APANews

ASIA-PACIFIC AGROFORESTRY NEWSLETTER

NO. 34 ● JUNE 2009 ● ISSN 0859-9742

Featuring

SEANAFE News

Dear readers

We welcome 2009 with the 34th issue of APANews. In this issue, we have interesting contributions from Nepal, the Philippines, and India.

The article from Nepal explores the effects of a new Leucaena variety on the growth of Tarai male goats. It measures the effects of stall feeding and grazing on the goats' body weight and daily average feed intake. Read more on the results of this new leucaena variety in combination with para grass on page 5.

Meanwhile, an article from India presents the results of a study that explored how an indigenous tree can be an alternate source of raw material for pulp and paper. Read about *Melia dubia* and why it is a suitable raw material for pulp and paper on page 2.

Another article from India discusses *Santalum album L.*. Sandal is a highly commercial crop in India because of its scented heartwood and oil. Read more on the policies of producing and harvesting the East Indian sandal wood, how it can be domesticated, and the results of the financial analysis on page 9.

We also have two interesting articles from the Philippines. One discusses a state college's initiatives in promoting vermicomposting and vermimeal production. Read more on the production processes of vermicomposting and vermimeal, and the different advocacy initiatives being done by the Kalinga-Apayao State College in northern Philippines on page 13. The other article presents the results of research on the indigenous knowledge and practices of tribal groups on community-based forest management, or CBFM. This article analyzed how two tribal communities perceived the forests, and explored how their indigenous knowledge and practices helped promote CBFM in La Union, northern Philippines.

All is set for the 2nd World Congress of Agroforestry in Nairobi, Kenya. Knowledge sharing is the focus of this Congress. Specific topics include agroforestry markets, tree-based rehabilitation, climate change adaptation and mitigation, contribution to multifunctional agriculture, policy options, and institutional innovations. Read more on what's in store for this highly anticipated event which will be held 23-28 August 2009 on page 8.

The Philippine Agroforestry Education and Research Network (PAFERN) and its partner agencies are also set for the 4th Philippine Agroforestry Congress. To be held 18-20 November 2009, this event will gather agroforestry practitioners in the Philippines to share their experiences on agroforestry technology development, and promotion and adoption for climate change mitigation and adaptation. Farmers' experiences in agroforestry technology adoption will also be highlighted in the event. Find out the details on page 14.

We are once again presenting the latest news on the Southeast Asian Network for Agroforestry Education (SEANAFE) in our featured SEANAFE News. This will be the first time that SEANAFE News will be publishing updates from all the national networks. This issue also welcomes Malaysia in SEANAFE's roster of member-countries.

As always, find out the latest publications and websites that may be of use in your various agroforestry initiatives.

We hope you enjoy reading this issue and thank you once again to all the contributors. We hope to receive more articles from you in the future! –

The Editors

OUR ADDRESS. FAO Regional Office for Asia and the Pacific, 39 Phra Atit Road, Bangkok 10200, Thailand; Website: www.fao.org and www.fao.or.th; E-mail fao-rap@fao.org; SEANAFE c/o World Agroforestry Centre (ICRAF)-Southeast Asia Regional office, PO Box 61, Bogor 16001, Indonesia; Website: www.worldagroforestrycentre.org/sea/networks/Seanafe/Index.asp; E-mail icraf-indonesia@cgiar.org

PRODUCTION. Patrick B. Durst, Michael Pescott, Lutgarda L. Tolentino and Rowena D. Cabahug (Editorial Consultants); Leah P. Arboleda (Editor); Perseveranda G. Tubig and Reinelen M. Reyes (Production Assistants)

COVER PHOTO. Mr. Santiago Cepada and his wife established their large-scale integrated agroforestry farm in Nabunturan, Compostela Valley, southern Philippines with their children more than 10 years ago. The farm boasts a forest planted with dipterocarp species in the high elevated areas, and high-value fruit trees (durian, cacao, rambutan, and lanzones) in the lower areas. This family enterprise now grows crops commercially and provides employment to other people in the community. In recognition of his leadership and efforts, Mr. Cepada has been the recipient of the Outstanding High Value Commercial Crops Farmer Award, and the Gawad Saka Award for Outstanding Farmer Scientist, both given at the national level.

(Photo courtesy of the UPLB Institute of Agroforestry)

PRINTER. Thammada Press Co. Ltd., 86 Soi 501/1 Charansanitwong Road, Bangplad, Bangkok 10700 Thailand

Integrating *Melia dubia* in agroforestry farms as an alternate pulpwood species

K.T. Parthiban (ktparthi2001@yahoo.com), Akilesh Kumar Bharathi, R. Seenivasan, K. Kamala (thirushivani@yahoo.co.in) and M. Govinda Rao

Because of its burgeoning population, India is under tremendous pressure to meet the growing demand for wood and wood products, such as pulp and paper.

The current production of raw materials for pulp and paper is 2.76 million tonnes, against the demand of 5.04 million tonnes, a shortfall of 45 percent. The projected demand by 2020 is 13.2 million tonnes, which is still more staggering (Palsaniya *et al.*, 2009).

Today, there are about 594 paper mills in India, with 34 considered as large companies. In the State of Tamil Nadu, there are 39 paper mills, including the Tamil Nadu Newsprint and Paper Ltd (TNPL) and Shesayee Paper Boards Ltd (SPB). The demand for wood-based products in Tamil Nadu is 8-10 lakh tonnes of wood pulp per year, which is greater than the 4 lakh tonnes that are currently available (Parthiban and Govinda Rao, 2008).

Inadequate raw materials and stringent forest policies have forced the wood-based industries to become self-reliant in terms of acquiring their own raw materials. They established agroforestry farms through contract farming. At present, these farms integrate the production of *Eucalyptus* spp. and *Casuarina* spp. as major sources of raw materials for pulp and paper. However, these two crops are constrained by poor productivity, long rotation periods, and pests and diseases. To address these concerns, studies were conducted to explore the potential of indigenous trees as alternate sources of raw materials for pulp and paper.

Suitability of *Melia dubia* as pulpwood

To screen suitable pulpwood species, eight different fast-growing tree species were tested for their pulping quality. The species were assessed based on their physical, chemical, and strength characteristics using standard methodologies (Tappi, 1980).

Table 1. Silvicultural characteristics of *Melia dubia* suitable for pulp.

Silvicultural characteristics	Unrefined pulp	Refined pulp
Pulp yield	50.5	50.3
Kappa number	19.60	19.60
Acid insoluble lignin	24.7	24.7
Hollow cellulose	73.7	73.7
bulk (g/cm3)	1.70	1.42
Tensile index (Nm/g)	49.2	86
Tear index (mN.m2 g)	5.2	10.1
Freeness (ml CSF)	540	300
Burst index (kPa.m2/g)	2.4	5.8
Brightness (% ISO)	80	82
Opacity (%)	83.4	79.2
Scatterning coefficient (m2/kg)	48.4	38.5
Yellowness (%)	8.9	9.2

Among the tree species tested, *Melia dubia* emerged as a suitable raw material because of its increased pulp recovery and exceptional strength. Pulp recovery was recorded at 50 percent, which is higher than that of eucalyptus (Table 1). Similarly, the Kappa number (used to assess bleachability) was less than 20, which is excellent as compared with the traditional raw material.

Measuring *Melia dubia*'s strength

Research results revealed that the paper produced from *M. dubia* exhibited excellent strength. In fact, the species recorded a burst index of 5.8 kPa.m^2/g and a brightness of nearly 82 percent (Table 1).

In general, the research showed that *M. dubia* could be used as an alternative pulpwood species (Table 1).

Distribution of *Melia Dubia*

M. dubia occurs in the tropical moist deciduous forests of the Sikkim Himalayas, North Bengal and upper Assam, the Khasi hills of Orissa, N. Circars, Deccan and the Western Ghats, at altitudes of 1,500-1,800 meters. It is known to yield useful timber.

This tree is often used as an ornamental plant. It is also used as boundary and shade trees in plantations. Because it grows rapidly, *M. dubia* can be used for afforestation.

Environmental requirements

M. dubia grows on a variety of soils; however, it grows well in deep, fertile and sandy loam soils.

This tree species requires high light intensity. Seedlings can tolerate frost, however, severe frost can result in plant death.

Like many other trees, *M. dubia* is susceptible to fire, and its saplings are at risk from livestock browsing.

Continued on page 4

Integrating *Melia dubia*...

Continued from page 3

Propagation

M. dubia can be propagated by seed, cuttings and by tissue culture. Directly planting saplings or stumps is recommended over direct sowing, as the latter method has been recorded to give poor yield.

Seed treatment

Seeds are collected from ripened fruits during January and February. The seeds are rubbed, washed, and dried before being stored in sealed tins. Using this method, seed germination is less than 25 percent.

M. dubia seeds may also be raised in nursery beds. The best treatment involves soaking seeds in a cow dung solution for one day prior to raising in the nursery beds. With regular irrigation, the seeds then take one to two months to germinate. It takes six months for the *M. dubia* seedlings to complete the nursery stage.

Spacing

Six to nine month-old seedlings are planted using a spacing of 3 metres by 3 meters, or 3 meters by 4 meters.

Pruning is done yearly to achieve straight cylindrical boles.

Irrigation and fertilizer requirements

During the dry season, *M. dubia* grows well if irrigated every 10-15 days.

The growth of *M. dubia* seedlings and trees can be further enhanced with the application of a 25-50 gram mixture of nitrogen, phosphorus, and potassium per tree. This mixture is applied two times a year. Fertilizers can be applied as needed, depending on the growth and development of the tree.

Other uses

The wood of *M. dubia* can be used as packing cases, cigar boxes, ceiling planks, building and construction materials, agricultural implements, pencils, matchboxes, splints, kattamarams, musical instruments, tea boxes, and plyboard. In Ceylon, the wood is used to construct outriggers for boats. It is also a good fuelwood (calorific value, 5.043 - 5,176 cal.). The fruits of *M. dubia* are bitter and considered an anthelmintic.

Market and trade

M. dubia wood can be sold for pulp and used in the veneer industry. *M. dubia* trees greater than 16 inches in girth can be sold at a minimum price of Rs 2,000 ($40 USD) per tonne for the match industry. For the veneer industry, the market rate is a little higher.

Promoting *Melia dubia* as an industrial wood species through contract farming

M. dubia is currently being promoted as a source of industrial pulpwood through contract farming. The promotional strategy applies the quadpartite model, comprising an institute to supply the genetic resources, farmers who cultivate the seeds and seedlings, industries that buy the products from the farmers, and financial institutions that provide credit to farmers.

This strategy shows encouraging results. However, the availability of quality planting materials remains a major constraint.

The Tamilnadu Agricultural University, through the Forest College and Research Institute, has initiated efforts to mass multiply quality seedlings through clonal propagation and tissue culture. Clonal propagation is being done through cuttings, while tissue culture is being done through nodal cuttings. *M. dubia* is also being integrated as a pulpwood species in agroforestry systems. ●

The authors can be contacted at the Forest College and Research Institute, Tamilnadu Agricultural University, Mettupalayam, India-641 301.

Acknowledgment: World Bank-funded National Agricultural Innovation Project.

References: 1) Srivastava, D. P., P. K. Srivastava, A. K. Goel and K. Thangavelu. 1993. Genetic variability in Terminalia arjuna. Indian J. For., 16: 223-225; 2) Srivastava, M. B. 2005.Timber industries and non-timber forest products. CBS Publication, New Delhi. Pp.518; 3) Tappi, 1980. Standard and suggested methods. Technical association of pulp and paper industry, New York. pp. 200-265; 4) Parthiban, K. T. and M. Govinda Rao. 2008. Pulpwood based industrial agroforestry in Tamil Nadu- A case study, The Indian forester. Vol. 134: 155-163; 5) Palsaniya D. R., S. K. Dhyani, R. K.Tewari, Ramesh Singh and R. S.Yadav. 2009. Marketing issues and constraints in agroforestry. In Agroforestry: Natural Resource Sustainability, Livelihood and Climate Moderation (eds) O.P. Chaturvedi, A.Venkatesh, R.S.Yadav, Badre Alam, R.P.Dwivedi, Ramesh Singh and S.K. Dhyani). Satish Serial Publishing House. India.Pp.563 – 577.

Figure 1. Counter clockwise from top: *Melia dubia* seeds, seedlings, and trees.

Grazing or feeding using the new Leucaena variety - which is better on the growth performance of goats in Nepal?

T P Barakoti (drtp.barakoti@gmail.com) and M Sapkota

Grasslands and good pastures are rare in the Tarai and mid-hills of Nepal where goat farming is common. Nutritious and palatable tree fodder is declining in most parts of these hills due to the over-exploitation of fodder trees in the farmlands and surrounding natural forests.

Meanwhile, overgrazing has caused the deterioration of pastures and farm productivity. Farmers can not afford concentrated feeding. Instead, the farmers traditionally feed their livestock with various species of fodder. The average daily deficit of fodder is estimated at 0.8 kilogram per animal (Maharjan, 1987).

Thus, fodder and feed scarcity have become major problems in the production of livestock in Nepal. Ipil-ipil (*Leucaena* spp.), a fast-growing leguminous fodder containing 27-34 percent protein (Baidya, 1985), has proved its suitability for multiple uses including fodder, fuelwood and green manure. All parts of the ipil-ipil plant, including the small twigs can be eaten by livestock. However, the mimosine present in the foliage is harmful to non-ruminants, causing weight loss and ill health (Anonymous, 1984).

For ruminants, especially cattle, buffalo and goats, the fodder is generally palatable, digestible and nutritious. Rangankar (1980) and Jones (1982) reported that ipil-ipil can be fed safely to ruminants if their stomach contains microorganisms that render mimosine harmless. Neupane (1987) concluded that the growth performance of the newly introduced variety *Leucaena leucocephala* was much better compared to other species. Napier grass (*Pennisetum purpureum*) and para grass (*Brachiaria ruziziensis*) are the common forage crops recommended for different livestock.

This research explored the effects of the new leucaena variety K-29, (*Leucaena leucocephla* var.K29) on the growth performance of Tarai male goats. The tests involved feeding and grazing the Tarai male goats with K-29 alone and K-29 in combination with other fodders (para grass and napier grass).

Materials and methods

Twenty-four male goats, of similar age and weight, were selected from the Tarai district (Rautahat) of Nepal. They were randomly grouped at four goats per treatment. The experiments were conducted at the Institute of Agriculture and Animal Science (IAAS) Rampur, Chitwan in 1999. Prior to experimentation, the goats were surgically castrated and de-wormed with Banminth at a dosage of one tablet per 20 kilograms of body weight.

The treatments were laid out in a completely randomized design. Stall feeding was done individually in a shed managed for this purpose. The mineral mixture Minamil, containing vitamins A, B, D, E, and K, and nutrient elements (calcium, phosphorus, manganese, zinc, iron, nicotinamide, choline chloride) was given at a dosage of 10 grams per goat every 10 days from March to June.

The fodder species fed to the goats were ipil-ipil (*Leucaena leucocephla* var.K29), para grass (*Brachiaria ruziziensis*) and napier grass (*Pennisetum purpureum*). These were grown at the IAAS agroforestry site. The amount of feed was calculated based on dry weight. The fodder left everyday was weighed and analyzed.

The grazing was done in the pasture of the IAAS livestock farm. The farm is where the major grass species were being grown, such as *Cynodon dactylon*, *Homarthria compressa*, *Digitaria abscendens*, *Oxalis corniculata*, *Cyperus* spp. and *Imperata cylindrica*.

The parameters monitored were changes in the livestock's live weight, daily average feed intake and feed efficiency. Live weight was recorded at 15-day intervals, while feed efficiency was calculated monthly. The daily average weight gain was calculated based on the initial and final weights divided by the number of goats and trial period in days. The treatment means were compared to those generated by Gomez and Gomez (1981).

The daily average weight gain was calculated using the following formula:

$$\text{Daily average weight gain} = \frac{\text{Final weight - Initial weight}}{\text{No. of days on trial x No. of animals}}$$

Feed efficiency was calculated using the following formula:

$$\text{Feed efficiency (weight gain ratio)} = \frac{\text{Daily average feed intake}}{\text{Daily average weight gain}}$$

Results and discussion

Live (body) weight increment

In general, the weight of the goats increased in the range of 0.25 to 4.84 kilograms over the 90-day trial period. The treatment that resulted in the greatest weight increase was free grazing for 4 hours plus ad lib feeding of leucaena (4.84kg). This was followed by free grazing for 8 hours (3.50kg) (Table 1).

The increased weight gain in the latter group, as compared to the other treatments, might be due to the good grass cover in the pasture land and the freedom of the goats to move in the

Continued on page 6

Feeding or grazing...

Continued from page 5

open field. However, there was no significant difference found between the treatment groups.

Similar results were obtained in a previous experiment (Anonymous 1986). Bhandari and Reshami (1987) found that pigs fed with 15 percent leucaena leaf meal gained more live weight than the group that was fed with 20 percent leaf meal. Buffaloes that were fed with ipil-ipil (25-30%) gained more body weight than the group fed with non-ipil-ipil fodder (Veldhuis 1988).

It was evident that stall feeding of goats with only leucaena, did not increase their body weight, rather it resulted in weight loss as observed during the third month.

Daily average weight gain

Daily average weight gain (grams) was found to be higher in the first month and declined thereafter during the second and third months. The higher temperature in the summer months was attributed as a possible cause. The greatest weight gain of 72 grams per day (1st month) was found with the free grazing for 4 hours + leucaena ad lib combination, followed by 0 grazing + 50 percent leucaena + 50 percent para grass (68 grams per day, 1st month).

The minimum weight gain was observed from the 0 grazing + leucaena ad lib combination (8 grams per day, 1st month), with weight loss occuring during the third month for this treatment (-17 grams per day). This finding might indicate an insufficient number of microorganisms in the goats' stomachs to fight the harmful effects of mimosine.

Daily average feed intake

The results indicate that dry matter intake (feed intake) increased during the second and third months as compared to the first month. However, the live weights did not increase proportionately as seen in Table 1. This lack of change in the live weights may be due to the warm temperature as experimentation was done during the summer months of Nepal, or possibly influenced by goat age.

The feed intake was found to be highest in the zero grazing + 50 percent leucaena + 50 percent napier grass combination (Figure 1). This was followed by the zero grazing + 50 percent leucaena + 50 percent para grass combination. The analysis of variance of the data found the results were non-significant.

Grazing 4hr + leucaena ad lib was found to be better at increasing the body weight gain of the goats, compared with other treatments.

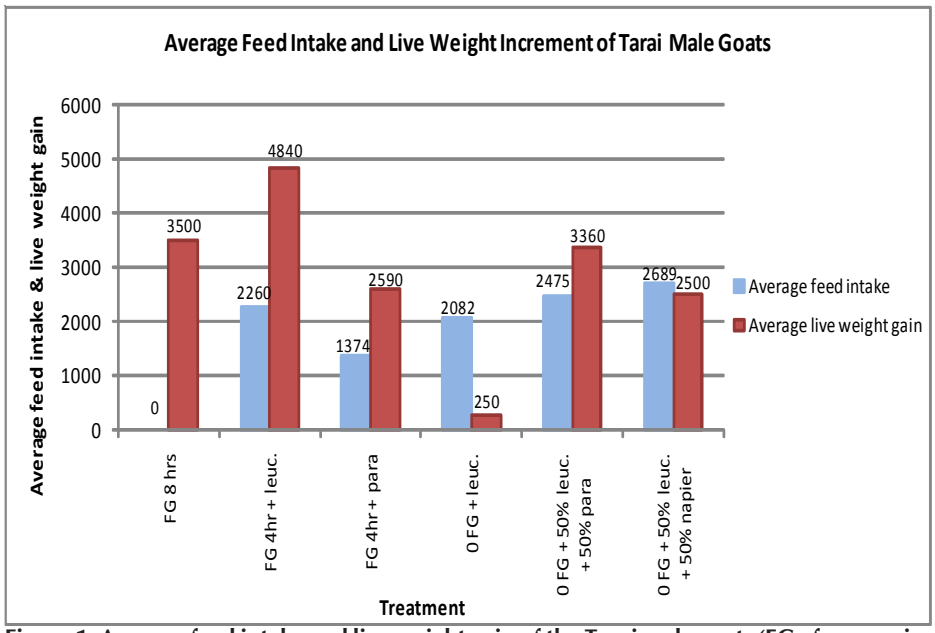


Figure 1. Average feed intake and live weight gain of the Tarai male goats (FG - free grazing)

Table 1. Total weight changes at monthly intervals

Treatment	Weight (kilograms)					
	Initial	Change 1st month	Change 2nd month	Change 3rd month	Final	Total Change
Free grazing (FG) 8 hrs	6.88	1.83	1.00	0.67	10.38	3.50
FG 4 hrs + leucaena *ad lib*	8.67	2.17	1.84	0.83	13.51	4.84
FG 4 hrs + para *ad lib*	8.00	1.25	1.00	0.34	10.59	2.59
0 FG + leucaena *ad lib*	7.25	0.25	0.50	-0.50	7.50	0.25
0 FG + 50% leucaena + 50% para	7.88	2.03	0.83	0.50	11.24	3.36
0 FG + 50% leucaena + 50% napier	8.00	1.33	0.67	0.50	10.50	2.50
F test		NS	NS	NS		
SD		2.61	2.76	2.39		
CV %		33.00	31.00	27.00		

Feeding or grazing...

Continued from page 6

Feed efficiency

The mean feed efficiency varied from 17.8 (free grazing 4 hours + leucaena ad lib) to 40.4 (0 grazing + 50% leucaena + 50% napier grass) (Table 2). Feed efficiency declined as the daily average weight rose from the first to third month. Feed efficiency varied with feed intake and daily weight gain regardless of the type of fodder used.

In terms of feed efficiency, free grazing for 4 hours + leucaena ad lib was found to be the best treatment for the male goats (Table 2).

Table 2. Feed efficiency (weight gain ratio) of the goats at monthly intervals.

Treatment	Month			Mean
	First	Second	Third	
Free grazing (FG) 8 hrs	-	-	-	-
FG 4 hrs + leucaena *ad lib*	6.70	14.40	32.20	17.80
FG 4 hrs + para *ad lib*	8.60	14.90	47.40	23.60
0 FG + leucaena *ad lib*	71.60	46.30	-42.50	25.10
0 FG + 50% leucaena + 50% para	8.70	34.80	53.60	32.40
0 FG + 50% leucaena + 50% napier	14.80	46.10	60.30	40.40

Conclusions and recommendations

This study thus presents the following conclusions:

1. The live weights of four- to six-month-old Tarai male goats increased by 0.25 to 4.84 kilograms, depending on the combination of stall feeding and free grazing;
2. The live weight increment, daily average weight gain, daily average feed intake and feed efficiency are influenced by fodder species, the proportion of the fodder used and grazing time;
3. The combination of free grazing for 4 hours + leucaena ad lib was found to be the most effective method at increasing the growth performance of the Tarai male goats under Chitwan conditions; and
4. Using *Leucaena leucocephla* var.K29 alone is not recommended as it is not digestible by goats and could even be harmful due to the mimosine content. ●

Dr. Barakoti is a Senior Scientist (S-4) at the Nepal Agricultural Research Council, Singhdurbar Plaza, Kathmandu, Nepal. Dr. Sapkota is a Professor at the Institute of Agriculture and Animal Science, Rampur, Chitwan, Nepal.

Acknowledgment: International Development Research Centre (IDRC), Canada; Mr. P.M. Dixit, Coordinator of the Farm Forestry Project; Mr. G. P. Kandel and Mr. M. Adhikari; and Mr. U. N. Dabadi.

References: 1) Anonymous. 1984. Leucaena: promising forage and tree crop for the tropics (second edition). National Academy Press, Washington D.C. 100 pp.; 2) Anonymous. 1986. Third Annual Report. Farm Forestry Project IOF-IAAS, Tribhuwan University-IDRC Nepal. pp 56-62; 3) Baidya, H. R. 1985. Ipil-ipil. World Neighbors, Kathmandu, Nepal.; 4) Bhandari, N. B. and T. B. Reshami, 1987. The effect of Leucaena leaf meal on swine. Proceedings of Agriculture Resource Management Seminar, Rampur 5 pp.; 5) Gomez, K. A. and A. A. Gomez. 1981. Statistical procedures for agricultural research, second printing, IRRI 294 pp.; 6) Jones, R. J. 1981. Wonder tree ipil-ipil for ruminants in tropics. Asian Livestock 6(11): 11; 7) Maharjan, M. R. 1987. Agroforestry in community forestry development. Banko Janakari, Vol. 1 No. 4, pp 63-66.; 8) Neupane, S. P. 1987. Fodder tree management in Chitwan. Proceedings of Agriculture Research Management Seminar, Rampur 9 pp.; 8) Rangankar, D. V. 1980. Studies on utilization of subabul as fodder of dairy cattle. Proceedings of seminar on ipil-ipil, Gandinagar, Gujarat, pp 74-79; 9) Veldhuis, M. 1988. Feeding ipil-ipil to buffaloes. Banko Janakari, Vol2, No.1 pp 51-52.

Exploring the indigenous knowledge and practices of Philippine tribal groups on CBFM

Lilito D. Gavina (ldgavina@yahoo.com)

During the past two decades, efforts to encourage farmers to grow and manage trees in the Philippines have gradually increased. Most of these were externally sponsored interventions based on unconventional forestry techniques. No attention was given to the idea that local people were capable of not only developing viable solutions to local problems, based on their understanding of local conditions, but also in implementing practical field experiments in response to local constraints and opportunities.

More recently, social forestry programs have aimed at involving the community in forest management efforts, but were expected to do better in understanding local peoples' knowledge and practices. The peoples' indigenous forest management practices reflect their priorities, aspirations and constraints. Such knowledge is dynamic, and the result of a continuous process of experimentation, innovation, and adaptation. More importantly, such knowledge has been handed down verbally from generation to generation.

Indigenous peoples are believed to have been practicing community forestry from time immemorial. However, it was only recently that the idea of community forestry has been rediscovered and reintroduced in the forestry sector by rural development professionals. As in in many parts of the world, most indigenous community forestry practices in the Philippines have been lost over time. The majority

Continued on page 8

Exploring the indigenous knowledge...

Continued from page 7

of practices were not documented, yet many believe that a lot of these 'lost' practices could serve as the basis for sustainable forest management.

This study analyzed the perceptions of two tribal communities regarding forests and indigenous management practices. It demonstrated empirical evidence, and documented the indigenous knowledge and practices related to forest management. It also suggested ways in which indigenous knowledge and practices could be used in the implementation of the Community-Based Forest Management (CBFM) Program.

Methodology

The study was explorative in nature and made use of qualitative and quantitative research methods. It was carried out in the two *barangays* (villages) of Santol, La Union in the Philippines. These *barangays* were included in the CBFM Agreement awarded by the Department of Environment and Natural Resources (DENR) in 1996. They were treated as one case in the study because they did not differ in respect to forest-related values and livelihood sources.

Secondary data was obtained from the DENR, and primary data was collected through semi-structured household interviews, group interviews, and participant observations. The semi-structured interviews were used to elicit information on household socio-economic characteristics, such as livelihood sources and landholding types. The open interviews described the perceptions on forest resources and their use. Descriptive statistics were used to analyze the data.

Results

Results revealed that values of the local people toward the forest and forest products are multi-dimensional.

The local use of the forests was not only perceived in terms of wood and non-timber forest products, but also in terms of support provided to staple and non-staple crop production in various landholding types, such as *uma* (swidden), *bangkag* (dryland), and *talon* (wetland). These various landholding types were supported by the forest in terms of soil and water conservation. The environmental protective role of forests was also recognized.

The study demonstrated that local people have several indigenous practices related to forest management, especially with regards to the use of forest products and growing trees. The people described their controlled practices of forest management with the terms controlled utilization, protection/maintenance activities, and regeneration/propagation activities. These were applied in various types of landholdings.

Forest values and the responsibility of forest management planning were not highly influenced by the differences in age or the land property status. However, there is a clear gender differentiation with respect to authority in forest management planning.

In the CBFM Agreement, conscious efforts have been undertaken to establish interfaces between the official and tribal institutions. However, local values and practices were not reflected in the Agreement. The CBFM Program focuses on plantation forestry rather than the integration of forestry into the local land-use system.

Recommendations

From the results, the study recommends that more research is carried out on indigenous knowledge systems, especially on the development of appropriate methods to incorporate them into forestry development programs.

In terms of policy, it is recommended that indigenous knowledge systems must be understood and consideration of the interaction of traditional and modern systems of governance should be made. Such systems should be recognized as having specific technical and institutional features. More stringent government policy and service agency programs must be formulated for indigenous communities. ●

Prof. Gavina is the Extension Facilitator of the Institute of Agroforestry and Watershed Management of the Don Mariano Marcos Memorial State University, Bacnotan, La Union in the Philippines.

All set for the 2nd World Congress of Agroforestry

Agroforestry researchers, practitioners, educators and policy makers around the world are gearing up for the 2nd World Congress of Agroforestry to be held 23-28 August 2009 in Nairobi, Kenya.

The Congress aims to strengthen the impetus that started during the 1st World Congress of Agroforestry in 2004 in Florida, USA. It also hopes to enhance agroforestry knowledge-sharing and support the increasing global interest in agroforestry. With the overall theme of 'Agroforestry – the future of global land use,' the Congress aims to promote the sharing of new findings, lessons, experiences and ideas that impact people's livelihoods and the environment as a whole. Moreover, opportunities to 'leverage scientific agroforestry' will be highlighted to promote global sustainable land use.

Continued on page 9

All set for the 2nd World Forestry Congress...

Continued from page 8

Plenary, symposia, concurrent sessions, and poster sessions will focus on:

- Markets as opportunities and drivers of agroforestry land use;
- Tree-based rehabilitation of degraded lands and watersheds;
- Climate change adaptation and mitigation;
- Agroforestry's contribution to a multifunctional agriculture which combines productivity with environmental sustainability; and
- Policy options and institutional innovations for agroforestry land use.

Participants and agroforesters worldwide can look forward to the publication of summary documents, a book of abstracts, refereed journal articles, journal special issues, and books on the key topics covered in the sessions capturing the knowledge shared among the participants. A declaration will also be a key output as it contains the deliberations and agreements made during the Congress. This will be a useful tool for policy makers and donor agencies who are engaged in efforts to advance agroforestry initiatives worldwide.

For the latest information, visit www.worldagroforestry.org/wca2009

Domestication of Sandal (*Santalum album L.*) in India: constraints and prospects

S. Viswanath (sviswanath@ icfre.org), Dhanya B. (krupaias@gmail.com) and T. S. Rathore (tsrathore@icfre.org)

Among the 16 species of the economically important genus *Santalum*, *Santalum album* L. or Indian sandalwood is highly prized for its scented heartwood. The heartwood yields the commercially known East Indian sandalwood oil. The oil contains 90 percent α and β santalols which are in high demand by perfume manufacturers. The oil is also used in indigenous medicine, while the wood is used in the religious rituals of Hindus, Buddhists and Muslims.

The East Indian sandalwood has very uniform fibers, and the grain is straight and close. These characteristics make it one of the finest woods for carving.

As a tree, sandal is medium-sized and hemi-parasitic. Its average height is 12-13 m with a maximum girth of 2-2.5 m. The species is distributed from Indonesia in the West to the Juan Fernandez Islands in the East, and from Hawaii in the North to New Zealand in the South (Srinivasan *et al*., 1992), including India.

In India, nearly 90 percent of sandal naturally occurs across about 9,600 km^2 of deciduous forests in the Deccan region of Peninsular India (Gairola *et al*., 2007). The south Indian states of Karnataka and Tamil Nadu harbor more than 90 percent of sandal along with some patches in the states of Kerala, Andhra Pradesh, Maharashtra and Madhya Pradesh.

Socio-economic policies on sandal production and harvesting

The history of sandal conservation in the southern states is filled with instances of protectionist policies which were promulgated to maintain a state monopoly over the trade of this prized resource. In 1792, Tippu Sultan, then ruler of Mysore (presently Karnataka), declared sandal as a royal tree (Rai, 1990) and even ordered the hands of sandalwood thieves to be amputated to enforce the royal decree (Shetty, 1977).

As recently as 2002, state governments, especially in Karnataka and Tamil Nadu, had a monopoly over the control of all sandal resources. State laws specified that all sandal trees growing

Continued on page 10

Figure 1. High-grade sandal wood stored for auction in a government depot.

Domestication of Sandal...

Continued from page 9

on any land, including private lands, belonged to the government. However, the landowners were responsible for preserving the trees on their respective lands. Only the government had the right to sell or trade the wood.

This system neither deterred the illegal and indiscriminate harvesting of sandalwood by smugglers, nor did it help conserve the species in its natural habitat (Mahapatra, 2001). Moreover, the monopolistic laws acted as a huge disincentive for the planting of sandal on private lands. Farmers even destroyed the saplings that naturally grew on their lands.

This situation was aggravated by recurring annual fires, lopping of trees for fodder/grazing, spread of the sandal spike disease, proliferation of weeds like *Lantana camara*, and the introduction of monoculture eucalyptus plantations in natural sandal areas. All these factors significantly contributed to the decline of natural sandal populations. Hence, in 1998, the International Union for the Conservation of Nature (IUCN) listed the East Indian sandal as a vulnerable species after its production fell by at least 80 percent in 10 years (Awasthi, 2007).

From 4,000 tonnes in the 1950s, Sandal heartwood production fell to only 500 tonnes in 2006 (Gairola *et al*., 2007). Meanwhile, demand for sandalwood rose to 5,000–6,000 tonnes annually, and prices increased to $92,500 USD per tonne in 2007.

India was the leading exporter of sandal oil especially during the 1980s when it was exporting approximately 100 tonnes of oil annually. At present, production levels are falling due to the decline in the extraction of sandalwood and poor out-turn of extracted wood (Baruah, 1999).

Figure 2. The Marayoor sandal reserve in Kerala state is considered one of the vanishing treasures of India.

Figure 3. A seven-year old sandal plantation on farm land.

Countries like Australia and Indonesia have taken steps to reduce the deficit in Indian sandalwood production and are gearing up to meet the increasing global demand for sandalwood. In 2001, Australia had 830 ha of Indian sandalwood plantations. This is projected to expand to 2,300 ha by 2011 (Awasthi, 2007).

Domestication of sandal

To address the declining share of sandal in international markets and conserve it in natural areas, major producer states in India (e.g., Karnataka and Tamil Nadu) relaxed the existing rules and regulations related to sandal in 2001 and 2002. These modified policies aim to encourage private domestication of sandal. Landholders now have legal rights over the sandal trees on their properties. It is thus now possible for growers to receive as much as 100 percent of the value of the tree as determined by the forest department.

Cultivation of sandal on private lands has since become an attractive option. It is a suitable species for integration in agroforestry farms due to its hardiness and resilience to biotic interferences, including browsing and hacking. It also has the ability to grow in a wide variety of soils, and can be easily propagated through root suckers. The long maturation period of a sandal tree (15-20 years) before it can be commercially utilized for its heartwood, also provides multiple opportunities for inter-cropping with other crops.

Analyzing the net present value (NPV), benefit-cost ratio (B/C ratio), internal rate of return (IRR), land expectation value (LEV), and equivalent annual income (EAI)

A financial analysis on sandal as a monoculture plantation and sandal integrated with Indian gooseberry (*Phyllanthus emblica*) in the drylands/ semi-arid areas of India revealed promising opportunities (Table 1). Indian gooseberry served as a secondary host for sandal. Annual crops like horse gram (*Dolichos uniflorus*) could be cultivated in three- to four-year rotations.

All three options listed are financially feasible since they have NPV values higher than zero and B/C ratios greater than one at both the discount rates. Sandal block plantations, with a rotation period of 15 years, had the highest NPV ($67,077 USD at 10% and $31,317 USD at 15%), B/C ratio (4.4 at 10% and 3.3 at 15%), IRR (33%), EAI ($8,819 USD at 10% and $5,356 USD at 15%) and LEV ($88,189 USD at 10% and $35,705 USD at 15%). These high values

Continued on page 11

Domestication of Sandal...

Continued from page 10

reflect the high returns of selling sandalwood, and relatively low costs. Inter-cropping of sandal with gooseberry and horse gram (sandal + gooseberry, sandal + gooseberry + horse gram) showed slightly lower financial returns compared to the monoculture plantations of sandal.

However, the possibility of yielding annual returns from inter-cropping makes sandal inter-cropping models comparatively more attractive to farmers who prefer intermediate returns as compared to sandal monoculture plantations where returns are delayed.

The analysis also demonstrated that a rotation period of 15 years is more economical than 20 years for all the models. However, these results are only possible in a liberalized policy environment with open markets where the owner is entitled to receive the full market value of the wood upon extraction. The present policies, however, declare the state (the Forest Department and other public sector agencies) as the sole buyer and seller, thereby denying farmers the full market value for their produce and even compelling them to go through elaborate bureaucratic procedures to receive the benefits.

Hence, a revamp of the legal provisions on sandal is needed to facilitate free trade and ensure higher and speedy returns to farmers. This revamp will likewise encourage the private domestication of sandal.

Overcoming technical constraints in sandal domestication

To make sandal cultivation a viable proposition, policy changes have to be supplemented with measures to overcome current technical constraints in cultivation. These constraints include lack of knowledge of proper cultivation practices and inadequate supply of quality planting stock.

To address these constraints, sufficient germplasm, with a wide genetic base, should be established as clonal seed orchards (CSO). Sandal, being a predominantly outbreeding species, has enormous natural variability in terms of leaf size, shape, flowering pattern (period), fruit/seed size, heartwood, and oil content (Srinivasan *et al*., 1992; Srimathi *et al*., 1995). These

Continued on page 12

Figure 4. A young sandal plantation with mango trees as host.

Figure 5. Seven-year old sandal plantation with Indian gooseberry trees as host.

Table 1. Financial analysis of various sandal cultivation models in 1 hectare of land at different discount rates.

Sl. No	Model	Rotation period (years)	NPV ($*)		B/C ratio		IRR	EAI ($*)		LEV($*)		Rank
			10%	15%	10%	15%	(%)	10%	15%	10%	15%	
1	Sandal+gooseberry	15	63 932	29 411	3.8	2.8	29	8 405	5 030	84 054	33 531	3
		20	39 638	11 832	2.7	1.7	21	4 656	1 890	46 559	12 602	
2	Sandal+gooseberry+ horsegram	15	64 308	29 764	3.8	2.8	30	8 455	5 090	84 548	33 934	2
		20	40 013	12 186	2.7	1.7	21	4 700	1 947	46 999	12 979	
3	Sandal block plantation	15	67 077	31 317	4.4	3.3	33	8 819	5 356	88 189	35 705	1
		20	41 290	12 371	3.0	1.9	22	4 850	1 976	48 499	13 176	

*1 US$ = Approx. 40 Indian Rupees. Source: Viswanath et. al. 2007

Domestication of Sandal...

Continued from page 11

differences provide a vast scope for genetic improvement and immediate use of superior genotypes/clones to improve productivity.

Raising sandal seedlings from seeds would result in variations in growth, heartwood, and oil content since these traits are at least partially genetically controlled. To yield clones, grafting is common practice, however it is not viable for fast and large-scale propagation of sandal. *In vitro* propagation, through tissue culture, is the only feasible option to achieve uniform quality planting stock. However, *in vitro* propagation procedures have only been standardized under laboratory conditions at the Institute of Wood Science and Technology (IWST), and have yet to be tested under field conditions.

Figure 6. Sandal seedlings raised at the Institute of Wood Science and Technology nursery for private domestication.

Figure 7. Smugglers check for the presence of heart wood by cutting the base of the sandal tree.

In addition, the Institute has developed modern nursery practices to produce quality planting stock of sandal in root trainers and polybags. At present, the Institute supplies nearly 65,000 of sandal seedlings annually. It also encourages private entrepreneurship in sandal nursery technology to meet the growing demand for sandal seedlings all over India.

Identifying gaps and actions

The growth data for sandal has so far been systematically recorded only in forest reserves. Research gaps exist with respect to the optimum age of sandal for harvesting, heartwood yield, factors affecting yield, age of heartwood initiation, and relationship between tree girth and heartwood content under managed conditions.

Cultivation packages also need to be standardized according to the area's agroclimatic situation, existing cropping pattern, and compatibility of sandal with other herbaceous understorey crops. Data on suitable host species for sandal have so far been limited to forest tree species. Research is hence needed on horticultural species which can be integrated in agroforestry systems, like Indian gooseberry and mango (*Mangifera indica*), which are high in demand and yield regular returns.

At present, a large share of investment on sandal domestication goes into protection costs as the trees are highly prone to theft and smuggling.

To address this problem, cost-effective electronic surveillance systems can be established to make sandal cultivation more economically attractive. Relaxation of policies can boost the domestication of sandal. It will also help solve associated technical constraints, as private entrepreneurship may bring in investments to critical research and development areas.

If cost-effective solutions to technical constraints are developed, together with initiatives to increase proper public awareness on the economic prospects of sandal cultivation, and to promote policy changes, India may witness an increase in the domestication of sandal in the coming years. ●

S. Viswanath and T. S. Rathore are Senior Scientists, and Dhanya B. is a Senior Research Fellow at the Tree Improvement and Propagation Division of the Institute of Wood Science and Technology, Malleswaram, Bangalore-560003, India

References: 1) Awasthi, K. 2007. Oz beats India. Down to Earth, 15 July 2007. Published by Centre for Science and Environment, New Delhi. p32.; 2) Baruah, A. D. 1999. The economics of sandal oil. Indian Forester.125 (6):640-643.; 3) Gairola, S. C., P. S. Aggarwal, G. S. Ravikumar. 2007. Status of production and marketing of sandalwood. Paper presented in National Seminar on Conservation, Improvement, Cultivation and Management of Sandal, Institute of Wood Science and Technology, Bangalore. 12-13 December 2007.; 4) Mahapatra R. 2001. King without a Jungle. Down to Earth. URL: www.cseindia.org/html/dte/dte20000831/dte_news.htm (Retrieved 19 November 2007).; 5) Rai, S. N. 1990. Status and cultivation of sandal in India, Proceedings of the Symposium on Sandalwood in the Pacific. Hamilton, L. and Conrad, C. E. (editors). USDA Forest service General Technical Paper, PSW-122, Honolulu, 66-71.; 6) Shetty, J. B. 1977. Proposals for the adoption of adequate legal measures for the protection of sandalwood. Proceedings of All India Sandal Seminar, 7-8 February, Bangalore: 198-204.; 7) Srinivasan V. V., V. R. Sivaramakrishnan, C. R. Rangaswamy, H. S. Ananthapadmanabha, K. H. Shankaranarayana. 1992. Sandal (Santalum album L.). Published by the Director, Institute of Wood Science and Technology (ICFRE), Bangalore, pp 233.; 8) Srimathi, R. A., H. D. Kulkarni and K. R. Venkatesan. 1995. Recent advances in research and management of sandal (Santalum album L.) in India. Srimathi, R. A., H. D. Kulkarni and K. R. Venkatesan (editors), India: Associated Publishing Company. p 416.; 9) Viswanath, S., B. Dhanya, and T. S. Rathore. 2008. Financial viability of sandal cultivation practices. Proceedings of National seminar on conservation, improvement, cultivation and management of sandal, Institute of Wood Science and Technology, Bangalore. 12-13 December 2007. Gairola, S., T. S. Rathore, A. N. Geeta Joshi, Arun Kumar and P. K. Aggarwal. (editors). Published by IWST (ICFRE) pp 158-165.

KASC advocates vermicomposting opportunities

Perfelia R. Buen (fe_buen65@yahoo.com)

Vermicomposting is the process of using earthworms to facilitate the decomposition of organic matter to create high quality compost. The process involves mixing dried rice straws/grass clippings and farm manure in correct proportions. This allows pre-decomposition to occur, producing heat and allowing suitable conditions for seeding earthworms such as African Nightcrawlers *(Eudrillus euginae)*. The decomposition process then continues until vermicompost is produced.

Vermimeal production is the process of drying and pulverizing the earthworms used in vermicomposting, which is rich in protein and other essential elements needed by animals and aquaculture species. In vermimeal production, the moisture level of the dried earthworms must be just right to avoid rancidity and growth of fungi (molds).

Vermicomposting and vermimeal production provide a lot of benefits when integrated in agroforestry. According to Dr. Herbert Imatong, Vermiculture Project Leader, the use of vermicompost can reduce the commercial fertilizer requirements for farmers. This will increase their reliance on the wastes of their agro-livestock farms, promoting prolonged soil fertility. Farmers are likewise encouraged to develop their self-reliance to reduce the incidence of poverty. He added that instead of burning agricultural wastes, the farmers would be decomposing and feeding these wastes to the earthworms. This process creates an environment-friendly approach by getting rid of agricultural wastes.

Dr. Imatong also shared that vermimeal is a potential feed ingredient in the local formulation of feeds for livestock and fish growers. If farmers are able to compound their local feeds, the cost of feed will be reduced, thereby maximizing their net income from integrated animal-crop production.

KASC as a regional center for vermitechnology

Kalinga-Apayao State College (KASC) became involved in vermitechnology when it established the Regional Vermicompost and Vermimeal Production Center in May 2007. This was the offshoot of the National Vermicompost and Vermimeal Production Program (NV2P2) through the initiative of Dr. Rafael D. Guerrero III, the Executive Director of the Philippine Council for Marine and Aquatic Resources Development (PCAMRD) of the Department of Science and Technology (DOST). This initiative was supported by the Philippine-Japan Support Fund for Underprivileged Farmers and coursed through the National Economic Development Authority. It was implemented by KASC in collaboration with state colleges and universities and local government units in the region.

Among the 16 regional vermicomposting centers throughout the Philippines, KASC was chosen as the regional center for vermicomposting in the Cordillera Administrative Region (CAR).

With Dr. Eduardo T. Bagtang at the helm, the KASC regional vermicomposting center aims to:

1. Implement techno-transfer demonstrations on vermicomposting and vermimeal production;
2. Encourage the active involvement of all participating families in the provinces of CAR to produce their own fertilizers from farm wastes to be used in their home gardens/farms and for commercial purposes;
3. Demonstrate the commercial feasibility of producing vermicompost and vermimeal as an economical and environment-friendly option for recycling biodegradable materials;
4. Mass produce the appropriate earthworm species (African Nightcrawlers) to be sold at a minimal cost; and
5. Foster a closer relationship among community-based organizations, the participating families/communities and KASC.

Achievements

Since its establishment, the Center has forged a Memorandum of Agreement between Heifer International and other private individuals to promote vermicompost and biogas production. It has conducted seminar-workshops on agri-waste management among local partners, and the self-help groups of Heifer International based at Kalinga, Mountain Province, and Isabela.

In terms of production, the Center generated an income of PhP 28,150 ($596 USD) from the sales of vermicompost from May 2007 to January 2008.

Advocacy initiative

The implementation of techno-transfer demonstrations resulted in the establishment of 15 vermicomposting centers in the province of Kalinga,

Continued on page 14

Figure 1. African Nightcrawlers (*Eudrillus euginae*) are weighed before being seeded to the pre-decomposed breeding beds.

KASC advocates vermicomposting...

Continued from page 13

three centers in the province of Apayao, one center in the province of Abra, and one center in Kabayan, province of Benguet. These centers were established from October 2007 to May 2008.

This initiative was a continuation of the PCAMRD-DOST and NEDA project. The services of these centers have been modified to fit the existing rural situation of the provinces.

This advocacy initiative exemplifies KASC's belief that farmers should be empowered to increase the capacity of their land resources in a sustained manner. They must be taught initiatives to enhance human and animal health, without adversely affecting the environment. Vermicomposting, the production of vermimeal as a feed supplement, and biogas production, are timely opportunities for farmers at this time.

The importance of recycling

According to Dr. Imatong, there is a need to manage and divert the disposal of agricultural wastes and farm manure. These products produce methane, which is a greenhouse gas, and therefore contribute to climate change. Likewise, rice straws and other farm by-products produce carbon dioxide in large quantities when burned.

Figure 2. Participants of the 2007 Regional Training-Workshop on Vermicomposting and Vermimeal Production with Dr. Rafael Guerrero III (center, in striped shirt) of PCAMRD and Dr. Eduardo T. Bagtang, KASC President (center, in white shirt).

Vermicomposting and biogas production are alternative ways to better utilize these agricultural wastes, farm manure, rice straws, and other farm by-products. Aside from providing livelihood opportunities and addressing poverty in the countryside, vermicomposting and biogas production could also help mitigate climate change. Moreover, if integrated in agroforestry systems, vermicomposting, biogas production, and vermimeal production could realize the potential of agroforestry to achieve zero waste and proper waste management.

For more information about vermi technology, contact Dr. Herbert Imatong, Project Leader, at bert_imatong @yahoo.com ●

The author is the Board Secretary and RMIS Coordinator of Kalinga – Apayao State College, Buanao, Tabuk, Kalinga, Philippines.

The 4th Philippine Agroforestry Congress slated for November 2009

Leila Landicho (leila_landicho@yahoo.com)

The Philippine Agroforestry Education and Research Network (PAFERN), University of the Philippines Los Baños-Institute of Agroforestry (UPLB-IAF), and the Misamis Oriental State College of Agriculture and Technology (MOSCAT) are jointly organizing the 4th National Agroforestry Congress, with the theme "Agroforestry promotion for climate change mitigation and adaptation: building lessons from the field." To be held 18-20 November 2009 at the Chali Beach Resort and Conference Center in Cagayan de Oro City, the Congress aims to: a) enable the various stakeholders to share experiences in agroforestry technology development, promotion and adoption for climate change mitigation and adaptation; b) intensify agroforestry promotion through agroforestry road shows; and, c) highlight farmers' experiences in agroforestry technology adoption.

Interested paper or poster presenters may submit abstracts on: the role of agroforestry in climate change mitigation and adaptation; agroforestry towards food security and biodiversity conservation; agroforestry enterprise development; and innovative approaches in agroforestry development and promotion. The Best Concurrent Paper and Best Poster Paper Awards will be given during the Conference.

Registration forms may be submitted to the Congress Secretariat (Email agro_cfnr@yahoo.com and/or secretariat@pafern.org.ph or by fax +63 49 536 3809) not later than 20 September 2009. Registration fees must be remitted on or before 30 September 2009, either via bank transfer or money order. For more information, log on to www.pafern.org.ph ●

PAR invites contributions to the The Overstory E-Journal

Permanent Agricultural Resources (PAR) is inviting interested agroforestry researchers, scientists, educators, extension agents, consultants, students and practitioners to submit articles for The Overstory E-Journal. This is a free agroforestry e-mail journal with over 8,000 subscribers in 184 countries.

Since March 1988, The Overstory E-Journal has been featuring articles that present broad rather than local perspectives that are of general interest to its target readers. Articles may focus on agroforestry; non-timber forest products; indigenous knowledge; land-use management approaches that integrate silvicultural, pastoral and/or aquaculture systems; economics of agroforestry; small-scale forestry; training and education. Survey articles that focus on trees and their roles in agriculture, natural ecosystems, and human culture and economy are likewise encouraged.

Other topics that PAR is eager to publish in future editions are the following:

- agrodiversity's ecological and economic benefits;
- agroforestry to meet the Millennium Development Goals;
- agroforestry for poverty alleviation;
- agroforestry in saline soils;
- bamboo in agroforestry systems;
- biodiversity benefits of agroforestry;
- comparing pests and diseases in mono- and polycultures;
- food insects with tree connections;
- highly useful multipurpose species of bamboo;
- human waste for fertility in perennial cropping systems;
- interactive learning environments;
- mangrove agroforestry;
- the benefits and drawbacks of monocultures and polycultures;
- multistory tree gardening in temperate climate;
- perennial leaf vegetables;
- perennial vegetables in temperate climate;
- protection of indigenous rights;
- soil food web in multistory agroforestry systems;
- temperate edibles for use in a perennial homegarden;
- year-round fruit production;
- value-added products from agroforestry;
- medicinal plants in agroforestry; and
- agroforestry and watershed protection.

For those interested, article contributions must adhere to the following guidlines:

- be written for a general and worldwide audience of educators, extension agents, researchers, consultants, students and practitioners;
- be well-written in English;
- be written in the third person;
- present brief examples of systems and species from various environments;
- be between 2,000 and 3,000 words, excluding references;
- include full references; and
- possess high standards of integrity (e.g. proper citation of other works and results, proper substantiation of scientific claims with data, proper acknowledgment of contributions, etc.).

Articles may also be a summary of a longer publication as long as written permission has been obtained from the original publisher for its publication.

Submit the articles in Word format or e-mail text to Craig Elevitch, Editor, The Overstory, Permanent Agriculture Resources, P.O. Box 428, Holualoa, HI 96725 USA at overstory@agroforestry.net

For more information, visit www.agroforestry.net/overstory/ovsubm.html

New information resources

The following publications are new releases from Springer Publications, CABI International, IIED, World Agroforestry Centre, and International Development Research Center.

Agroforestry Abstracts

This is a fully searchable database of internationally published research on agroforestry journal articles, bulletins, conferences, and books about agroforestry. Topics cover agroforestry systems and other types of land use, trees and shrubs for agroforestry, horticultural and plantation crops for agroforestry, pasture and field crops for agroforestry, animals, agroforestry products, environmental and service aspects, sociological, cultural and economic aspects, and research and development, including techniques and methodologies. For more information, visit www.cabi.org

Green water management handbook: rainwater harvesting for agricultural production and ecological sustainability

Edited by M. Malesu, A. R. Oduor and O. J. Odhiambo, this publication presents the concept of greenwater partition for agricultural production and ecosystem sustenance. To download this resource, visit www.worldagroforestry.org

Indigenous fruit trees in the tropics: domestication, utilization and commercialization

Written by F. K. Akinnifesi, R. R. B. Leakey, O. C. Ajavi, G. Sileshi, Z. Tchoundjeu, P. Matakala, and F. R. Kwesiga, this book discusses the relationship between husbandry and the domestication of indigenous fruit trees with markets, and the growth and poverty reduction among rural farmers.

Continued on page 16

New information resources...

Continued from page 15

This is a pioneering attempt to synthesize the state-of-the art for indigenous fruit trees in the tropics. It presents the latest concepts, approaches, case studies and results of researches conducted by ICRAF on the domestication of indigenous fruit trees. For more information, visit www.worldagroforestry.org

Knowledge to policy: making the most of development research

Written by Fred Carden, this book explains the extent of influence of research on public policy and decision making. It discusses the role of research in achieving better governance – by encouraging open inquiry and debate, empowering people with the knowledge to hold the government accountable, and widening the policy options and solutions to the policy process. For more information, visit www.idrc.ca

Rainfed agriculture: unlocking the potential

Edited by S. Wani, J. Rockstorm and T. Oweis, this book discusses the results of researche undertaken in Asia and Africa by leading scientists from 10 global organizations. The discussions focus on the potential of rain-fed agriculture in achieving food security and reducing poverty. The results highlight the yield gaps of major rainfed crops, and the possible technological, social and institutional options to bridge these yield gaps. For more information, visit www.cabi.org

Supporting small forest enterprises: a cross-sectoral review of best practice

Written by Duncan McQueen, this report discusses the 'market system development' framework which unites initiatives to strengthen enterprise associations, facilitate the provision of financial and business development services, and improve the business environment. It reviews the best practices in small enterprise support, while providing specific recommendations. For more information, visit www.iied.org

Sustainable development and environmental management

Edited by Corrado Clini, Ignazio Musu, and Maria Lodovica Gullino, this book discusses the new approach of the European Union to environmental management, viewed from the perspective of sustainable development. Discussions focus on how the European experience can help countries, like China, in dealing with both economic growth and environmental protection, through better environmental governance. For more information, visit www.springerpub.com

Sustainable farmland management

Edited by R. Fish, S. Seymour, and M. Steven, this book examines the relationship between farmland management and sustainability. Discussions include information and knowledge for sustainable farmland management, ethical production and protection, multifunctionality and sustainable farmland management, systems for sustainable farmland management, and scales of sustainable farmland management. For more information, visit www.cabi.org ●

Journals for agroforestry knowledge sharing

The following journals can be referred to for information and knowledge sharing on original agroforestry research and other relevant initiatives:

Environmental management

Edited by Virginia H. Dale, this journal offers research and opinions on the use and conservation of natural resources, the protection of habitats, and the control of hazards that span the field of ecology. Contributions are sourced from the fields of biology, botany, climatology, ecology, ecological economics, environmental engineering, fisheries, environmental law, forest sciences, geology, information science, public affairs, zoology, and others. Articles are also contributed by professionals from the business, government, research, and the public sectors. For more information, visit www.springerpub.com

Journal of bamboo and rattan

This is a peer-reviewed scientific journal which presents articles on bamboo and rattan's potentials for income security, craft industry, small- to medium-sized enterprises, industrial fiber, and fuel. Contributions on the natural distribution and conservation of bamboo, genetics and biotechnology, harvesting and production systems, environmental applications, marketing and policy restraints are also presented. For more information, visit www.springerpub.com

Small-scale forestry

Edited by J. Herbohn, this journal is produced by the International Union of Forest Research Organizations (IUFRO) to help exchange information on research problems, ongoing research efforts, and research results on the management of small-scale and non-industrial private forest woodlots. Contributions also include economic and policy issues. For more information, visit www.springerpub.com ●

New FAO Publications

The United Nations Food and Agriculture Organization (FAO) has produced the following information resource materials that may be relevant to agroforestry practitioners:

Conservation agriculture: when agriculture is profitable and sustainable

This CD-ROM is part of FAO's Land and Digital Media Series. It details information and literature on conservation agriculture to improve the knowledge base of those interested in sustainable agriculture. It also aims to provide technical staff and policy makers with information and arguments to support, promote and introduce conservation agriculture.

Efficiency of soil and fertilizer phosphorus use: reconciling changing concepts of soil phosphorus behavior with agronomic information

Written by J. K. Syers, A. E. Johnston, and D. Curtin, this FAO Fertilizer and Plant Nutrition Bulletin (No. 18) presents a review, analysis and synthesis of information on the efficient use of soil and fertilizer Phosphorous (P). The bulletin discusses plant availability of soil and fertilizer P, with focus on soil-plant interactions. It details the changing concepts on the behavior of both soil and fertilizer P, and the need to define and assess their recovery for P to be used efficiently.

Farm ponds for water, fish and livelihoods

Written by James W. Miller, this FAO Diversification Booklet presents basic and practical information on multiple-use smallholder farm ponds. Discussion covers how ponds add value to farming activities in terms of: a source of domestic and livelihood water supply, a source of irrigation for crops, and opportunities to improve livelihood.

Forests and energy: key issues

This FAO Forestry Paper (No. 154) focuses on the role of forests in energy production. This publication is very timely as forests and energy are considered the center of climate change debates today. The high energy consumption and prices, and increasing greenhouse gas emission provide major challenges and opportunities for the forestry sector to find a new role in energy supply, climate change, and sustainable development. This publication is also available in Chinese, French, Russian and Spanish.

Good practice for the small-scale production of bottled coconut water

This guide describes the application of the cold preservation process which can slow the rapid deterioration of coconut water, while preserving its flavor. Coconut water has been traditionally consumed as a refreshing beverage. This has paved the way for the growing consumer market for bottled coconut water as a refreshing beverage and a sports drink. However, its delicate flavor and freshness can only be experienced by cutting through a coconut. With the cold preservation process, coconut water will be stored at 0-4º C and achieve a shelf-life of 10 days to 3 weeks.

Written by R. Rolle, this guide is very useful for those who wish to venture into bottled coconut water as a micro and small-scale enterprise. It is also useful as a training resource for extension agents and trainers.

Growing vegetables for home and market

Written by M. Nichols and M. Hilmi, this FAO Diversification Booklet discusses the opportunities available for producing and marketing high quality vegetables and their capabilities to provide economic, social and nutritional advantages to smallholder livelihoods.

Make money by growing mushrooms

Written by E. Marshall and N. G. Nair (Tan), this FAO Diversification Booklet discusses the strategies in promoting mushroom cultivation. Mushroom cultivation can help the poor strengthen their livelihood initiatives, and at the same time establish a reliable source of income.

Non-farm income from non-wood forest products

Written by E. Marshall and C. Chandrasekharam, this FAO Diversification Booklet discusses the ability of non-wood forest products to meet the basic needs for forest goods, food, fodder, fertilizer, fiber, medicine, organic construction materials, cultural products and raw industrial materials. It also presents the role that non-wood forest products play in generating income from local, regional and international trade.

Opportunities to mainstream land consolidation in rural development programmes of the European Union

Published in 2008, this FAO Land Tenure Policy Series paper (No. 2) addresses the policy implication of using new instruments to support land consolidation. The instruments have been introduced by the European Union (EU) especially for its member- and neighboring countries. Land consolidation may be an important tool in increasing agricultural competitiveness and improving rural conditions. This publication describes the various funding opportunities available, and provides recommendations to include land consolidation within a rural development program.

Organically produced food

This publication presents the international standards on organically produced foods to facilitate trade and prevent misleading claims. By following the international standards, the requirements for producing organic products at the international level will

Continued on page 18

New FAO publications...

Continued from page 17

be harmonized. At the same time, the standards will assist governments in their initiatives to establish national regulations on the production and trade of organic foods at the international level.
The publication is in its third edition and part of the new FAO/World Health Organization (WHO) Codex Alimentarius series. The Codex Alimentarius is a result of the works done by the Codex Alimentarius Commission, an intergovernmental body with over 170 members, functioning within the framework of the FAO/WHO Food Standards Programme. The Codex Alimentarius series is a collection of internationally adopted food standards, guidelines, codes of practice and other recommendation to protect consumers' health and ensure fair practices in the food trade.

Payment for environmental services in agricultural landscapes: economic policies and poverty reduction in developing countries

Payment mechanisms for environmental services or PES programs have been set up in developing countries. They make use of market and institutional incentives to address environmental conservation and poverty alleviation concerns. This book discusses the analytical tools used in evaluating the optimal design and implications of PES on the rural poor. It also discusses how PES programs are integrated in international treaties on global warming and biodiversity loss. Discussions focus on the role of PES in agricultural landscapes which provide for the survival of many poor families in developing countries.

The state of food and agriculture 2008 – Biofuels: prospects, risks and opportunities

This annual publication discusses how biofuel helps achieve energy, security, reduced greenhouse gas emissions, and promotes rural development. It also presents the current status of the biofuel debate, and explores the implications of biofuel for food security, the environment and agricultural development in developing countries. The risks to land, water, biodiversity and food security are also discussed.

The state of food insecurity in the world 2008 – High food prices, and food security: threats and opportunities

The latest statistics on global undernourishment are presented in this publication while discussing the impacts of high food prices. Information presented concludes that chronic hunger in the world has rapidly increased, and is now affecting 900 million people. Considering this situation, this report discusses opportunities to relaunch smallholder agriculture.

Water and the rural poor: interventions for improving livelihoods in sub-Saharan Africa.

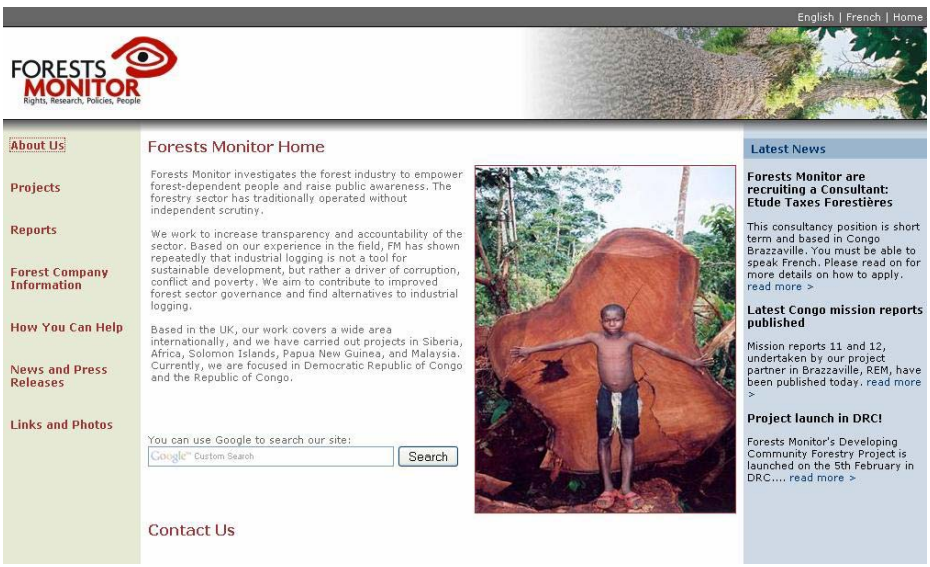
Edited by Jean-Marc Faurès and Guido Santini, this e-book focuses on small-scale on-farm improvements, particularly on structures that can help improve water management in rainfed agriculture. These structures are easy to operate and maintain locally by both female and male smallholders. Aside from these structures, the report presents other local interventions on water management that aim to cope with the effects of climate variability. Produced by FAO and the International Fund for Agriculture Development (IFAD), the report's findings aim to contribute to the rapid improvement in the livelihoods of the rural poor in small-scale agriculture in Sub-Saharan Africa.

For more information on these and other publications, visit www.fao.org ●

Useful Websites

Forests Monitor

This website provides information on the results of research on forestry companies to raise public awareness and assist forest-dependent communities and sectors in their decision-making processes. The site offers project information, forest company information, news and press releases, photos and relevant links. For more information, visit www.forestsmonitor.org

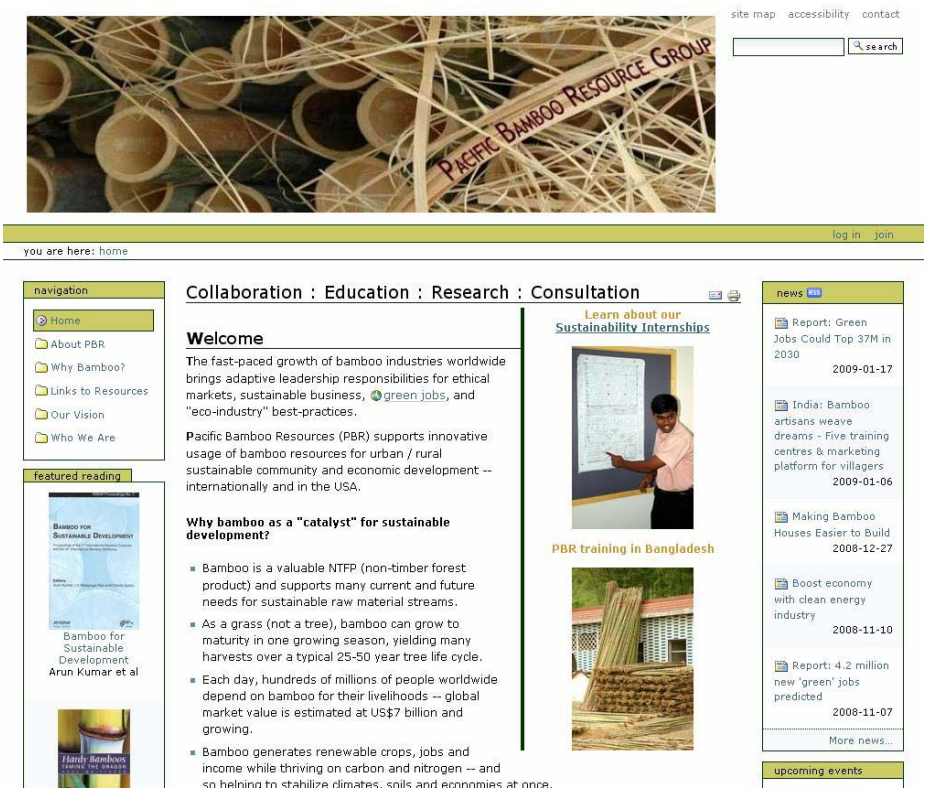


Useful websites...

Continued from page 18

Pacific Bamboo Resource Group

The website offers publications, research findings, resource links, and other opportunities for collaboration to promote sustainable bamboo resources. Information focuses on the resources and methods used by the Group on bamboo utilization, including market perspectives. For more information, visit www.pacificbamboo.com



World Forest Institute

This website serves as the information services division of the World Forestry Center. The website offers information on its international fellowship program, conferences, publications, and information resources. Publications cover forest resource statistics, wood products data, and market opportunities. For more information, visit http://wfi.worldforestrycenter.org

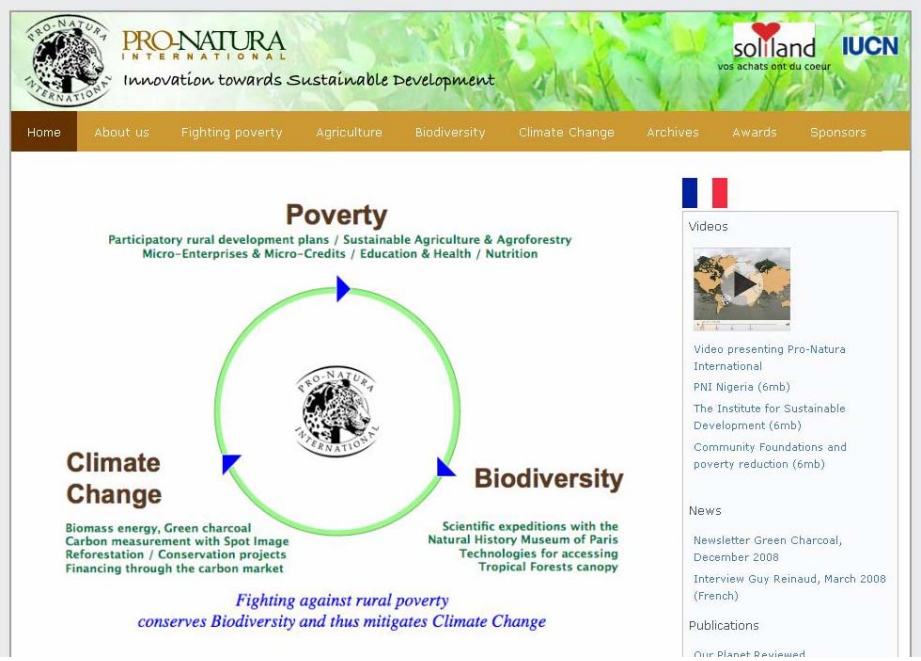
Continued on page 20

Useful websites...

Continued from page 19

ProNatura

The website offers information on the services of ProNatura - providing community and local government development, training programs on community development, sustainable farming, agroforestry and sustainable forestry techniques, fighting against malnutrition, small and medium-sized enterprises, cross-border conservation area planning and implementation, environmental, social and human impact assessment for investments, forest canopies and biodiversity preservation, and biomass energy assessment (green charcoal). For more information, visit www.pronatura.org



Society for Conservation and Protection of the Environment (SCOPE)

The website offers information resources that focus on the involvement of local communities in mitigation measures including, maintaining forest areas and rangelands, promoting sustainable agriculture, and conserving water. Programs include: combating drought and desertification in drylands, protection of natural resources and biodiversity, environmental health, clean drinking water and sanitation and promotion of environmental law. For more information, visit www.scope.org.pk ●

Call for contributions

We are inviting contributions for the 36th and 37th issues of the Asia-Pacific Agroforestry Newsletter (APANews) on or before 9 January and 15 May 2010, respectively.

Contributions may focus on activities that highlight agroforestry research, promotion and development, and education and training.

Topics of particular interest are on agroforestry and:

- poverty alleviation;
- livelihood;
- farmers' income;
- mining area rehabilitation;
- climate change;
- biodiversity conservation;
- desertification; and
- other key development issues.

Announcements on new information materials, online resources, and useful websites are also welcome.

Interested contributors must adopt the simple, straightforward and popular style in writing the articles instead of that used in journals. This way, your articles can help farmers, development agents, researchers, and practitioners in coping with the challenges of promoting and developing agroforestry in their respective countries.

Limit your contributions to 1,000 to 1,500 words. Include good-quality photographs (scanned at 300 dpi) that are properly labeled and referred to in the text. Indicate your complete contact details, especially your E-mail address in the article, for readers to contact you should they have further inquiries about your article.

Send your contributions through E-mail 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, agro_cfnr@yahoo.com. ●