

Dear readers

Welcome to the 30th issue of APANews! This issue includes several interesting articles on recent developments in agroforestry. We also have several contributions presenting findings of agroforestry research.

Two articles discuss non-wood forest products in this issue. One article features the findings of a research that explored various ways of storing rattan seeds to increase its viability. The article also presents a comprehensive overview of rattan seed storage and propagation in Southeast Asia.

Another article discusses the potential of integrating Burma bamboo in various farming systems in India. As we all know, bamboo culms are very much in demand as raw materials for furniture, baskets, incense sticks, and many other products. The article discusses the results of a study that integrates Burma bamboo with ginger in terms of constraints, prospects, and financial benefits.

There is also an interesting article discussing the potential of a biofuel-based agroforestry system. The article discusses the potential of integrating *Jatropha* (*Jatropha curcas* L.) in agroforestry systems to

produce vegetable oil. The oil is not only rich in nitrogen, phosphorus and potassium, but can also be converted into industrial biodiesel. This article is indeed timely as recent research efforts are focusing on alternative sources of fuel and energy.

Another article presents the results of a study that investigated the physiological processes of agroforestry systems in India. The study focused on photosynthesis and other related growth parameters that affect crop production under tree canopies.

In agroforestry promotion and development, the impacts of a five-year grassroots-oriented project on a people's organization are presented in an article from the Philippines. The results of the impact evaluation affirmed agroforestry's potential for increasing incomes of farmers, and at the same time optimizing land use. More importantly, the article discusses how the project was able to empower the people's organization to become self-sufficient and at the same time provide relevant agroforestry extension services to others.

We continue to feature developments in agroforestry education and training through the SEANAFA News. Articles in this issue of SEANAFA News discuss about projects on landscape agroforestry, and marketing of agroforestry tree products. There are also updates on its Research Fellowship Program and reports from the national networks of SEANAFA's member countries.

There are also information on upcoming international conferences in agroforestry which you may be interested in attending. Websites and new information sources are also featured to help you in your various agroforestry activities.

Thank you very much to all the contributors, and we eagerly look forward to more of your interesting articles! – *The Editors*

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COVER PHOTO. Mr. Agustin Calanao applied his learnings in agroforestry on his three-hectare farm in Barangay Nazuni, Dingle, Iloilo, Philippines, implementing various agroforestry systems. Mahogany (*Swietenia macrophylla*), gmelina (*Gmelina arborea*), coconut (*Cocos nucifera*) and several fruit trees were planted along contours with pineapple, bananas, vegetables and other cash crops in the alleys. Mr. Calanao learned the practice of agroforestry from a training conducted by the FAO-Technical Support for Agrarian Reform and Rural Development (TSARRD) in the 1980s. (*Photo courtesy of the UPLB Institute of Agroforestry*)

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Exploring the possibility of biofuel-based agroforestry

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India has a huge requirement for fuel. Non-renewable fossil fuels are thus being exploited at an alarming rate to meet this demand. The country's domestic supply can only fulfill 22% of the country's total fuel demand. Inevitably, the shortfall is met by imported fuel.

Potentials of bio-fuel

A potential alternative to petro-based fuels is the biofuel. It can be sustainable, renewable and ecofriendly, and may substitute for fossil fuel in the future.

Growing biofuel crops in an agroforestry system can bring various benefits. At present, India has about 175 M ha of wastelands which are in need of rehabilitation. These lands can potentially be planted with trees/shrubs that bear oil seeds. Vegetable oil derived from these plants is similar to that of palms and animal fat, and can be used to produce industrial biodiesel. When refined, the oil can be blended with petro-based diesel to 20% of the volume.

One such example is *Jatropha* (*Jatropha curcas* L.). It is a shrub that reaches 5-6m high, with spreading branches and stubby twigs. It starts fruiting two to three years after transplanting. It bears seeds continuously for 50 years.

Jatropha

The seeds of *Jatropha* contain 30-40% oil. It is rich in nitrogen, phosphorous, and potassium. Aside from the oil, *Jatropha* produces high litter fall, thus maintaining soil productivity and promoting nutrient recycling. *Jatropha* also has hard stems, grows rapidly, is drought-tolerant, and can be easily propagated. This is a suitable crop



Fruits of Jatropha (Jatropha curcas L.)



Raising Jatropha in the nursery.

for integration in agroforestry systems, especially when agroforestry is used to rehabilitate wastelands.

Biofuel-based agroforestry

Recognizing the potential of *Jatropha*, a study was conducted in Hisar, India in September 2003 to develop a *Jatropha*-based agroforestry system.

Hisar is an arid area with an average annual rainfall of 350-400 mm, occurring mostly (70-80%) during July to September. Aside from these adverse climatic conditions, the soils in Hisar are highly saline and have low fertility.

For the study, six-month old nursery-raised *Jatropha* plants were transplanted in two blocks at spacings of 5m X 3m. Monocropping of *Jatropha* was done in one block, while *Jatropha*-based agroforestry

was established in another block. The *Jatropha*-based agroforestry was planted with raya (*Brassica juncea*) in the winter season, and mungbean (*Vigna radiata*) during the rainy season.

Results showed marginal differences in the growth of *Jatropha* between the two treatments. The majority of the *Jatropha* plants started flowering and fruiting a year after planting. This is in contrast with earlier reports that *Jatropha* starts flowering and fruiting three years after being transplanted. In northern India, flowering in *Jatropha* occurs twice a year - during March-June and September-December.

Jatropha is a monoecious plant that has separate male and female flowers within the same inflorescence. Thus, honeybees, ants, thrips, butterflies, and flies are

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Exploring the possibility...

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needed for cross-pollination. Annual flowering crops may be planted between *Jatropha* plants in an agroforestry system to attract insects needed to ensure cross-pollination. This will help maximize the fruit yield of *Jatropha*. The fruits of *Jatropha* turn yellow as a sign of maturity 2-4 months after flowering.

In the study, the average seed yield obtained during the first year was 198 kg/ha. This is expected to increase up to 10,000 kg/ha when *Jatropha* plants reach 6-7 years old.

In India, *Jatropha* seeds cost 5-10 Rs/kg, depending on their quality. Thus, a farmer can earn extra income from integrating *Jatropha* in his agroforestry farm.

At present, *Jatropha* cultivation is still a new concept in India. Most Indian farmers are venturing into this for the first time, and they are still unaware of the appropriate



Jatropha-based agroforestry system.



Jatropha in boundary plantation.

agronomic/silvicultural practices for cultivating *Jatropha*. There is thus a dire need to standardize such practices, and at the same time continuously explore the integration of other biofuel crops in agroforestry systems. ■

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Studying rattan seed germination and storage in Southeast Asia and Northern Thailand

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Rattan is a very diverse plant group in the palm family. Best known for its use in furniture construction, rattan can also be used in making baskets, mats and ropes, and consumed as food and medicine. In Vietnam, rattan is used in constructing bicycles (Nguyen and Ngo, 1996).

Although various species have been introduced in South and Central America, rattan is most abundant in Southeast Asia and Africa. It is considered an economically

important nonwood forest product (NWFP) in a number of Southeast Asian countries. Because of this, the natural population of rattan has been decreasing in many forest areas.

Rattan in Southeast Asia

Planting of rattan. Cultivating rattan to reduce the harvesting of wild rattan is being tried in a number of countries, including Malaysia and Thailand. Malaysia has had

commercial plantations of rattan since the 1970s. Rattan plantations in Malaysia begin to mature in four to five years and become ready for harvesting after 10 years (Manokaran, 1984). The Royal Forest Department of Thailand maintains 1,000 ha of rattan plantations (Vongkualong, 2002).

Experiments with intercropping rattan and rubber in peninsular Malaysia showed that some species such as *C. manan*, *C. scipionum*, and *C. palustris* were suitable for intercropping (Ali and Raja Barizan, 2001). These studies showed that 4-7-year-old rubber trees are best for intercropping with *C. manna*. The cane harvest should also be timed to coincide with plantation replacement. Low branching varieties of rubber are best suited for the climbing rattan.



Meanwhile, other plants, such as oil palm and bamboo, are also being studied as possible intercrops with rattan in Malaysia.

In the Philippines, NGOs have promoted small-scale agroforestry with rattan and perennial crops. Rattan seeds are broadcasted and later transplanted into proper spacing. Private companies in the Philippines have likewise established commercial plantations, but have experienced problems with poaching (Baja-Lapis, 1996).

Farmers in Kalimantan, Indonesia, have been practicing a swidden form of rattan intercropping with upland rice and other components since the mid-9th century. The harvest of rattan begins 7-8 years after establishment, and peaks at around 25 years. In recent years, competition from commercial oil palm and pulp plantations has threatened this form of rattan farming. In some cases, this competition had led to armed conflicts (Belcher, 2001).

In Sulawesi, Indonesia, *Calamus zollingeri* has been successfully intercropped with coffee and cacao. Nursery-raised seedlings showed a better survival rate (96%) than cuttings (61%) after 20 months. Plants with greater sun exposure on well-drained soils demonstrated better performance (Siebert, 2000). The amount of light required for optimal growth varies by species at 30-80% (Yin *et al.*, 2000).

In Thailand, small-scale cultivation of

rattan for its edible shoots has been promoted by the Royal Forest Department since 1991. This practice was brought to Lao PDR in 1994 and has spread quickly (Evans and Sengdala, 2002). In this system, rattan grown under full sunlight was more productive.

Propagation of rattan in Southeast Asia. Nursery protocols for rattan propagation have been established in several countries. The timing of seed collection is important since immature seeds show low rates of germination. Once the seeds are mature, their scales should separate easily and the inner seed coat should be dark (Dransfield, 1996). In northeast India, mature seeds have been reported to appear yellowish white with ruptured scales (Bora *et al.*, 2000). They also show accumulated thorns, inflorescence branches, and pericarp fragments on the ground as a result of animal feeding (Ahmad and Hamzah, 1984). The pulp of mature fruits in some species is sweet (Seethalakshmi, 1989).

Bora *et al.* (2000) recommend the collection of seeds from plants that are at least 6-m tall. Alloysius (1996) noted that seed collected in plantations from the first flowering showed lower quality and reduced germination. Collected seeds should immediately be packed in bags that allow aeration but can also be kept moist. Temperature during transport should not exceed 28°C (Mohd *et al.*, 1994). Upon arrival at the nursery site, the seeds should be spread out and

kept cool and moist until processing.

Processing and planting should take place as soon as possible. The removal of the pericarp and sarcotesta, the fleshy pulp around the seed, helps increase germination rates in most species (Ahmad and Hamzah, 1984; Bora *et al.*, 2000; Evans and Sengdala, 2003; Mohd *et al.*, 1994; Singh *et al.*, 1989). In Thailand, *C. perigrinus* showed 91% germination in 12-35 days with the sarcotesta removed (Vongkualong, 1984).

A number of techniques have been developed to remove the pericarp and sarcotesta. These include beating or stepping on the seeds to break the pericarp, rubbing the seeds between gunny sacks or on a wire mesh to remove the sarcotesta, pre-soaking the seeds for 24-48 hours, or using a blender with the blades taped or covered. Removal of the hilar cover also helps increase germination rates (Evans and Sengdala, 2003).

Seed processing should be done carefully, especially if the hilar cover is removed, to avoid damaging the seeds and thereby resulting in lower rates of germination. Soaking the processed seeds in cold water for seven days can increase germination rates (Evans and Sengdala, 2003). Seethalakshmi (1989) recommends soaking the processed seeds for 48 hours to induce fermentation, and then discarding the seeds that float. Treating *C. latifolius* with heat at 40°C for 48 hours also increased germination. The cleaned seeds should be treated with fungicide before sowing (Mohd *et al.*, 1994).

Processed seeds should be sown in raised beds or boxes, or on trays until germination takes place, before being transplanted

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The pericarp and sarcotesta of rattan seeds are removed using mortar and pestle.



Rattan seeds are washed, treated with fungicide, and placed in plastic screen.

Studying rattan seed...

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to polybags (Mohd *et al.*, 1994). Large seeds should be sown at 2cm x 4cm spacing with the seed pore pointed upwards to hasten germination (Ahmad and Hamzah, 1984; Mohd *et al.*, 1994). Smaller seeds can be broadcasted.

Nursery beds should consist of a sand:soil mix (1:4 or 1:3). Sown seeds should be covered with 3cm of sawdust and watered regularly (Ahmad and Hamzah, 1984). Farmers in northeast India sow *C. erectus* in nursery beds, covered with a 5cm layer of mixed sand and manure, and dry grass (Haridisan, 1996). For *C. manan* and *C. caesius*, germination should take place in 2-3 weeks. When seedlings are 2-3-cm tall, they should be transplanted to polybags. Seedlings should not remain in the



Rattan seeds are placed in a plastic tub over water at room temperature.



Storage containers are sealed to maintain the humidity of the rattan seeds.



Storage containers are periodically opened to allow aeration of the rattan seeds.

nursery for more than a year (Ahmad and Hamzah, 1984).

Some rattan species can also be propagated from suckers or rhizomes (Yusoff and Manokaran, 1984). Harvested suckers should be kept to a length of 20-25 cm (Haridisan, 1996). Although Haridisan reported little success with stem cuttings, Siebert (2000) reported 61% survival with cuttings of *C. zollingeri*. Suckers should be harvested at the beginning of the rainy season and treated with rooting hormone before planting (Seethalakshmi, 1989).

It is best to plant rattan seeds immediately after harvest. They should not be allowed to dry as seeds kept under dry conditions only maintain viability for two weeks, compared to two months under moist conditions (Bora *et al.*, 2000).

Studies have shown that seeds of *C. simplicifolius* stored in wet sand at 5-8°C had a 70% germination rate after three months (Yin, 2000). Seeds of *Daemonorops margaritae* stored in a medium of crushed coconut shells, with moisture kept at 55-65% and sealed in a plastic bag (with a plastic tube to maintain aeration) at 15°C, were able to maintain a germination rate of 64-71% after six months (Yin and Xu, 2000). In another study, cleaned and fungicide-treated *C. tenuis* seeds stored over water inside a sealed container at room temperature maintained their viability for one year. The box was opened periodically to maintain aeration (Kundu and Chanda, 2001).

Rattan in Thailand

There are over 80 species of

rattan found in Thailand, mostly from the genus *Calamus* (Vongkualong, 2002). A one-hectare plot in the Khao Chong National Park contained 11 different rattan species with a total stem length of over 2,300 m. Most of these were being used to make furniture (Bogh, 1996). The most common species were *Calamus peregrinus* and *C. rudentum*, with an annual growth of 1.24 m/year and 1.42 m/year, respectively.

The most economically important rattan species in Thailand are *C. longisetus*, *C. rudentum*, *C. peregrinus*, *C. caesius*, *C. manan*, and *C. wailong* (Vongkualong, 2002). Rattan furniture manufactured in Thailand is considered to be of high quality in many markets. However, forest law prevents the harvesting of wild rattan. Hence, a considerable amount is imported from other countries such as Indonesia, Myanmar, Lao PDR and China.

The rattan species found in northern Thailand are distinct from those found in the southern portion. Their use as a traditional food source is significant (Anderson, 1993). The disappearance of rattan from northern Thailand has forced hilltribe people to go to Myanmar to harvest rattan.

Studying rattan seed storage.

To find a way for extending the storage of viable rattan seeds, the Upland Holistic Development Project (UHDP), with technical support from Floresta International, conducted a rattan seed storage trial at the UHDP Agroforestry and Small Farm Resource Center in Mae Ai, Thailand in 2006.

Approximately 500 seeds of *Calamus wailong* were soaked in water for a week. The water was changed daily. The pericarp and sarcotesta were then removed using a mortar and pestle. The seeds were rinsed with water and rubbed on a #4 screen to remove any residual sarcotesta. The seeds were then placed in a breathable plastic



screen, and then in a sealed plastic tub over water at room temperature.

Likewise, approximately 500 seeds of *Daemonorops jenkinsiana* were treated in the same way. All the seeds were then treated with fungicide (Solaxyl) to inhibit mold growth (which has started on the seeds of *C. wailong*). Fungicide was applied as dry powder. The seeds were then placed in a breathable plastic screen, and then in a sealed plastic tub over water at room temperature. The sealed container was opened periodically, and the seeds were removed temporarily to allow aeration.

The storage method of *Daemonorops jenkinsiana* was similar to a method done in China which allowed the seeds to be viable for up to a year.

Study Results

The storage practices for the rattan seeds were maintained for seven months. The containers were opened periodically (a few times monthly) with the seeds being aerated for more than a few minutes at a time.

After a month, the rattan seeds were examined each month to determine the degree of viability. During this time, roots had begun to emerge from a large number of seeds. Six months after, at least 75% of the *Calamus wailong* and *Daemonorops jenkinsiana* seeds had emerging roots. Thus, the study demonstrated the following:

- The viability of rattan seeds of *C. wailong* and *D. jenkinsiana* could be extended from the usual period of less than a month to at least several months. The germination rate at this duration is over 75%.
- Prolonged storage greatly extends the viability of these species, which is useful when shipping rattan seeds.
- Seeds of these rattan species need not be immediately sown after harvest, as their viability

can be maintained even after prolonged storage.

Additional work needs to be done in the following areas:

- Studying the storage viability of all five indigenous rattans that are often used in the agroforestry programs of UHDP. This will determine if all species can be stored for longer periods.
- Future studies can determine if commercial fungicides are needed to store rattan seeds.
- Studies may also be conducted to determine how long rattan seeds can be stored without spoilage. ■ *Mr. Rick Burnette can be contacted at the Uplands Holistic Development Project (UHDP), P.O.Box 43, Fang, Chiang Mai 50110 Thailand. Mr. Bob Morikawa can be contacted at Floresta USA, 4903 Morena Blvd, Suite 1215, San Diego, California 92117, USA.*

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Potential of Burma bamboo for integration with various farming systems in India

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Coorg district in Karnataka state, southern India, covers a land area of 4,104km². It consists of 48% natural forests and 32% private coffee plantations. The rest are non-forested areas where paddy cultivation is the dominant land use.

Recently, however, the production of paddy rice has been declining and yields are no longer sustainable. Moreover, the conversion of paddy fields to monocropping of ginger (*Zingiber officinalis*) and lack of labor availability have adversely affected the income of communities.

To address these issues, the possibility of integrating *Dendrocalamus brandisii* (Burma bamboo) as part of an agroforestry system is being explored.

The potential of Burma bamboo

Burma bamboo has been grown by enterprising farmers since being introduced to Coorg in 1915. The culms of Burma bamboo are smooth and around 25m tall with a diameter of 13-30cm. The walls are 1.7 to 3cm thick, with an internodal length of 30-60cm. Its straight growth and thornless nature, unlike the other local bamboo species such as *Bambusa bambos*, makes Burma

bamboo an attractive species for integration with various farming systems (e.g. ginger cultivation, sericulture, and others).

Studies of households in Coorg by the Institute of Wood Science and Technology (IWST), Bangalore, revealed that carefully managed block plantations of *D.brandisii* may be a viable alternative in abandoned paddy fields because it requires very low financial inputs. Most of the costs are incurred in its initial establishment and protection, and almost no costs are incurred during maintenance, except for the annual marking and harvesting of culms.

Assuming 278 plants per hectare planted at 6m x 6m spacing, culms can be harvested at the rate of 2 culms/clump in the third year to 10 culms/clump from the 8th to the 40th year. Each culm can fetch up to US\$1.14-1.25 (at US\$1 = 44 Indian rupees) in the market at current prices.

Ginger cultivation is currently the preferred land use in unutilized paddy fields in Coorg, even though it entails high labor and financial inputs. Drastic fluctuations in ginger prices (US\$6-57/kg) and incidences



A 30-year-old unharvested clump of Burma bamboo (*Dendrocalamus brandisii*) with more than a thousand culms.



of soft rot disease in water-logged conditions often make the monocropping of ginger an unreliable enterprise.

Because it is a soil-exhaustive crop, ginger cannot be cultivated continuously. Hence, a gap of five years is needed between two successive crops of ginger. This gap is what the intercropping of ginger with Burma bamboo hopes to dispose of. Intercropping of the two crops can offer better returns due to multiple yields. However, the two crops need to be managed properly to avoid competition.

One concern that needs to be considered is the difficulty of intercropping in Burma bamboo plantations. The culms of Burma bamboo grow fast. Hence, they should be harvested regularly to promote good plantation management.

If Burma bamboo is integrated with ginger in block plantations, a spacing of 6m x 6m for Burma bamboo can be used to establish four rows with 10 ginger beds in each row. It is possible for ginger to flourish in between bamboo rows in the initial year. However, light availability for ginger will be reduced as the bamboos grow. In this type of planting configuration, one more crop rotation of ginger comprising two rows between the bamboo rows, is still possible in the fifth year.

At a spacing of 6m x 10m for Burma bamboo, intercropping is possible for longer periods, up to the 15th year. Although the number of ginger bed rows may decrease progressively (from 6 rows in the first year to only one row in the 15th year), benefit-cost analysis revealed that *D.brandisii* intercropped in ginger plantations is still viable (Table 1).

The high Net present value (NPV) and Benefit-cost (B/C) ratio of Burma bamboo cultivation can be attributed to the low financial inputs needed and sustained yield. Intercropping with Burma bamboo

can also reduce the costs of ginger cultivation. An example is the cost incurred in mulching. Mulching ginger can now be done using the copious leaf litter from the Burma bamboos.

Intercropping of Burma bamboos with ginger, at 6m x 6m spacing, maximizes the NPV. Increasing bamboo spacing to 6m x 10m to accommodate more intercropped ginger rotations may not be as profitable as the wider spacing arrangement results in lower NPV and B/C values.

Constraints and prospects

Inadequate planting stock. Although studies have proven the financial viability of *D.brandisii* cultivation as an attractive alternative for unutilized paddy fields in Coorg, an inadequate supply of quality planting materials is considered a major constraint.

To address this issue, IWST conducted preliminary trials focusing on the selection of candidate plus clumps (CPCs) of *D.brandisii* based on morphological and physical properties, and the macropropagation of materials from CPCs to produce quality planting stock. Further macropropagation trials that used offset culm cuttings, rhizomatous branch cuttings, and culm cuttings from CPCs revealed that horizontally planted culm

cuttings resulted in 90% success in rooting, which was much higher compared to vertically planted rhizomatous branch cuttings in propagation beds. A project is now being implemented by the National Mission on Bamboo Applications, New Delhi and the Vegetative

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Harvesting, transport, and use of Burma bamboo as fence for ginger cultivation.

Table 1: Financial analysis of different farming systems in a hectare of upland paddy field in Coorg district at different discount rates.

Sl. No.	Type of farming system	Net present value (US\$)		Benefit-cost ratio	
		10%	15%	10%	15%
1	Ginger + rice (sequential intercropping)	4968	3148	1.52	1.47
2	Burma bamboo (Block plantation at 6m x 6m spacing)	9232	4714	3.75	2.90
3	Burma bamboo + Ginger (Block plantation at 6m x 6m spacing)	11307	6182	3.1	2.4
4	Burma bamboo + Ginger (Block plantation at 6m x 10m spacing)	8143	5144	2.71	2.27

agroforestry research

Potential of Burma...

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Propagation Centre (VPC) in Ponnampet, Coorg to produce 50,000 rooted cuttings every year to meet the increasing demand for the Burma bamboo in Coorg.

Value-added feature and additional markets. Other value-added features of Burma bamboo can also help increase the income of farmers. The morphological features of *D.brandisii* culms make ideal raw materials for incense stick making. This is a popular industry with an estimated market of 40,000-50,000 tons per annum. One culm of *D.brandisii* used to make incense sticks can provide a revenue of about US\$4.5. The local sale of a single culm, meanwhile, can only fetch US\$1.14-1.25.

These potentials can indeed provide incentives to farmers in Coorg to plant Burma bamboos, especially if linkages with the markets of Mysore, adjoining Coorg, are established. Mysore is one of the biggest markets for bamboo. Their bamboo supplies mainly come from the Northeastern part of India. If tapped, Coorg farmers can have additional markets for their bamboos.

Bamboo shoot processing. Another exciting prospect is the processing of bamboo shoots. Bamboo shoots are consumed as shoot gratings, shoot slices, and shoot pickles. Bamboo shoot pickles is a traditional delicacy in Coorg. Nearly 10,000 seedlings of *Dendrocalamus asper*, an edible species of bamboo, were distributed to farmers during a meeting of entrepreneurs in Coorg in July 2006.

The shoots of Burma bamboo are also edible. They are low in fat and good sources of soft fiber. In fact, Burma bamboo is listed among the top five edible species of bamboos in the world. However, its food value is not recognized in Coorg. This is the reason bamboo shoot processing is now being promoted through

the innovative programs of self-help groups.

Policy restrictions. Aside from the lack of quality planting materials, the policies and regulations in Karnataka are not conducive to bamboo farmers. Although bamboo has been exempted from planting permits within Coorg, they are still subject to felling restrictions and transit permits. This constrains the transportation of bamboos to and from markets, and the establishment of linkages with new markets.

Policy makers are just now realizing the need to modify existing state laws regarding the harvest and transportation of Burma bamboo which are cultivated on a large-scale. Policy changes can help enhance the systematic commercialization of bamboo, ensure a proper supply of quality planting materials, increase exposure to scientific management practices, promote value-added features, raise awareness of the economics of bamboo cultivation, and encourage the establishment of markets for bamboo within and outside Coorg. ■ *The authors work at the Tree Improvement and Propagation Division, Institute of Wood Science and Technology, Malleswaram, Bangalore, India.*



Different methods of vegetative propagation of Burma bamboo.



Automated incense stick making using Burma bamboo.



Value-added products from Burma bamboo.

Ecophysiology of crops grown under poplar tree canopy

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In Punjab, India, farmers are recognizing the potential of agroforestry in diversifying the practice of traditional agriculture to ensure a stable income.

The introduction of short rotation exotic trees such as *Populus deltoides*, *Eucalyptus tereticornis*, *Leucaena leucocephala* and *Melia composita* has encouraged farmers to venture into agroforestry. Even though the integration of timber trees does not contribute much to the annual production, fruit trees, vegetables, flowers, medicinal plants and other high value crops can compensate for the needed regular income.

Tree-crop integration leads to complex interactions among the biophysical components such as light, space, water and nutrients. In agroforestry, these key components complement each other, thereby contributing to the success of agroforestry systems.

Trees influence the various environmental factors that influence the growth of plants, especially those grown under shade. Among these factors is Photosynthetically Active Radiation (PAR). PAR is important as the radiant energy captured by the plants is utilized in photosynthesis, which in turn determines biomass production and yield. In agroforestry, PAR and temperature are reduced, while humidity is increased. It is therefore critical to investigate the physiological processes of agroforestry systems, especially those related to the photosynthesis of plants grown under the canopy of trees.

Photosynthesis-related parameters affecting intercropping

A study was conducted to examine the photosynthesis-related parameters affecting the intercropping of turmeric (*Cucuma longa*) and soybean (*Glycine max*) under the canopy of two-year old poplar trees. These poplar trees were planted at 6m X 6m spacing.

During the month of May, turmeric and soybean were sown in between the poplar trees. The plot without poplar trees served as control. The net photosynthesis (P_n), PAR, Intercellular CO_2 (C_i), transpiration rate (E) and stomatal conductance (C) were measured for 9 to 11 hrs every week. This lasted from 45 to 130 days after sowing. Measurements were made using a portable photosynthesis system (CID 340, CID Inc., USA).

Fifty fully expanded leaves, in both open and under the poplar tree canopy, were measured. Measurements were not taken during cloudy and rainy days. The P_n/E ratio (water use efficiency) and P_n/C_i ratio (carboxylation efficiency) were also calculated.

The canopy of the poplar trees was measured in terms of leaf area index. The average leaf area index recorded was 0.40. The canopy of poplar is shown in Figure 1.



Fig. 1. Turmeric (*Cucuma longa*) grown under poplar-pear combination.

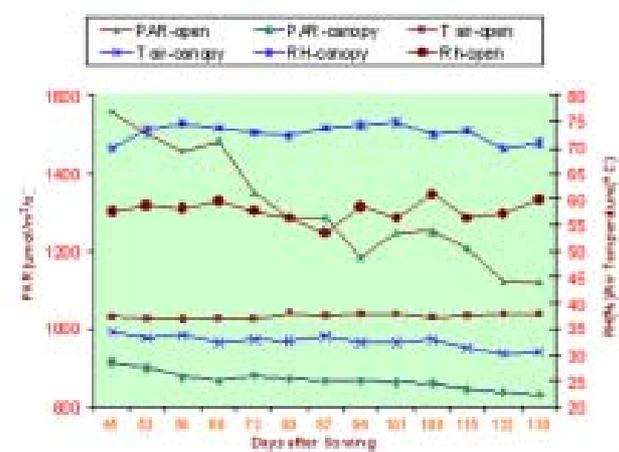


Fig. 2. Microenvironmental parameters in open and shaded conditions.

Light interception increased with time in proportion to canopy cover. Results showed a minimum of 55% light interception at the time of sowing, and a maximum of 70% after 130 days of sowing. Reduced air temperature and increase in relative humidity were also recorded (Figure 2).

The relative PAR showed a decreasing trend. This may be due to the increase in tree canopy cover, and seasonal changes. Significant variations were observed in the rates of photosynthesis, transpiration, stomatal conductance, and intercellular carbon dioxide concentration in both the crops in open and under tree canopy.

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Ecophysiology of crops...

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The net rate of photosynthesis and transpiration was higher in open conditions than in the tree-crop interface. But the internal CO₂ content recorded higher values under shade.

In the open, the P_n/E ratio of turmeric, which indicates water use efficiency, was higher (0.0042) than in the shade (0.0034). The carboxylation efficiency (P_n/C_i) of turmeric, which indicates production potential, was also maximized (0.062) in open conditions.

A similar trend was observed in the soybean crop. It obtained higher values for P_n/E and P_n/C_i at 0.0045 and 0.058, respectively, in open conditions. Soybean grown under shade resulted to 0.0031 P_n/E and 0.033 P_n/C_i.

Assessing photosynthesis efficiency

Photosynthesis efficiency is influenced by the sensitivity of the stomata to variations in the environment, especially temperature and water availability. Under stress conditions, stomatal functioning appears to be a major limitation to CO₂ influx, thereby reducing the level of photosynthetic production. In the present study, there was no significant variation in the stomatal conductance in the crops grown under poplar canopies and in open conditions.

Furthermore, the strong correlation (> 0.85) between internal CO₂ content and net photosynthesis ruled out the possibility of stomatal limitation due to water stress. These results thus support the absence of competition for moisture between poplar trees and intercrops, which may be due to their varied root depths.

Competition is expected in intercropping. This usually results from nutrient stress, which may inhibit plant growth under tree canopies. Several studies have reported that photosynthetic capacity is directly related to leaf nitrogen content. A reduction in nitrogen availability negatively influences Rubisco enzyme activity.

The leaf nitrogen content in turmeric (1.32%) and soybean (2.54%) grown under the canopies of the poplar trees did not differ from that grown in open conditions (1.41% for turmeric and 2.67% for soybean).

However, crops grown under shaded conditions gave lower yields as compared to those grown in open conditions. In the study, turmeric had a 14% reduction in yield, and soybean 17.6%. This indicates that PAR was indeed the major limiting factor of crops grown under shaded conditions.

Recommendations

Pruning is recommended to negate the effect of tree canopies. Pruning must be practiced to prevent possible competition for light, nutrients, water, and others as the trees become mature.

Future studies may focus on belowground competition for nutrients, partition of water use between trees and crops, and other related areas. Long-term studies are needed to assess the actual potential of growing crops under tree canopies, including the identification of crops that perform well under such conditions. ■ *The authors work at the Department of Horticulture or Department of Agronomy, Agrometeorology and Forestry, Punjab Agricultural University, Ludhiana 141 004 India.*

Evaluating the impacts of ASPECTS in Mindanao, Philippines

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The Agroforestry Support Program for Empowering Communities Towards Self-Reliance (ASPECTS) was initiated by the Institute of Agroforestry, University of the Philippines Los Baños (UPLB) and Ford Foundation in 1998. The five-year program was implemented in three sites – one each in Luzon, Visayas and Mindanao.

In Mindanao, ASPECTS was implemented in Claveria, Misamis Oriental. Project implementers in the Mindanao site were the Misamis Oriental State College of Agriculture and Technology (MOSCAT), the Department of Environment and Natural Resources (DENR), local government units, Landcare

Philippines, and the World Agroforestry Centre (ICRAF).

ASPECTS

ASPECTS aimed at developing a grassroot-oriented extension model that simultaneously addresses the twin objectives of community empowerment and advancement of agroforestry education. At the same time, it enabled the communities to establish and maintain extension services that facilitate linkages with adjoining communities, local government units, and other sources of development assistance.

Among the 24 barangays in the Municipality of Claveria, Barangay Sta. Cruz was identified as the



agroforestry promotion and development

partner community. The activities of ASPECTS included the establishment of a people's organization in Barangay Sta. Cruz – the Sta. Cruz Growers Association (SUGA). SUGA was identified as a partner in implementing ASPECTS.

Other activities included the training of selected potential farmer leaders of SUGA in UPLB, implementation of onsite livelihood trainings, and the establishment of a communal farm, farmer-training center and a nursery demonstration farm.

Barangay Sta. Cruz and SUGA

The study was conducted in Barangay Sta. Cruz, which was composed of 272 households with an average household size of six members. Twenty percent (20%) are *Higa-onons* (indigenous cultural communities), and the rest are Visayan migrants (65%), Ilocanos (10%) and Ilonggos (5%). The chief means of livelihood is farming.

Barangay Sta. Cruz has an elevation of 600 to 900 m asl. It has Jasaan clay soil, with low to moderate fertility, suitable to the cultivation of agricultural crops and fruit-bearing trees. The climate is Type 2, which is characterized by the absence of a distinct dry season and pronounced rainfall from November to January.

As a partner of ASPECTS, SUGA was registered at the Securities and Exchange Commission (SEC) in June 1998. It was established with an initial membership of 28 farmers. Eventually, the membership expanded to 68.

SUGA obtained an agreement with DENR through the Community-Based Forestry Management (CBFM) Program to manage of 395 ha of forestlands. These lands are part of the Pugaan River Watershed Area.

Evaluating the impacts

A study was conducted to determine the differences that have occurred in the socioeconomic status of the SUGA members. The evaluation was done in terms of improvements in income, changes in the state of farm development, and use of cultural and management practices in agroforestry. The study also aimed at finding out the extent of development of the Community-Managed Agroforestry Extension Services (CMAFES).

CMAFES is the ultimate goal of ASPECTS at the local level. It is the realization of an extension service developed by the farmers themselves to address their own needs and that of the adjacent communities. Part of this extension service was the implementation of livelihood projects and outreach programs, and establishment of farmer-training centers, community nurseries, and demonstration farms that emphasized the farmer-to-farmer approach.

Using complete enumeration, data were gathered through questionnaires and interviews of 68 farmers who were all members of SUGA. The questionnaires and interviews focused on the impacts of ASPECTS on the members' socioeconomic development, and cultural and management practices in agroforestry. The study also determined the extent of SUGA's CMAFES. The paired t-test was used to analyze the data.

Impacts on the lives of the SUGA Members

Income of the SUGA members. The study showed that the income of the farmers before the implementation of the ASPECTS Program averaged US\$196.00. After the implementation of ASPECTS, their income improved to US\$391.00. The mean difference in income before and after the project was US\$125.00. This may be attributed to significant changes in the state of farm development among the SUGA members.

Utilization of agroforestry practices.

SUGA members no longer practiced monoculture but rather combine different crops in various agroforestry systems, while integrating other technologies. The agroforestry systems in practice included alley cropping or contour farming, the planting of natural vegetative strips (NVS), improved NVS, woodlots or tree plantations, silvopasture (planting of trees combined with the raising of animals), protein bank, green manure, and aquasilviculture. Aquasilviculture is the planting of fruit trees adjacent to an inland fishpond.

Extent of the CMAFES development .

Within five years, ASPECTS was successful in enabling SUGA to become a self-reliant and sustainable organization. Through ASPECTS's various activities, SUGA was able to build its capacity, and developed and implemented training programs for non-members. These training programs were conducted in the training hall that SUGA established, by the experts that they established links with. To date, SUGA has offered training programs on banana production, agroforestry establishment, anthurium production, inland fish development, nursery establishment, and grafting.

In addition, the SUGA members became innovative farmers – developing and implementing agroforestry projects that combine fruit tree plantation, banana production, timber trees, inland fish, and swine production. They were able to use the knowledge gained from ASPECTS to source funds on their own.

Moreover, SUGA members who were trained in developing project proposals were able to come up with projects that were given grants by the Provincial Agriculture and Natural Resources Office, DENR, and

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Evaluating the impacts...

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local government units. These projects involved the establishment of anthurium, banana, fruit trees and timber tree plantations, and integration of soil and water management technologies in agroforestry farms.

Conclusions

ASPECTS has indeed brought about positive changes in the socioeconomic status and technical capacity of SUGA members. The members have a better understanding of agroforestry and the use of agroforestry technologies, livelihood support, capacity building, and linkages. The members were transformed into innovative farmers, and SUGA has become a sustainable and self-reliant organization. ■ *The author works at the Misamis Oriental State College of Agriculture and Technology, Claveria, Misamis Oriental, Philippines.*

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International symposium on farming systems design to be held in Italy

The International symposium on methodologies for integrated analysis of farm production systems is scheduled to be held 10-12 September 2007, in Catania, Sicily, Italy. Dubbed as Farming Systems Design 2007, the symposium aims to provide opportunities to share knowledge across the disciplines that concern farming system analysis, design and innovation; compare approaches being used/developed; and identify available operational tools and future research needs.

This symposium was organized because of the growing interest in agricultural systems that serve multiple purposes.

Sessions will focus on the following themes, with their corresponding topics:

1. Farm-regional scale design and improvement

- Biophysical and economic trade-offs in farming;
- Farm models and market interactions;
- Model-based intervention in land management practice and policy;
- Multipurpose farming systems;
- Risk assessment and trade-off analysis for integrated farming systems; and
- Adapting farms to an uncertain future climate.

2. Field-farm scale design and improvement sessions

- Novel production systems (e.g. bio-energy) and systems for marginal areas;
- Agricultural management in future studies;

- Integrating genetics and management in improved production systems;
- Production system sustainability and externalities;
- Sustainability indicators at the farming systems level;
- Paddock/farm/catchment model platforms; and
- Integrating mechanistic models and expert knowledge.

Poster sessions will be held concurrently in all sessions. The symposium will also produce a proceedings that contains extended abstracts for each oral and poster presentation. At the same time, specific papers will be invited by the scientific committee to be submitted as full papers in special issues of key journals (e.g. European Journal of Agronomy, Agricultural Systems, Environmental Modelling and Software).

This symposium is being organized by the European Society for Agronomy, the International Environmental Modelling and Software Society, the American Society of Agronomy, and the International Farming Systems Association. It is being supported by the Società Italiana di Agronomia, and the Agricultural Research Council, Italy. ■



Multi-strata agroforestry systems symposium slated for September 2007

Interested agroforestry practitioners are invited to the Second International Symposium on Multi-Strata Agroforestry Systems with Perennial Crops, to be held at CATIE from 17 to 21 September 2007, in Turrialba, Costa Rica.

With the theme, "Making ecosystem services count for farmers, consumers and the environment," the symposium aims to inspire participants to intensify their efforts in developing and adopting sustainable agroforestry practices that focus on the integration of trees and perennial crops (primarily coffee, cacao, oil palm, coconut, fruit trees, tea and rubber). More importantly, the symposium will discuss strategies to successfully promote multi-strata agroforestry systems in tropical areas, particularly in areas considered as biodiversity hotspots.

Objectives

Organized by the International Union of Forestry Research Organizations (IUFRO), the symposium specifically aims to:

- Document and synthesize the results of research and pilot projects that link sustainable management and environmental services of tropical perennial crop agroforestry systems. These services include biodiversity conservation, water quality, watershed protection, climate change mitigation and adaptation, and soil and natural resources conservation.
- Enhance cooperation between research institutions, and governmental, non-governmental, and private sectors involved in promoting good agricultural practices in agroforestry.
- Prepare recommendations for future research priorities, and policies to facilitate the adoption of these perennial crop agroforestry systems

Sessions

The symposium is organized into four sessions:

1. Field level

This session will focus on the impacts of trees on the productivity and processes (e.g. effects of shade species on microclimate, soil, underlying crop productivity and quality, and pests and diseases) of agroforestry systems with perennial crops (especially cocoa, coffee, tea, rubber, fruit trees, coconut and oil palm)

2. Landscape and regional levels

This session will discuss the quantification and valuation of environmental services of perennial crop agroforestry systems. These include research methodologies for upscaling (pilot to the landscape and regional levels), and reports on pilot implementation of projects with local or international schemes that reward farmers for environmental services.

3. Scientific research

Results from scientific research will be presented. Topics include the validity and feasibility of the technical guidelines (e.g. good agricultural practices, including tree cover threshold levels), proposed criteria and indicators to monitor all agroforestry products and services, and the economic implications of these guidelines, criteria and indicators for producers and rural communities.

4. Social and economic importance of agroforestry products

This session will discuss experiences gained from diversifying farmers' revenues, valuing medicinal and indigenous tree species, and developing commodity value chains through producer-trader alliances and enhanced business skills of farming communities.

Oral and poster presentations, and plenary discussions will comprise the discussion of these sessions.

Emerging knowledge on agroforestry practices and presentations on the socioeconomic, political and environmental aspects of tropical agroforestry will also be discussed.

The symposium will emphasize documentation and valuation of the effects of agroforestry practices on biodiversity conservation, environmental services and economic sustainability.

For more information, contact Philippe Vaast, Correspondent of CIRAD for Central America (philippe.vaast@cirad.fr or pvaast@catie.ac.cr), John Beer, Director of the Department of Agriculture and Agroforestry of CATIE (jbeer@catie.ac.cr), Fergus Sinclair, Senior Lecturer at the University of Wales, Bangor and Editor-in-Chief of Agroforestry Systems (f.i.sinclair@bangor.ac.uk), and Jean-Marc Boffa, senior researcher at ICRAF (j.boffa@cgiar.org). ■

PAFERN conducts training of teachers and trainers on marketing agroforestry tree products

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The Philippine Agroforestry Education and Research Network (PAFERN) trained 26 lecturers from its academic and research member institutions and one Chairperson from a member non-government organization. The training was conducted 29-31 May 2007, at the Training Center for Tropical Resources and Ecosystems Sustainability (TREES), University of the Philippines Los Baños (UPLB), as part of the second phase of SEANAPE's project on Markets for Agroforestry Tree Products (MAFTPs).

The training made use of five case study materials from Indonesia, Lao PDR, Philippines, Thailand and Vietnam to help participants teach some of the key themes/modules of the marketing curricular framework. The framework was developed

during the first phase of SEANAPE's MAFTPs project. Each case study had a set of guide questions and suggested activities. These were simulated during the training depending on the key theme/module being discussed. These activities are in line with SEANAPE's aim to integrate marketing in the agroforestry curriculum of PAFERN member-institutions with a focus on its practical applications.

A field trip to visit private business enterprises was also included in the training. It demonstrated the actual applications of certain marketing modules. To facilitate teamwork and learning, exercises were also provided to extract the participants' ideas on the particular knowledge, skills and attitudes that agroforestry students should

develop when it comes to marketing. Insights and recommendations on the potential applications of the learnings to Philippine Agroforestry Tree Products (AFTPs) were also discussed.

Major outputs of the training were action plans to integrate marketing into the agroforestry curriculum of the participating institutions.

The lessons gained and documented from this training will be compiled by PAFERN through the AFTPs Philippine Marketing Team, and will become part of their Phase 2 MAFTPs Report. These will contribute to the Teacher's Guide that SEANAPE hopes to produce by the end of 2007.

Support for this project came from the Swedish International Development Agency (Sida), through the World Agroforestry Centre (ICRAF).

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Working towards the sustainability of PAFERN

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The potential of agroforestry in sustainable upland development and natural resource management has been recognized by government and non-government organizations. Likewise, there are now 35 state colleges, universities and private schools offering various agroforestry education programs. But just like any field of discipline, agroforestry education is confronted with a number of issues, concerns and challenges.

In 2001, the Philippine Agroforestry Education and Research Network

(PAFERN) was formally organized to build institutional and human capacity to help strengthen agroforestry education, research and development programs. It hopes to promote closer links among the agroforestry institutions to address the issues and concerns facing agroforestry development and promotion in the country. Until now, PAFERN has been working in partnership with the Southeast Asian Network for Agroforestry Education (SEANAPE) and the Swedish International Development

Cooperation Agency (Sida). PAFERN realizes the importance of being proactive when it comes to ensuring its survival. Hence, the network has initiated efforts to explore ways of sustaining its activities beyond 2009.

One such effort is the National Resource Mobilization Workshop held on 18-19 December 2006 at the University of the Philippines Los Baños, College, Laguna. The workshop aimed at developing a national resource mobilization framework to guide PAFERN in generating and mobilizing resources for agroforestry development in the Philippines.

The workshop was divided into two sessions:



1. Presentation of development trends in agroforestry

This session served as an opportunity to give update on the recent trends in agroforestry, including the proposed establishment of the National Agroforestry Development Program (NAFDP). This session also provided a venue for discussing the priority activities and thrusts of potential funding institutions and project partners - i.e., Foundation for the Philippine Environment (FPE), the Philippine Tropical Forest Conservation Foundation, Inc (PTFCFI), Development Bank of the Philippines (DBP), Department of Environment and Natural Resources (DENR), Department of Agriculture-Bureau of Agricultural Research (DABAR), World Agroforestry Centre (ICRAF), and the Philippine Council for Agriculture, Forestry and Natural Resource Research and Development (PCARRD).

2. Formulation of the resource mobilization framework for agroforestry development in the Philippines vis-à-vis the current trends and priority thrusts of the potential funding institutions and project partners

The workshop participants developed five project designs, which will be submitted to appropriate funding institutions. These projects focused on efforts to strengthen agroforestry education, promote agroforestry research, enhance farmer and community empowerment, intensify policy advocacy, and enhance enterprise development.

The two-day workshop was attended by 21 participants representing the selected member institutions of PAFERN, the members of the PAFERN Board, potential funding institutions, SEANAFE Technical Adviser, and project partners. ■

CIFOR releases new publications on forest rehabilitation

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The Center for International Forestry Research (CIFOR) released new publications on forest rehabilitation – three in Asia, and two in Latin America. These publications are results of the **Review of forest rehabilitation initiatives - lessons from the past** (REHAB) project, which aimed to identify the approaches that have sustained forest rehabilitation in different situations and those that had positive impacts to the stakeholders.

The outputs of the project consisted of country syntheses on the lessons learned from the various rehabilitation efforts in each country, and databases. The publications are part of the project’s effort to disseminate the findings and help design and implement future forest rehabilitation projects.

These publications are:

1. Meza, C. Sabogal. C., de Jong, W. 2006. **Rehabilitación de áreas degradadas en la Amazonia peruana: Revisión de experiencias y lecciones aprendidas.** Bogor, Indonesia, CIFOR. Country case studies on Review of Forest Rehabilitation Initiatives: Lessons from the Past. 106p.
2. Chokkalingam, U., Carandang, A.P., Pulhin, J.M., Lasco, R.D., Rose Jane J.P., Toma, T. 2006. **One century of forest rehabilitation in the Philippines: Approaches, outcomes and lessons.** Bogor, Indonesia, CIFOR. Country case studies on Review of Forest Rehabilitation Initiatives: Lessons from the Past.
3. de Jong, W.; Do Dinh Sam; Trieu Van Hung. 2006. **Forest rehabilitation in Vietnam: histories, realities and future.** Center for International Forestry Research (CIFOR), Bogor,



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5. Almeida, E.; Sabogal, C.; Brienza, S., Jr. 2006. **Recuperação de áreas alteradas na Amazônia Brasileira: experiências locais, lições aprendidas e implicações para políticas públicas.** Center for International Forestry Research (CIFOR), Bogor, Indonesia. **Review of Forest Rehabilitation: Lessons from the Past.** 202p.

All publications are available online at <http://www.cifor.cgiar.org/rehab>. Hardcopies can be obtained from CIFOR. ■

Information resources for agroforesters

Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World. Written by John Dixon, Aidan Gulliver and David Gibbon, this book presents the results of a joint study by FAO and the World Bank to contribute to the updating of the World Bank's Rural Development Strategy. It describes 72 major farming systems in six developing regions. These farming systems have been classified based on the available natural resource base, dominant pattern of farm activities and household livelihoods, including the relationship to markets, and intensity of production activities, among other key criteria.

The farming systems were described in terms of trends and issues. The authors also identified the priorities and main strategies for poverty reduction, and the factors that determine the growth potential of each system.

For more information, contact John Dixon at John.dixon@fao.org. A 49-page summary of this publication is available in PDF format at <http://www.fao.org/farmingsystems/>.

In Focus: Comanagement of Natural Resources Local Learning for Poverty Reduction. Written by Stephen Tyler and published by the International Development Research Centre in 2006, this book presents the concept of comanagement – the “collaborative arrangements in which the community of local resource users, local and senior governments, and other stakeholders share responsibility and authority for managing a specified natural resource or resources.” Comanagement is considered one approach to natural resource management that can help improve the livelihoods of poor people, and at the same time protect and enhance their natural resource base.

Information in this book are based from more than a decade of research across developing countries, and presents case studies from Bhutan, Cambodia, China, Ecuador, Lebanon, and Vietnam. One key message that the book presents to resource managers, policymakers, researchers, and development practitioners is that proposed solutions to NRM problems are effective and sustainable if driven by the knowledge, action, and learning of the local users.

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

Online database on agroforestry species research in India. Indian research on *Pongamia*, *Jatropha* and other agroforestry species are made available online by the Agroforestry Database Development Programme (INARIS), Indian National Research Centre for Agroforestry, Jhansi (UP), with the support of the World Bank. *Pongamia* and *Jatropha* seeds are being used to produce biodiesel,

hence the timeliness of this database.

The database contains over 700 records of research on agroforestry species that have been published between 1971 and 2005. For further information, visit <http://mirror.inaris.gen.in/net>.

People, Forests and Trees in West and Central Asia: Outlook for 2020. This Forestry Paper (No. 152) presents the results of the Forestry Outlook Study for West and Central Asia (FOWECA). Governments, civil societies, farmers and the private sector in the countries of West and Central Asia have been making great strides in improving the management of forest and tree resources.

This paper presents the various developments in forestry covering 23 countries in West Asia, Central Asia and the southern Caucasus. Contents include probable developments, regional and global issues that should be considered in developing national policies and programs, and proposed strategies to enhance the contribution of forests and trees to society. For more information, visit <http://www.fao.org/docrep/009/a0981e/a0981e00.htm>

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Useful websites

Sustainable Agriculture Research and Education
SARE Provides Grants and Information to Improve Profitability, Stewardship and Quality of Life

About Us | **Apply for Grants** | **Project Reports** | **Highlights** | **Events** | **Publications**

Home
Publications ▾

Diversifying Cropping Systems
Why Diversify?
Alternative Crops
Protect Natural Resources, Renew Profits
Agroforestry
Strengthen Community, Share Labor
Farmer Profiles
Resources

Printable Version

Did this bulletin prompt you to make any changes to your farming operation? This and other feedback is greatly appreciated!

Diversifying Cropping Systems
Agroforestry

Agroforestry integrates trees and shrubs with crop or livestock operations to create more diverse farms, ranches and communities. Research and field demonstrations of a wide range of practices from around the country prove that trees and shrubs provide numerous economic and environmental benefits.

Those benefits have not been lost on farmers and ranchers, who are employing agroforestry strategies in increasing numbers, said Greg Ruark, director of USDA's National Agroforestry Center (NAC) in Lincoln, Neb.

"Small producers can readily integrate many agroforestry practices into their existing operations and realize an economic benefit, both in terms of added income and reduced operating costs," he said.

Alley Cropping

Planting trees and row crops side by side in strips, or alleys, offers great profit potential. By growing cash crops simultaneously with a long-term tree crop, farmers can earn annual income while the trees mature. Hardwoods like walnut, oak, ash and pecan produce high-value logs for lumber or veneer.

While configuration can vary greatly, trees usually are planted in single rows, widely spaced. The spaces allow room for the annual crops as well as easy access for farm machinery. You can grow hay, wheat, soybeans and corn, as well as many vegetables and such specialty crops as St. John's Wort, a popular medicinal herb. Consider planting a ground cover, such as a grass-legume mix, under the tree rows in a strip extending to the width of the tree crowns.

Alley cropping allows a producer to grow two complementary crops – an annual crop like hay amid extremely profitable hardwoods like walnut. – Photo courtesy of the National Agroforestry Center

Sustainable Agriculture Research and Education (SARE)

SARE promotes farming systems that are environmentally sound and profitable through research and education grants. It also funds projects, conducts outreach activities for improving agricultural systems, develops databases, and publishes handbooks, e-books, free bulletins and many others. For more information, visit <http://www.sare.org/publications/diversify/diversify06.htm>.

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Integración de recursos hídricos
Acerca de WAFLA | Participantes | Temas relativos a WAFLA | Santiago de Chile 2009 | Sólo para miembros

WAFLA
Integrated Water resource management by the implementation of improved Agro-Forestry concepts in arid and semi-arid areas in Latin America

WAFLA country profiles

Search

Background information and articles
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Agroforestry publications
Agroforestry documents
Database of species
Useful links

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Library

The Library has been structured as follows:
Agroforestry publications
Publications regarding agroforestry related issues.

Agroforestry documents
Agroforestry documents is divided in six parts:

- Fundamentals of agroforestry
- Best practices and examples
- Desertification in Latin America
- Water management
- Forestry
- Stakeholders involvement

Database of species
This part presents a set of agroforestry species in arid and semi-arid areas of Latin America.

Integrated Water Resource Management by the Implementation of Improved Agro-Forestry Concepts in Arid and Semi-Arid Areas in Latin America (WAFLA)

The website offers publications and documents on the fundamentals of agroforestry, best practices and examples, desertification in Latin America, water management, forestry, and stakeholder involvement. It also features a database of agroforestry species in arid and semi-arid areas of Latin America and links to agroforestry directories, networks, organizations, agroforestry projects in Latin America, research centers and universities. For more information, visit <http://www.wafla.com/184.0.html?&L=1>.

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Thursday, May 17, 2007

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Is agroforestry likely to reduce deforestation?

Author : Angelsen, A.; Kaimowitz, D.

Abstract : Is agroforestry likely to reduce deforestation? Most agroforesters for the past 15 years have said "yes", some adding "by about 5 ha of reduced deforestation per ha of agroforestry adopted". The authors argue, nevertheless, that in many cases the answer is likely to be either "it depends" or even "no". The aim with this chapter is to discuss key factors which condition the agroforestry - deforestation link. That is, what makes a "yes" more likely than a "no"? The reformulated question therefore is: which types of agroforestry under what conditions are likely to reduce the conversion of natural forest?. This chapter provides a systematic review of arguments for and against agroforestry as a means to reduce deforestation.

Keywords : agroforestry, deforestation, reviews

Book : Schroth, G., Fonseca, G.A.B., Harvey, C.A., Gascon, C., Vasconcelos, H.L., Izac, A.M.N. (eds). Agroforestry and biodiversity conservation in tropical landscapes

Physical : 87-106.

Center for International Forestry Research (CIFOR)

Highlights of the CIFOR website are its various publications ranging from articles, books, computer-based tools (e.g., TROPIS), paper series, briefs, to its online Pox. The website also features information on CIFOR's various research undertakings. For more information, visit <http://www.cifor.cgiar.org/Publications/Detail?pid=1534>.

Information resources...

Continued from page 18

State of the World's Forests 2007. This biennial publication of FAO has been consistent at providing a global perspective on the environmental, economic and social aspects of the world's forests. This seventh edition evaluates the efforts being made towards achieving sustainable forest management (sfm).

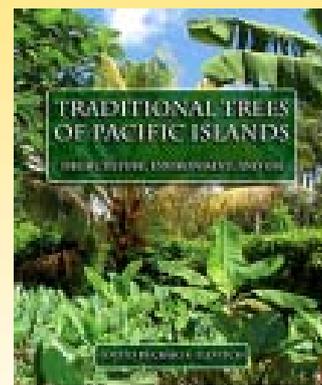
The first part describes the progress towards sfm in the region. The regional reports focus on the seven thematic elements of sfm: 1) extent

of forest resources, 2) biological diversity, 3) forest health and vitality, 4) productive functions of forest resources, 5) protective functions of forest

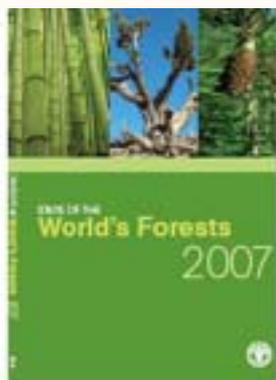
resources, 6) socioeconomic functions, and 7) legal, policy and institutional framework. These themes have been agreed upon as forming the framework for sustainable forest management in international fora. Data presented in the first part came from the results of the Global Forest Resources Assessment 2005.

The second part presents key issues in the forest sector, while describing the state of knowledge or recent activities in 18 areas of interest in forestry. These include climate change, forest landscape restoration, forest tenure, invasive species, wildlife management and wood energy. For more information, visit: <http://www.fao.org/docrep/009/a0773e/a0773e00.htm>

Traditional Trees of Pacific Islands: Their Culture, Environment, and Use. Edited by Craig R. Elevitch and published by Permanent Agricultural



Resources in July 2006, this book illustrates the importance of wisely choosing tree species to plant. It presents over 800 photos describing the stages in the lifecycle of trees, including the processes of grafting and transplanting. It also provides information on propagation, harvesting, and establishment of natural plantations in the Pacific Islands. For more information, email par@agroforestry.net ■



Call for contributions

We are inviting contributions for the 32nd and 33rd issue of the Asia-Pacific Agroforestry Newsletter (*APANews*) on or before 29 February and 30 June 2008, respectively. Let us help you share the relevant programs and projects that you are doing 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 on agroforestry.

Contributions for agroforestry promotion and development may contain information on various extension services aimed at promoting and developing agroforestry among communities.

Contributions for agroforestry education and training 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. We are thus requesting 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.

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.

Kindly 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, apanews0718@gmail.com. ■