with teak's defoliation period, much of the teak litter that accumulated on the forest floor is lost to fires (Fig. 1).

Meanwhile, the SOM in adjacent natural teak forests was observed to be significantly higher than that in teak plantations, despite the forest fires being just as frequent as in the plantations.

Due to the species richness of the natural forests, where the defoliation period of other species does not overlap entirely with the forest fire period, additional litter is supplied to the soil. Therefore, the impact of forest fires on the dynamics of SOM is less significant in

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Fig. 1. Litter in the forest floor of a 35-year-old teak plantation was burned during a forest fire incident.

Fig.2. Severe soil erosion observed in 21-year-old teak plantations have exposed the lateral roots.

Upland paddies, foliage hillocks and multistoried horticulture: an ecologically sustainable agroecosystem

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The *malnad* area (Fig. 1) (Western Ghats area) of Karnataka in Southern India is a mosaic of reserve forests, foliage hillocks (*Soppina betta* or SB) (Fig. 2), paddy fields and cash crop plantations. Its topography ranges from very steep to gently undulating, with peaks, ridges and outcroppings. Altitude ranges from 623 m above sea level (masl) at the Sringeri Township to 1 458 masl at Gangamoola of the Kudremukh National Park. The vegetation is mainly tropical evergreen and semi-evergreen. Its hilltops harbor grasslands and *shola* forests or tropical montane forests.

Rice is the major food crop in this area, where a good number of farmers still follow traditional agricultural methods. These paddy fields (Fig. 2) are located in rainfed uplands. When necessary, farmers make small dams with bamboos, twigs and mud in the streams for irrigation.

Land is prepared in May, and the seedlings are transplanted to the fields in June after the onset of the monsoon. Many traditional varieties are cultivated. Harvest takes place in December, with an average yield from 2-3 mt/acre.

Cultivation in this area largely depends on organic materials collected from adjacent SB forests: green foliage and leaf litter for compost production, and certain herbs for pesticides. The compost made of foliage and leaf litter are mixed with cow dung to produce an organic fertilizer. This fertilizer is used extensively in the farms (Fig. 3).

Traditional farmers still largely depend on botanicals collected from homegardens and SBs. But recently, owing to the inadequate supply from SBs, many farmers have started using chemical fertilizers as a nutrient supplement. Farmers now have to either gather leaf litter from distant places or plant green manure crops like *Gliricidia.*

Around 1864, *Areca* growers in the central Western Ghats of Karnataka state were granted tenures over

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Toward sustainable taungya...

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natural teak forests than in teak plantations.

Moreover, in teak plantations, soil erosion is another important ecological problem. In some experimental plots, severe soil erosion was observed (Fig. 2). Since early in the 20th century, soil erosion has been the most important cause of soil deterioration under teak monoculture in Myanmar. Although it is difficult to explain the mechanism of soil erosion in teak plantations, some researchers believe that forest fires burn the litter layer and expose the soil to heavy drips from the large teak leaves. However, in the case of fire-protected areas, the thick carpet of leaves breaks the force of direct drips and provides a matted cover that helps in holding the soil particles together.

Forest fires also destroy the undergrowth. Although sufficient quantitative data are not available, it appears probable that the lack of undergrowth and litter layer in teak plantations, as a result of forest fires, accelerates soil erosion.

These results indicate that forest fires have a detrimental effect on the preservation of soil productivity during the teak-tending period and the sustainability of the *taungya* teak reforestation.

The future of *taungya* teak reforestation in Myanmar

Teak forests in Myanmar, almost the only country that can produce natural teak timber, have been managed well using a selection felling system referred to as the Myanmar Selection System.

Studies have shown that these natural teak forests have experienced some degradation and depletion in the last few decades and their future yield will likely decline. Thus, a taungya teak reforestation, with proper management especially with regards to forest fires, can ensure a sustainable teak timber supply in Myanmar.

In addition, *taungya* teak reforestation provides local employment opportunities amid the uncertain economic situation in Myanmar.

More investment in sustainable forest management and social welfare is essential for the future development of *taungya* teak plantation. This method of reforestation will then serve as a means to achieve sustainable coexistence of the forest and the people.■ *The author can be contacted at the Graduate School of Asian and African Area Studies, Kyoto University, 46 Shimoadachi-cho Yoshida, Sakyo-ku, Kyoto 606-8501, Japan.*

Upland paddies...

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uncultivated public lands (UPLs). This gave the farmers user rights to the foliage hillocks, which provide manure, fuelwood, fodder, medicine, timber for minor constructions and some cash income to the communities.

In most parts of Western Ghats, anthropogenic disturbance of forests is the rule rather than the exception. After the prehistoric system of shifting cultivation gave way to more sophisticated multicropping systems involving high-value plantation crops like betel nut (*Areca catechu*), coffee, pepper and cardamom in the last two centuries, human use of the forests intensified.

Extraction of dry and green leaves, in addition to fuelwood, fodder, small timber and nontimber forest products led to the creation of a patchwork of dense secondary regrowth, savannas with sparse tree cover and degraded forests around cultivated areas. Yet, the plant species found in these intensively utilized and managed village forests are a subset of those found in nearby natural forests.

The SBs are examples of slightly managed, socioeconomically valuable, high-yielding forests. They are distinct land use systems that can neither be categorized as forests, plantations nor farmlands. The SBs are characterized by a relatively diverse plant community, the agricultural and community needs they meet, and ambiguous property rights.

The SBs are a treasure trove of medicinal plants on which the farmers living in this part of Western Ghats rely for various ailments. These forests and their floral diversity play a pivotal role in determining the health and productivity of the agroecosystems and in sustaining the livelihood patterns of rural populations.

Fig.1. A malnad landscape.

Fig. 2. Paddy fields with foliage hillocks in the background.

Vegetation of the SBs falls in continuum with the less disturbed protected areas of this region, and are typical of old-field successional communities. A study observed that although subjected to severe anthropogenic stresses by farmers, the SBs support floristic diversity and maintain regeneration patterns similar to that of the natural forests.

While valuable organic matter flows to the agricultural lands and plantations, the organic system of paddy cultivation, in turn, helps sustain the forests of SBs and subsequently the soil-water regime for the horticultural crops. The perennial stand of trees adds to the carbon sequestration benefits as well.

Threats and challenges

Economically efficient, self-sustaining SB-based systems are now fast-declining due to ambiguous property rights, improper management, overexploitation and lack of awareness.

While free access to SBs is beneficial to the village communities, such access accelerates their depletion. Due to overexploitation, the SBs are being degraded and changed to open scrub forests, which are then converted to agricultural lands,

When SBs were originally allotted, it was only for meeting the green manure requirement of limited betel nut areas. Farmers were supposed to follow a rotation of two years for litter collection and lopping. When the betel nut area increased, individual growers started enclosing the SBs and exploiting them intensively. Recently, some villagers have started commercial, large-scale composting which has led to continuous clearing and is threatening the SBs.

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Upland paddies...

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More and more SBs are also being converted to rice paddies or horticultural gardens that require more leaf litter and extraction from the remaining SBs. These areas also suffer when rice paddies are converted into plantations, as soil is extracted from SBs to fill the paddies. SBs are also the source of fuelwood used for the processing of betel nuts. The increase of betel nut plantations is putting additional stress on the SBs.

State forest policy during the colonial and post-independence period in the last century (1950–2000) replaced natural or degraded forests with timber plantations of teak, eucalyptus and *Acacia auriculiformis*. While foresters denigrate forest use by communities as "degrading," local communities criticize forest plantations as being "useless" and "monocultural."

Policy and development relevance

The practice of amending soil with leaves of various wild trees in this area has been recorded in 19th century travelogues by Francis Buchanan. The purpose was to arrest the loss of topsoil, suppress weeds and conserve soil moisture. Once the East India Company took over the country's forest administration, farmers could no longer depend on forests for litter and green manure.

Upon hearing their grievances, the government, in 1864, adopted the policy of allocating forest area to the farmers in order to save the rest of the forests in Uttara Kannada district. Cash crops like *Areca* requiring organic matter from SBs were taxed at a higher rate than rice and the farmers' privileges over the SBs were regularized in 1924. The state initially allowed the farmers to use an SB area of 4-8 times the size of the *Areca* holdings for foliage collection.

Later, this allowance was extended to other districts of Western Ghats like Shimoga, Chikmagalur and Dakshina Kannada, where *Areca* is grown.

Subsequent debate on this policy included whether to keep the extraction rights of SBs strictly to individuals or to have them managed by the community, and how to restrict conversion of SBs and paddy lands to other land uses. The development objective of such policies was to sustain the productivity of the staple crop of rice in the region while assuring the sustainability of the multistoried coffee-betel nut-pepper system.

How to develop regulations on extractions and how to implement participatory methods in enforcing these regulations are important issues to be addressed. The challenge is to involve the local communities in monitoring and protecting the health of the forest lands and to develop an innovative institution with appropriate information, capacity and authority that caters to the needs of the poor people who are dependent on the SBs.

A management plan consisting of: 1) institutionalized community rights over management, protection of and harvest from reserve forest land; 2) land regulations to prevent conversion of paddy lands and SBs; 3) regulation preventing extraction of forest soil; and 4) incentives for the use of nonconventional energy sources instead of fuelwood, especially in *Areca* processing, can go a long way in protecting the remaining parts of a unique and critical ecosystem. ■ *The authors can be contacted at the Ashoka Trust for Research in Ecology and the Environment, 659 5th A Main, Hebbal, Bangalore 560024, India.*

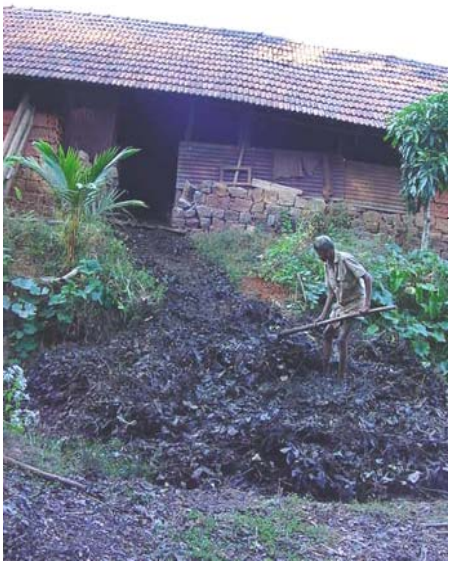
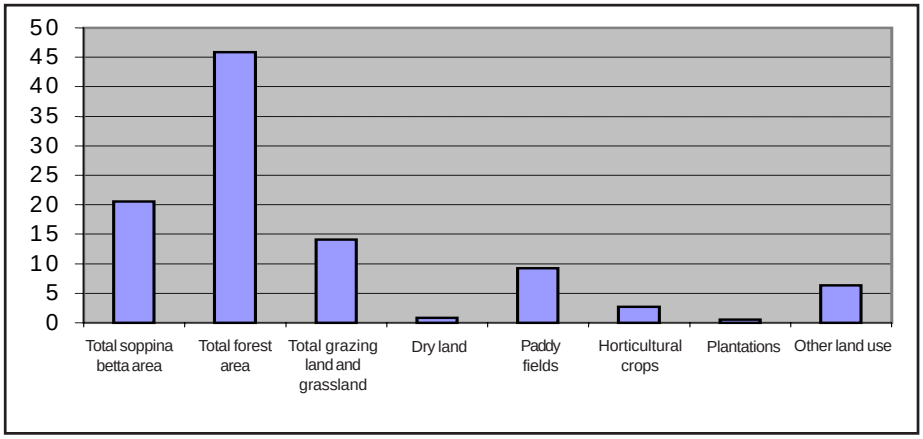


Fig. 3. Leaf litter mixed with cow dung being removed from cattle sheds for composting.

Fig. 4. Percentage of land use in Sringeri Taluk.



Bamboo: an ideal species for agroforestry in India

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India is second only to China in terms of bamboo production and diversity in the world. Since ancient times, Indian farmers have been growing bamboo on their fields, farm boundaries and in other locations. Because its roots have a binding effect and it can tolerate drought conditions, bamboo is a promising species for rehabilitating degraded lands, including lower *shiwalik* hilly areas. It thrives in semi-arid conditions characterized by low soil fertility and low water-holding capacity.

Dendrocalamus strictus could be an ideal alternative to other crops. Farmers need to be motivated to grow bamboo in agroforestry systems, in addition to wastelands, on saline-alkaline soils, along field and farm bunds, rivers and choe banks.

Bamboo has various uses. Recently, bamboo charcoal has opened up new avenues for its utilization and plantation establishment. Bamboo charcoal purifies and deodorizes water and keeps food fresh. In addition, bamboo charcoal controls fungus growth, absorbs odors and prevents diseases. It also absorbs residues of pesticides and fertilizers, improves the water permeability and the nutrient status of the soil.

Bamboo is mainly propagated through seeds or vegetative methods. Propagation by seeds, however, is limited by the long interval between flowering, clump mortality and short viability of seeds. Vegetative means of propagation is through rhizomes, usually with one-year-old culms excavated along with the root system.

D. strictus can be planted as double-noded shoot cuttings, poles and double-noded segments of poles. Tissue culture is also an option available for mass multiplication, but the practice is not possible without a sophisticated laboratory, which is not feasible for farmers.

In a study, encouraging results were observed in the vertical planting of double-noded shoot cuttings treated with 300 ppm of indole-3-butyric acid for 18 hours or 1 500 ppm of indole-3-butyric acid for 30 seconds. For pole planting in March and August, no foliage and branches were retained and the internodes were filled with growth hormones. The maximum success for rooting and growth was in the poles treated with 100 ppm of indole-3-butyric acid +100 ppm boric acid during both seasons. The comparative growth of plants was higher in poles planted in March than in August.

Fig. 1. Six-month-old D.strictus raised from double-noded shoot cuttings.

Fig. 3. Root growth of five-month-old D. strictus raised from poles.

The double-noded segments of poles were filled with different hormonal concentrations. When planted during August, the maximum rooting and shoot growth was recorded in the poles treated with 100 ppm of indole-3-butyric acid plus 100 ppm boric acid.

It is necessary for nursery beds to be treated properly against termite or grub attack. Insect pests and soil-borne diseases are a threat to the soil-grown cuttings. Thus, precautionary measures must be taken. Termites, which are major bamboo pests, can be controlled by the application of Dursban 20 EC (Chlorpyriphos) at 0.5 percent concentration to the nursery bed area.■ *The authors can be contacted at the Department of Forestry and Natural Resources, Punjab Agricultural University, Ludhiana-141 004, India.*

Fig. 2. Rooting in the D. strictus poles.

Fig. 4. Five-month-old D. strictus raised from double noded segments of poles.

Agroforestry farm in northern India serves as a learning field laboratory

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Agroforestry in northern India constitutes the commercial production of fast-growing timber species that can be harvested after only 6–10 years. Small-scale farmers tend these plantations with irrigation, manure and tree management technology. This practice has flourished in the northern Indian states of Haryana, western Utter Pradesh and Punjab.

Agroforestry has changed the wood industry in India. Today, over 15 000 tons of timber logs are marketed daily to supply over 600 wood-processing factories that have been established since 1990 in these three states, mostly concentrated in Jagadhri/Yamuna Nagar area. The wood industry operates at a market currently worth US$800 million a year and which is expected to reach billions in the near future.

Although Hara Farms is a private entity, it has provided hands-on learning experience for people who come to learn how to replicate agroforestry practices in their own farms. Hara Farms has taken on the challenge of efficiently producing more wood of better quality. It consistently produces timber yields in excess of 50 mt/ha/yr on a harvest cycle of 10 years.

Two tree species, poplar and eucalyptus, are successfully being produced at Hara Farms for ply boards, wood boards, flush doors, high-density boards for cement concrete shuttering, packing cases and crates. These products are sold throughout India and exported to some Middle Eastern countries.

Agroforestry essentials

Genetic superiority. The important genetic qualities of poplar, besides wood quality, is its adaptability to India's soils and local climate where the minimum temperature is around 4°C. This gives the selected poplar clones the required dormancy period.

Another quality is tree architecture. Trees should accumulate maximum wood in the main tree trunks with small, thin branches. Long, fat branches rob the trunk of wood and form undesirable knots that lower log value.

Poplar trees that grow straight up to 30 m in height with the least spread allows for greater density of trees. They are pruned every year to ensure one leader at the top, with a few potential fat branches pruned before they rob the trunk of the wood. Lower branches that do not get sunlight are pruned before they form undesirable knots.

Eucalyptus clones are self-pruning, with the main trunk having about 3 m of straight canopy, allowing an even higher density of trees. Most importantly, selected clones respond favorably to increasing amounts of irrigation, manuring and tree management.

Seed-reproduced plants are rarely true to their parent tree characteristics and are unsuitable for agroforestry. Therefore, selected tree clones are multiplied vegetatively. Poplar is reproduced through cuttings, but eucalyptus must be cloned and produced by plant breeding specialists and requires expensive infrastructure.

Plant nutrition. Over 50 tons of timber and 60-75 tons of biomass per hectare per year are produced, which requires substantial plant nutrition. NPK and micronutrient requirements must therefore be carefully determined. Organic fertilizer in the form of dairy manure, cultured sugar mill pressed mud, vermiculture and other biomanures are preferred for the long-term health of the soils. The soils at Hara Farms are more fertile now than they were 25 years ago.

Sunlight. Sunlight can not be increased, so optimal use of sunlight is vital. Five hundred poplars and 1 000 eucalyptus trees per hectare were found to be ideal. The distance was increased between tree lines and reduced between trees, with the rows running north to south to give maximum sunlight to each tree.

It can be said that this type of high-input-high-output agroforestry is sustainable, agronomically compatible, ecologically safe, environmentally useful and economically attractive for all. Visitors are impressed with the timber quality, yields and uniformity in growth. Moreover, the production of high-value intercropping adds to the appeal of Hara Farms' agroforestry system.

The timber needs of the 21st century will increasingly have to be met from agroforestry systems and less from natural forests. In developing and developed countries and in regions with tropical or temperate climates, timber production in natural forests varies between 4 to 10 t/ha/yr with a cycle of up to 100 years. Hara Farms produces 50 t/ha/yr of timber on a 10-year cycle.

Agroforestry can even be successfully established around pollution-creating centers of urban development and industrial complexes. Environmental degradation, pollution, and climate change, among other things, are recognized as being the result of

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Sri Lanka is 30th member-country of ICRAF: embarks on tree domestication project

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Sri Lanka is now the 30th member-country of the World Agroforestry Centre (ICRAF). The membership was formally launched when the ICRAF Sri Lanka Office was inaugurated on 7 March 2005 at the Council for Agricultural Research Policy (CARP) Secretariat.

As part of the cooperation, the ICRAF Sri Lanka Office hosts the CARP-ICRAF Tree Domestication Project. The project aims to network domestication research and development activities on fruit and timber trees and medicinal plants in Sri Lanka. It will identify stakeholders and their research activities, prioritize species for domestication and identify gaps that hinder the acceleration of domestication for both commercial and small-scale utilization.

This project will be a part of the South Asia Network of Tree Domestication with India, Nepal and Bangladesh. The project will help partners use, enhance and adopt these systems, and to identify and remove policy constraints. It will also develop models for germplasm management as well as systems to conserve genetic resources, allowing small farmers to benefit from these resources.

The details of the project can be obtained from Dr. DKNG Pushpakumara, ICRAF country liaison scientist, ICRAF Sri Lanka Office/ CARP-ICRAF Tree Domestication Project, Sri Lanka Council for Agricultural Research Policy, 114/9, Wjerama Mawatha, Colombo 7, Sri Lanka; phone: 0112 2697103, 2698001; Mobile: 0714 933591; fax: + 0112 682951; and E-mail: ngpkumara@pdn.ac.lk, pkumaralk@yahoo.com. ■

Fig.1. Launching of ICRAF Sri Lanka Office and CARP-ICRAF Tree Domestication Project. (From left to right) Dr. Tony Simons, principal tree scientist, ICRAF; Mr. Tissa Warnasuriya, secretary of the Ministry of Agriculture, Livestock, Lands and Irrigation and chairman, CARP; Prof. HPM Gunasena, executive director, CARP; Dr. VP Singh, South Asia Regional representative of ICRAF; Dr. DKNG Pushpakumara, ICRAF country liaison scientist.

Fig. 2. (left to right) Dr. Pal Singh, Prof. HPM Gunasena and Mr. Tissa Warnasuriya inaugurates the ICRAF Office at CARP Secretariat.

Fig. 3. (left to right) Dr. Tony Simons presents the ICRAF information package to Mr Tissa Warnasuriya, with Prof. HPM Gunasena.

Agroforestry farm in...

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two factors: unprecedented fossil fuel burning and forest destruction that has occurred in the last few decades. Neither factor can be stopped, because of compelling economic reasons.

Therefore, economically attractive and environmentally desirable agroforestry is a positive contribution for coping with ecological and climatic disasters in the world. The agroforestry practices at Hara Farms can be replicated using other timber tree species of diversified wood quality for diverse climates of the world. ■ *The author can be contacted at Hara Farms, P.O. Amadalpur, Jagadhri, Haryana 135101, India or through his blog http://thefarmstory.blogspot.com.*

IUFRO World Congress...

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of national forest research institutes. The forum clearly showed that many institutions were experiencing times of radical change with regard to their tasks and frame conditions. Thus, the importance of stronger cooperation in the future was explicitly emphasized, and it was no surprise that the directors agreed on convening the forum regularly in the future.

Congress outcomes

The congress participants released two congress resolutions where they analyzed their own roles in a quite critical manner.

The first Brisbane Resolution, entitled "Promoting global cooperation in forest-related research," is primarily directed to the forest science community and IUFRO itself. The scientists declared their readiness to focus their research work more strongly on the key issues of society and the global environment and to respond to the information needs of the different stakeholders. Forest science is also needed to strengthen cooperation with other scientific disciplines.

The second Brisbane Resolution on "Promoting science for decision-making" is clearly directed to the world outside the forest science community. In this resolution, scientists declared their desire to provide relevant scientific findings more often as a basis for political decision making and translate present research results into a language that is readily understood by policy makers and other stakeholders. However, the resolution also noted that science could only live up to its role in research and education if sufficient resources were available, which is not always the case in view of the budget cuts affecting forest science in many countries.

Fig.3. The Yuggera Aboriginal Dance Troupe at the opening ceremoney of the Brisbane congress.

The new IUFRO leaders

It is IUFRO's tradition that a new President is elected during the world congress. The Brisbane congress participants elected Prof. Don Koo Lee from South Korea as IUFRO President from 2006 to 2010, succeeding Professor Risto Seppälä from Finland. Prof. Lee will play a decisive role in the development of IUFRO over the next five years. He will be joined by Dr. Niels Elers Koch from Denmark as Vice-President Science and Dr. John Innes from Canada as Vice-President Policy. South Korea also won the bidding for hosting the next IUFRO World Congress in 2010 which will take place in the capital city of Seoul.

Addressing issues and concerns

In the course of congress discussions, many answers surfaced, but many questions were also raised. In response, several new IUFRO working parties were created during the congress to directly address these questions. Furthermore, all issues referred to in the Brisbane Resolutions will be duly considered in the new IUFRO strategy for the years 2006 to 2010. Thus, IUFRO is certainly well prepared to tackle the tasks of the future.

IUFRO celebrates its world congresses in different parts of the world every five years. This year's Brisbane congress was the first time that IUFRO held the world congress in the southern hemisphere.■ *IUFRO press release provided by Gerda Wolfru (wolfrum@iufro.org)*

Agroforestry stakeholders...

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workshop sessions that enabled the participants to identify the challenges, issues, concerns and gaps in the areas of agroforestry education, policy advocacy, extension for rural and enterprise development, and research and technology development. Short-, medium- and long-term plans were formulated in order to address the challenges and contribute to the efforts of institutionalizing the NAFDP.

The resolution calls for the concerted efforts of various sectors to address the immediate and long-term concerns in agroforestry development which include the need to:

1. fast-track the approval of the proposed "House Bill on the Creation of the Agroforestry Board," and the policy standards and guidelines for the Bachelor of Science in Agroforestry;

2. recognize the agroforestry programs of the member-institutions of the Philippine Agroforestry Education and Research Network (PAFERN) as part of the National Agriculture and Fisheries Education System (NAFES);

3. facilitate the promotion of investments and enterprise developments of agroforestry products;

4. include agroforestry as one of the prescribed land uses under the National Land Use Classification Act;

5. exempt critical watersheds, protected areas, ancestral domains and agroforestry areas from mining explorations and operations;

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IAF offers agroforestry training courses for 2006

Leah P. Arboleda (iaf@laguna.net)

The UPLB Institute of Agroforestry (IAF) is announcing the following agroforestry training courses for 2006:

Planning and managing agroforestry projects (PMAP)
To be held 16-29 April, this course will discuss participatory rural appraisal, agroforestry land capability assessment and mapping scheme, feasibility study preparation/ development and monitoring and evaluation techniques.

Sustainable agriculture through agroforestry initiatives of people in the uplands (SAGIP)
To be held 21 May - 3 June, this course will primarily discuss the concepts and significance of agroforestry and sustainable agriculture development in relation to natural and managed ecosystems. Participants will develop and apply key indicators of sustainable agroforestry systems, while discussing techniques in diagnosing problems, needs, constraints, practices and opportunities.

Agroforestry production practices and management (AG-PRO)
To be held 25 June - 8 July, this course will discuss agroforestry's various production technologies and their corresponding management strategies, seed technology and nursery management, soil and water conservation and management, and other technologies that support agroforestry farms.

Agroforestry postproduction systems (AG-POST)
To be held 13-26 August, this course will discuss the principles and processes of the different postproduction technologies of agricultural crops, perennial crops and animal and dairy products. Topics on marketing, financing, credit and other support services for agroforestry postproduction will be included.

Participatory technology development for agroforestry (PT-DAF)
To be held 24 September - 7 October, this course will discuss the processes involved in promoting agroforestry for extension and research and development activities. Topics will include participatory appraisal, on-farm trials, farmers' field schools and other participatory approaches.

Promoting sustainable agroforestry livelihood and other enterprises (SALE)
To be held 5-18 November, this course will provide the knowledge and skills that will enable farmers to decide, plan and carry out livelihood enterprises that will provide them with income while waiting for their agroforestry farms to mature and be productive. Topics will include the policies affecting agroforestry and livelihood enterprise development, enterprise development in the uplands, SALE planning and management, extension concepts, methods and approaches and marketing/trading of livelihood products.

These courses are offered to project managers, researchers, field technicians, farmer/community leaders and other development workers from local and international nongovernmental organizations, government agencies, academic and research institutions, people's organizations and other concerned institutions.

For more information, please contact the Director, Institute of Agroforestry, College of Forestry and Natural Resources, University of the Philippines Los Baños, PO Box 35023, College, 4031 Laguna. Tel +63 49 5362657/5363657, Fax +63 49 5363809 and E-mail iaf@laguna.net or iaf_cfnr@yahoo.com. ■*The author works at the Department of Science Communication, UPLB College of Development Communication.*

Agroforestry stakeholders...

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6. simplify the requirements for the issuance of permits to harvest and transport timber and nontimber products from agroforestry farms;

7. pass local resolutions and ordinances that will support the institutionalization of agroforestry development programs;

8. conduct appropriate science and technology programs in agroforestry;

9. conduct regular multisectoral agroforestry stakeholders' meeting; and

10. formulate NAFDP to facilitate the institutionalization of agroforestry development in the Philippines.

The agroforestry congress was co-organized by the Institute of Agroforestry of the University of the Philippines Los Baños, PAFERN and the Camarines Sur State Agricultural College. ■*The author is a researcher at the UPLB Institute of Agroforestry.*

Useful information sources

The following information sources were compiled from Springer Publications, the User's Perspectives with Agricultural Research and Development (UPWARD), Canada's International Development Research Centre (IDRC), research, contributions and some with permission from the Low-External Input Sustainable Agriculture (LEISA):

Agroforestry e-news. Published bi-monthly by the School of Forest Resources and Conservation, University of Florida, this online newsletter informs readers of relevant conferences, meetings and publications on agroforestry. For more information or to submit news items, contact Prof. Shibu Jose by e-mail sjose@ufl.edu,or visit the website: http://www.sfrc.ufl.edu/

Beyond intellectual property: toward traditional resource rights for indigenous peoples and local communities. Written by Darrel A. Posey and Graham Dutfield, this 1996 publication provides practical suggestions on how indigenous peoples and local communities worldwide should approach and deal with issues in intellectual property and traditional resource rights. It provides invaluable and eye-opening information on the most provocative and explosive issue of the "patenting of life." For more information, please visit http://www.idrc.ca.

Counting on the environment: forest incomes and the rural poor. Written by P. Vedeld, *et al.*, this is a World Bank Environment Department Paper No. 98, published in 2004, which presents the results of an analysis of 54 case studies showing that forests are significant sources of income for rural households. The case studies recommend some best practices in studying incomes derived from forests with focus on research protocols, field methods, and simple analytical models. You can download a PDF file of this document at http://lnweb18.worldbank.org/ESSD/envext.nsf/44ByDocName/Publications. For more information, please E-mail noragric@noragric.nlh.no.

Cultivating peace: conflict and collaboration in natural resource management. Edited by Daniel Buckles, this 1999 IDRC and World Bank publication presents original case studies and essays highlighting experiences in Africa, Asia and Latin America on cultural dimensions of conflict, the concept of stakeholder analysis, the impact of development interventions on peace and conflict, and the policy dimensions of conflict management. These case studies present the evolving trend from conflict to collaboration in natural resource management. More importantly, the book highlights lessons learned and identifies strategic gaps in natural resource management. For more information, please visit http://www.idrc.ca.

Developing smallholder agriculture: a global perspective. Written by R.L. Tinsley, this book published in 2004 presents lessons learned from farming systems research with a focus on the factors and issues constraining smallholder agricultural development. By looking beyond technology development and focusing instead on service delivery systems, the author emphasizes the importance of village-level, private micro-enterprises as a means to assist smallholders and studies the effectiveness of the public sector. For more information, please E-mail agbe@skynet.be.

Forest ecosystems and environments: scaling up from shoot module to watershed. Written by T. Kohyama, J. Canadell, D.S. Ojima and L.F. Pitelka, this 2005 publication presents the results of the Global Change Impacts on Terrestrial Ecosystems in Monsoon Asia (TEMA) project that was implemented to contribute to the international project on Global Change and Terrestrial Ecosystems. The book presents the accomplishments of the project in terms of the integration of forest ecosystem and watershed processes. Specific topics include leaf physiology, meteorological budget, prediction of long-term change of vegetation composition and architecture through demographic processes, the effects of forest ecosystem metabolism on the properties and biogeochemical budgets of freshwater ecosystems, and the direct and indirect effects of environmental change on rivers, wetlands and lakes. The results focused on the experiences in coastal east and Southeast Asian countries that are characterized by wet growing seasons and species-rich forest ecosystems. For more information, please visit http://www.springerpub.com/

Genes in the field: on-farm conservation of crop diversity. Edited by Stephen B. Brush, this 2000 publication provides a comprehensive overview of the issues and challenges of on-farm conservation of genetic resources shared by experts in the fields of biology, agronomy, anthropology, economics, law and agricultural development. For more information, please visit http://www.idrc.ca.

In focus: seeds that give – participatory plant breeding. Written by Ronnie Vernooy, this 2003 book presents the results of IDRC's research projects on agricultural biodiversity and participatory plant breeding research that are aimed at conserving agricultural diversity, improving crops and producing quality food. It discusses issues, procedures in developing research questions, and steps in designing on-farm research considering farmers' and breeders' rights. It also highlights the need to develop new and supportive policies and legislation while presenting cases of successful partnerships of farmers and plant breeders in these fields.

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Useful information sources...

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For more information, please visit http://www.idrc.ca.

Managing natural resources for sustainable livelihoods: uniting science and participation
Edited by Barry Pound, Sieglinde Snapp, Cynthia McDougall and Ann Braun, this 2003 book presents field experiences on Participatory Natural Resource Management (NRM) research, with focus on smallholder agricultural systems in the developing world.

It presents an analysis of the issues and lessons gained from the practical application of participatory principles to complex landscapes and social situations from 23 relevant case studies. It also considers strategies in meeting the challenges of improving the livelihoods of local natural resource managers, as well as conserving the natural resources for future generations. The case studies covered Asia, Africa and Latin America. For more information, contact the IDRC at E-mail pub@idrc.ca or please visit http://www.idrc.ca and Earthscan Publications at earthinfo@earthscan.co.uk.

Forest restoration in landscapes: beyong planting trees. Edited by Stephanie Mansourian, Daniel Vallauri and Nigel Dudley, this 2005 book presents the experiences of World Wildlife Fund (WWF) International and its partners in integrating the restoration of forest functions into landscape conservation plans.

Aside from the practical information, the book also discusses specific systems and issues, and identifies key areas for further research. For more information, please visit http://www.springerpub.com/.

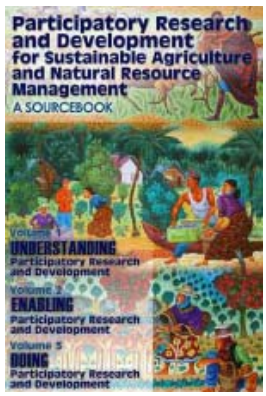
Nitrogen fixation in agriculture, forestry, ecology and the environment. Edited by Dietrich Werner and William E. Newton, this 2005 book is the fourth of the seven-volume comprehensive series on nitrogen fixation. This volume discusses the integration of basic and applied work on biological nitrogen fixation in the fields of agriculture, forestry and ecology.

Highlights of the book include discussions of crops of major global importance (soybeans, rice and sugar cane), agroforestry, specifically on the use and legume trees with their rhizobial symbionts and other nitrogen-fixing trees with their actinorhizal colonization and the interaction of plants and trees.

It also describes the biogeochemically important nitrogen cycle and its key relationships among nitrogen fixation, nitrification and denitrification. Moreover, readers will be provided with updates on the production of microbial inocula, especially for legume crops. For more information, please visit http://www.idrc.ca.

Organic agriculture: a handbook. Written by A. Rosenberg and T. Linders, this 2004 handbook presents the authors' 30-year experience in organic agriculture, mainly practiced in South Africa. The book provides a background on organic agriculture, and practical information on soils (texture, structure, organic matter, etc.), composting, soil conservation, vegetable cultivation, animal husbandry (poultry, cattle, rabbits, bees), farm planning and organic certification with theoretical discussions. The experiences presented can also be applied in other countries worldwide. For more information, please visit http://www.lindros.co.za or E-mail info@lindros.co.za.

Participatory research and development for sustainable agriculture and natural resource management: a sourcebook. This three-volume sourcebook compiles 79 articles highlighting experiences in participatory research and development of more than 30 countries in the fields of sustainable crop and animal production, forest and watershed management, soil and water conservation and postharvest and utilization.



Published in 2005 by UPWARD, IDRC, and the International Fund for Agricultural Development, this sourcebook focuses on the growing interest in developing approaches for joint research and development with the participation of the local people and other concerned stakeholders. These diverse and yet interrelated approaches comprise participatory research and development concepts and practices for trainers, policy makers, donors and professionals in other development sectors. For more information, contact CIP-UPWARD, c/or IRRI DAPO Box 7777, Metro Manila, Philippines, or please visit http://www.cip-upward.org/.

Traditional foods: processing for profit. Edited by P. Fellows, this 1997 publication is a comprehensive guide to the processing of traditional foods which are made and sold at small commercial scales of operation from Asia, Africa and Latin America. For more information, send e-mail inquiries to cta@cta.nl.

■ *Compiled by Leah P. Arboleda*

Agroforestry and forestry info sources from FAO

The United Nations Food and Agriculture Organization (FAO) Regional Office for Asia and the Pacific (RAP) is promoting the following publications which they have produced in collaboration with several institutions. Print and PDF versions of these publications are available at http://www.fao.org/.

Advancing assisted natural regeneration (ANR) in Asia and the Pacific (RAP Publication 2003/19). Compiled and edited by Patrick C. Dugan, Patrick B. Durst, David J. Ganz and Philip J. McKenzie, this report discusses the key concepts and aspects of ANR, including its technical and social dimensions. It also compiles the experiences of the Philippines, China, Indonesia, Thailand and Viet Nam in implementing ANR. For the HTML version of this document, please visit http://www.fao.org/DOCREP/004/AD642E/AD642EE00.HTM.

Agroforestry: a way to better farming – a manual for trainers, teachers and extension workers. Written by Inoka Ratukalou *et al.*, this two-volume, spiral-bound 1999 publication provides a clear introduction to agroforestry. The two volumes introduce the rationale and definition of agroforestry, various forms of agroforestry, management techniques and plant species. This manual was produced by the Fiji Ministry of Agriculture, Fisheries and Forests (MAFF) and the SPC/GTZ Pacific German Regional Forestry Project. For the HTML version of this document, please visit http://www.fao.org/DOCREP/004/AD466E/AD466E00.HTM.

Forests and floods: drowning in fiction or thriving on facts? (RAP Publication 2005/03, Forest Perspectives 2). This booklet examines the scientific evidence that links floods and forests, as man is often blamed for the consequences of natural disasters on the environment. This booklet will inform policy makers, development agencies and the media of the distinction between facts and fiction on the relationship between forests and floods. It also recommends alternative approaches for effective watershed and flood plain management. The PDF version of this publication is available at http://www.fao.org/docrep/008/ae929e/ae929e00.htm

In search of excellence: exemplary forest management in Asia and the Pacific (RAP Publication 2005/03). Edited by Patrick B. Durst, Chris Brown, Henrylito D. Tacio and Miyuki Ishikawa, this publication presents the successful experiences of forest managers, farmers and local communities in balancing the various socioeconomic and environmental demands made on the forest. The book provides inspiring accounts of innovation, perseverance, and dedication of farmers across the region that should motivate others to intensify their efforts in protecting and managing the region's forest resources. A PDF version of the document is available at http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/007/ae542e/ae542e00.htm

Proceedings of the workshop on forests for poverty reduction: opportunities for clean development mechanism, environmental services and biodiversity (RAP Publication 2004/22). Edited by H.C. Sim, S. Appanah and Y.C. Youn, this publication presents the highlights of the workshop of the same title that was held 27-29 August 2003 in Seoul, Korea. The proceedings comprise the workshop discussions and presentations on poverty reduction by tropical forests, markets for forest communities, policy and market support mechanisms, strategies in implementing the Clean Development Mechanism, partnerships, forestry and biodiversity conservation, carbon sequestration, watershed protection and other opportunities. For the HTML version of this document, visit http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/007/ae537e/ae537e00.htm.

Proceedings of the workshop on forests for poverty reduction: can community forestry make money? (RAP Publication 2004/04). Edited by H.C. Sim, S. Appanah and W. M. Lu, these proceedings present the highlights of the workshop of the same title held 1-2 September 2003 in Beijing, China. The proceedings comprise the presentations on community forestry and agroforestry experiences in Viet Nam, the Philippines, Pakistan, Cambodia, Indonesia, Mongolia, Bangladesh, Bhutan, China and Thailand. The presentations focus on the dependency of communities on non-timber forest products, sustainable harvesting, the role of gender and the establishment of a nontimber forest products development body. For the HTML version of this document, please visit http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/008/ae537e/ae537e00.htm.

State of forestry in Asia and the Pacific: 2003 status, changes and trends (RAP Publication 2003/22). Edited by Chris Brown and Patrick B. Durst, this book assesses the state of natural resources, forest plantations, forest policy, legislation and planning, and the economics, social and environmental aspects of forestry utilization. It identifies the various forestry institutions, and provides an overview of the international conventions and agreements as it calls for international cooperation to address critical issues and concerns. For the HTML version of this document, please visit http://www.fao.org/DOCREP/006/AD642E/AD642E00.HTM. ■ *Compiled by Leah P. Arboleda and Philip J. McKenzie*

Useful websites and links

The following web sites and links were obtained from the World Agroforestry Centre, the Permanent Agriculture Resources, through its e-newsletter "The Overstory," research and contributions:

Web Sites

Center for Indigenous Knowledge For Agriculture and Rural Development (CIKARD) focuses on preserving and using the local knowledge of farmers and other rural people around the globe. For more information, please visit http://www.ciesin.org/IC/cikard/CIKARD.html

Centro Internacional de Información Sobre Cultivos de Cobertura (CIDICCO) has green manure/cover crop information for small farmers. For more information, please visit http://www.cidicco.hn/

CONTOUR is a newsletter dedicated to the exchange of information on soil and water conservation in South East Asia. For more information, please visit http://www.asocon.org/main.htm

Garden Organic provides information on organic gardening at http://www.gardenorganic.org.uk/

Indigenous Knowledge and Development Monitor (IKDM) serves those with an interest in the role of indigenous knowledge in participatory approaches to sustainable development. For more information, please visit http://www.nuffic.nl/ciran/ikdm/index.html

International Soil Reference and Information Centre provides information on soils and promotes sustainable use of the land at http://www.lime.isric.nl/

Livelihoods Connect provides information on how to eliminate poverty through sustainable livelihoods. For more information, please visit http://www.livelihoods.org/

The Soil and Water Conservation Society fosters the science and the art of soil, water and related natural resource management to achieve sustainability. For more information, please visit http://www.swcs.org/

User's Perspectives with Agricultural Research and Development (UPWARD) provides news and information resources on participatory research and development (PR&D) and innovations for sustainable rootcrop livelihood. For more information, please visit http://www.cip-upward.org/

Links

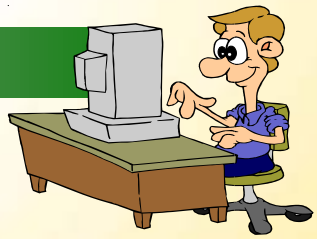
Agroforestry Database: http://www.worldagroforestrycentre.org/Sites/TreeDBS/aft.asp

Biodiversity Support Programme: http://www.BSPonline.org/

Eldis Food Security Resource Guide: http://www.eldis.org/food/

International Fund for Agricultural Development (IFAD): http://www.ifad.org/ ■ *Compiled by Leah P. Arboleda, Rowena D. Cabahug and Reinelen M. Reyes*

Call for contributions



We are inviting contributions to the 28th and 29th issues of the Asia-Pacific Agroforestry Newsletter (*APANews*) on or before 31 March and 30 June 2006, respectively. Let us help you share the relevant programs and projects that you are working on in the areas of agroforestry research, promotion and development, and education and training.

Contributions for agroforestry research may contain results of short- and long-term studies that will update readers on how agroforestry is being developed as a distinct science separate from agriculture and forestry.

Contributions for agroforestry promotion and development may contain information on various extension services aimed at promoting and developing agroforestry among communities. This section helps update readers on how agroforestry is being promoted in the field as a distinct practice.

Contributions for agroforestry education and training, meanwhile, may contain announcements on conferences, symposiums, training opportunities and other news on the various efforts being made toward generating more agroforestry professionals and practitioners, and providing venues for interpersonal sharing of agroforestry information, and networking opportunities. We will also help you announce new information sources and useful websites.

For several years now, *APANews* has continued to reach out to people from various sectors. Hence, we would like to request interested contributors to adopt the simple, straightforward and popular style in writing the articles instead of that used in journals. By adopting the popular writing style, your articles can help farmers, development agents, researchers, practitioners and other interested individuals in coping with the challenges of promoting and developing agroforestry in their respective countries, and at any level of project or research implementation.

In addition, the FAO and IAF editors would like to accommodate as many articles as possible in every issue. Hence, kindly limit your contributions to 1 000 words, and include good-quality photographs (scanned at 300 dpi) that are properly labeled and referred to in the text. Please don't forget to include your complete contact details, especially your E-mail address, should the readers have questions, clarifications or requests for further information.

Please send contributions through E-mail as attachments or via snail mail in diskettes/CD-ROM or printed form to the FAO/RAP Office or to the UPLB Institute of Agroforestry, 2/F Tamesis Hall, College of Forestry and Natural Resources, UP Los Baños, PO Box 35023, College, 4031 Laguna, Philippines; Fax +63 49 5363809; E-mail fao_apanews@yahoo.com.■