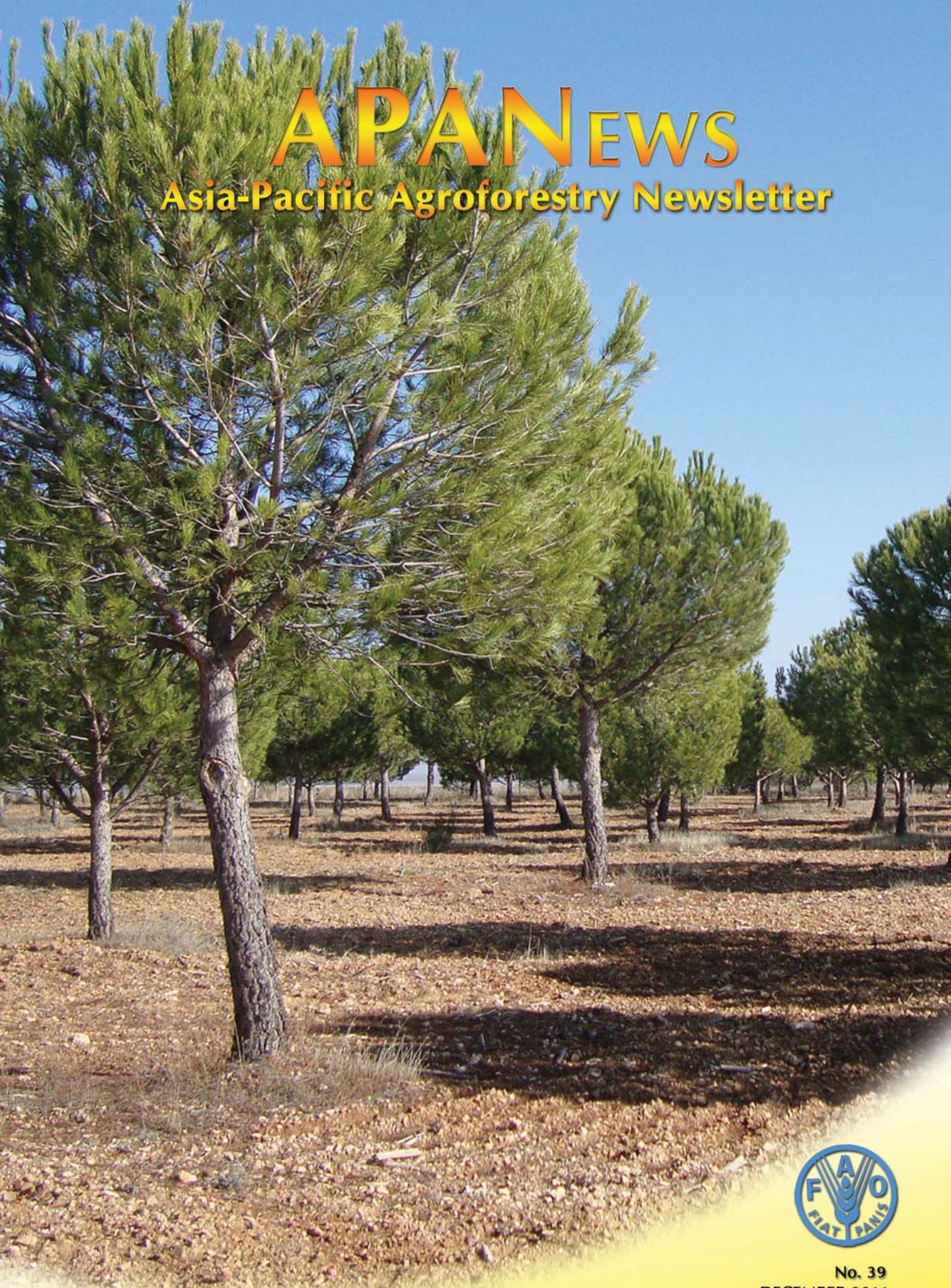
APANEWS

Asia-Pacific Agroforestry Newsletter



No. 39
DECEMBER 2011

Dear Readers

Welcome! The 39th issue of APANews features articles on species that could help protect coastal erosion, prevent desertification and yield various products and services. These species could boost production and diversify benefits when integrated in agroforestry systems.

One article discusses the potentials of *Cynodon dactylon*, a grass widely distributed in Viet Nam. The article presents the species' morphology, ecology and distribution. Read more on how the fruits and seeds could be harvested and how the species could be propagated.

Stone pine (*Pinus pinea*), meanwhile, is discussed in an article as a potential tree species for integration in agroforestry systems, particularly in temperate countries. The species produce pine nuts, which are consumed as is or used as a key ingredient in ice creams, cakes and other desserts, and in sauces and seasonings. Pine nuts are also high in protein, vitamins, minerals, and dietary fiber. These benefits pose high economic returns to farmers who would like to integrate stone pine in their agroforestry systems. However, propagation of stone pine is a problem in most countries due to inconsistencies in planting stock and ineffective propagation techniques. Find out the results of a study on how to better propagate stone pine using different grafting techniques.

Another article presents the findings of a study on how to propagate *Ficus roxburghii* Wall using vegetative means. *Ficus roxburghii* is a popular multipurpose tree species in India. Its fruits provide additional income to farmers, while its leaves are nutritious fodder for livestock. Because of these benefits, *Ficus roxburghii* is often integrated in agroforestry farms. However, seeds are still often used to propagate *Ficus roxburghii* which result in inconsistencies in planting stock. The article proposes vegetative propagation as an alternative. Vegetative propagation can quickly multiply the reproduction of tree species. Read more on what specific vegetative propagation technique is most effective when propagating *Ficus roxburghii*.

One article also discusses the effects of tree canopy closure in an agroforestry system. Using the intercropping system of poplar (*Poplar deltoides*) and *Colocasia esculenta* as an example, find out how tree canopy closure affects photosynthetic active radiation, temperature, humidity, and photosynthesis rate of the system.

In this issue, we also feature relevant events in 2012 that focus on sustainable development, climate change, health and ecology, mountain resource management, sustainable forest management and biodiversity. We continue to feature interesting websites and information resources that you might find useful in your practice of agroforestry.

As always, thank you to all the contributors. Let us continue finding ways to be more creative, innovative, and committed in practicing and sharing knowledge in agroforestry research, promotion and development, and education. Knowledge is vital only if we share and learn from it and use it to influence our daily lives.

—The Editors

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COVER. Stone pine (*Pinus pinea*) is sourced for its edible pine nuts which are also nutritious and used as a key ingredient in desserts, sauces and seasonings. Integration of stone in agroforestry farms pose high economic returns to farmers. To homogenize and improve planting stock, stone pine is best propagated using grafts *(see story on page 4)*.

PRINTER. Thammada Press Co. Ltd., 86 Soi 50 /1 Charansanitwong Road, Bangplad, Bangkok 10700, Thailand.

Featuring the capabilities of *Cynodon dactylon* Pers. to prevent coastal erosion and desertification in Viet Nam

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Cynodon dactylon Pers., commonly called cay co chi, is considered one of the economically valued grasses in the coastal areas of Viet Nam. From the family Poaceae, the grass is well-known to most coastal provinces in Viet Nam, and is often known as vivaces rampantes.

The grass is used as sea dikes to prevent erosion and desertification of coastal areas. It is also planted in grazing lands of cattle. The species can be easily propagated through ground stems, similar to that of *Zingiberaceae*, where the root systems are widely distributed into the surface layers of plain and sandy soils.

Morphology

The grass is a perennial climbing plant characterized by long stems of 50-100 cm long or more with stem diameter of 0.05-0.08 cm. The leaves are blue-green and oval which are 0.05-0.08 cm wide and 612 cm long. The flowers are white and 1-2 in long. The fruits are oblong and hairy.

Distribution and plant ecology

Cynodon dactylon Pers. grows in a wide range of latitudes (100 N- 220 N), altitudes (up to 500 m asl), areas with high rainfall (700 mm-2 700 mm or more), and many types of soils and microclimates. It grows well in fertile, deep and well-drained soils in September-December usually in the central provinces of Viet Nam, and during the spring season in the northern areas.

Mature mother grass are also planted in grazing lands to help prepare coastal areas for resettlement.

Fruits, seeds and seedlings

The flowers of *Cynodon dactylon* Pers. bloom from February to August. The fruits are produced from April to August. The seeds are collected for 2-3 months, while 10-20 cm cuttings are grown for 1-2 months in nurseries or home gardens. Seedlings are transplanted in January- March, and June-September. In April-July, the growth of the grass in the north central provinces of Viet Nam is constrained by the hot temperatures

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Fig. 1 Clusters of Cynodon dactyon Pers. are commonly planted along the coastal areas of Viet Nam.

Fig. 2 The root system of Cynodon dactylon Pers. after 2-4 months.

Fig. 3 The natural sand cover of Cynodon dactylon Pers.

Featuring the capabilities...

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of western winds from Lao PDR and central Viet Nam.

Propagation

The treated seeds of *Cynodon dactylon* Pers. are sown directly in barren lands or fallowed areas. When planted in fallowed areas, the seeds are treated by fire prior to the onset of the rainy season. The seeds are then sown while hot to prevent insect attack. The cuttings, meanwhile, are prepared and maintained in the nursery or home gardens before the planting season.

Cynodon dactylon Pers. can be easily planted during the spring and summer seasons in Viet Nam through stems, seeds or cuttings. The grass can cover 60-80 percent of the coastal areas. Cattle can graze on *Cynodon dactylon* Pers. for 6-8 months.

Cynodon dactylon Pers. is one of the economically and ecologically valued grasses in Viet Nam. Further research is needed to explore the grass's capabilities of preventing soil erosion in agroforestry systems. •

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References: (1) Ha, H. Q., and Nguyen, N. T., 1989. Economic grasses in Eakao Forest-Park, Buon Ma Thuot City, Forestry Engineer Thesis in Tay Nguyen University, Dak Lak Province, Viet Nam; (2) Ho, P. H., Volume 1, 1970., Volume 2, 1972. South Viet Nam's Vegetation, Lua Thieng Publisher, Sai Gon, Viet Nam; (3) Ly, T. D. et al. 1993. 1900 Used plant species in Viet Nam, P. 334, National Centre for Natural Science and Technology, Institute of Biological Resources and Ecology, Ha Noi, Viet Nam; (4) Trung, T. V., 1998. Tropical Forest Ecosystems in Viet Nam, Scientific and Technical Publisher, Ha Noi, Viet Nam; (5) Sy, H. M. 1974. Wildgrass in South Viet Nam, PP. 44-45, Institute of Agricultural Research, Sai Gon, Viet Nam; (6) Victor W. Sidel et al., 1997. A Barefoot Doctor's Manual, The Revolutionary Health Committee of Hunan Province, Routle & Kegan Paul, London, U.K.

Pine nut (*Pinus pinea* L.) production, an alternative for temperate areas

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Stone pine originated in Mediterranean Europe with a distribution of approximately 600 000 ha. The species is mostly concentrated in Spain (476 000 ha), Portugal (70 000 ha), Turkey (40 000 ha), Italy (40 000 ha), Tunisia (15 000 ha), France (13 515 ha), Morocco (3 000 ha) and Israel (2 000 ha).

Stone pine reaches 20-25 m high with an umbrella-shaped crown. The species grows in a wide range of soils and climates, is resistant to wind, and used to control erosion in coastal areas. It can resist saline winds and adverse conditions. The species forms good forests for fungi production. When planted in areas with an annual rainfall of more than 400 mm, stone pine attains a relatively high fruit yield.

Stone pine is famous for its fruits, called pine nuts. Pine nuts are consumed directly or processed as ice cream, cakes and other forms of desserts. It is also used as seasoning and raw material in pesto sauce. Pine nuts are the highest valued dried fruits in the international market because of its high protein content (30%), dietetic fiber, vitamins and minerals, high unsaturated fatty acids content (93%), as well as its low carbohydrate content (7%). Pine nuts are, therefore, good sources of bioactive compounds which could be added to other processed food.

Unfortunately, world production of pine nuts is lower than demand. It is estimated that world production is only 30 000 tons (6 000 tons of white pine nuts). Spain is the major producer of pine nuts, contributing to 45 percent of total production.

Challenges to production

In Europe, stone pine has been attacked by the insect *Leptoglossus occidentalis*. Infestation severely reduces pine nut production. It is estimated that this problem will continue progressively in the coming years.

The species was introduced in Chile more than 100 years ago mainly to stabilize coastal dunes which was proven effective. In this country, the consumption of pine nuts is limited to immigrants from Italy, Spain and Arab countries. Several European producers have expressed their interest to cultivate stone pine for the production of pine nuts in over 10 million ha in Chile, where the potential area is over 1.3 million ha. This species is being considered to complement crops planted in small- and medium-sized farms to provide added annual income.

Grafting techniques

In Europe, non-grafted trees bear fruits at 15-18 years. In Chile, fruit production starts at around eight years old. To homogenize fruit quality, increase fruit production, and improve orchard management and harvest, different types of grafting techniques were explored.

In October and November 2010, grafts were done in three different zones: Constitución, Curicó and Valdivia. In Constitución, grafts were executed on a three-year-old *Pinus radiata* plantation to form a clonal orchard and initiate fruit production. *Pinus radiata* in this area is mainly considered a forest

species. In Curicó and Valdivia, trials were done in two nurseries (Viverosur and Bopar) to obtain clones that would be used to establish clonal seed orchards.

Scion collection was done between 4 October and 18 November 2010 between the regions Metropolitan and Araucanía, specifically in the localities of Pirque, Cáhuil, Toconey, Mulchén, and Antiquina.

In Viverosur, rootstocks were obtained from three-year-old *Pinus radiata* seedlings and two-year-old *Pinus pinea* seedlings. In Bopar, four types of rootstocks were obtained from one- to four-year-old *Pinus pinea, P. radiata, P. ponderosa* and *P. contorta*, located in both bed layers and greenhouses.

The percentage of graft survival was higher in *Pinus radiata* rootstocks which were obtained from Viverosur and in *P. ponderosa* rootstocks which were obtained from Bopar (Table 1). The number of successful grafts (35.2%) in the natural environment was found superior as compared to those grown in the greenhouse environment (Table 2).

In the Bopar nursery, cleft (apical shoot on basal tissue) and side grafts obtained good results. Basal cleft graft worked well on *Pinus radiata* rootstocks at an average of

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Table 1. Survival of *Pinus pinea* grafts in nurseries.

Nursery	Rootstock	Clone	Month of grafting (2010)	Total grafts (N°)	Final evaluation		
					Days since grafting	Alive grafts (N°)	Average success rate (%)
Viverosur	*P. radiata*	C1-C2-C3-C4-C5	October	541	101 a 102	187	34.5
		C6-C7-C8-C9-C10					
		C11-C12-C13-C14-P1					
	P. pinea	EC1-EC2-EC3-EC4	October	210	114	0	0
Bopar	*P. contorta*	C20-C21-C22-C23-	November	813	66 a 67	35	4.3
		C25-C26-C27					
	P. ponderosa	A1-A2-M1-M2-M3	October and November	838	70 a 87	128	15.3
		T1					
	P. radiata	M1-M4-C25	November	173	66	21	12.1
		C28-30					
	P. pinea	A1-A3-T1-M1	October	1 132	60 a 88	110	9.7
		M2-M3-M4-M5	November				
		C25-EC1-EC3	November				
Total				3 497	Total	481	

Table 2. Survival of grafts from three-year-old *Pinus radiata* rootstocks.

Clone	Grafting date (2010)	Total grafts (N°)	Final evaluation			
			Evaluation date (2011)	Days since grafting	Alive grafts (N°)	Average success rate (%)
C2-C3-C5-C6-C7						
C8-C9-C29-C30-P1	October	315	January	109	111	35.2

Fig. 1 Stone pine orchard.

Fig. 2 Stone pine cones.

Fig. 4 White pine nuts.

Fig. 3 Nuts sourced from stone pine cones.

Pine nut production...

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41 percent graft survival. However, basal cleft graft was not found successful in stone pine rootstocks, probably due to their limited development.

The Whip & Tongue technique, used in Viverosur, achieved 34.6 percent graft survival, which is similar to the results obtained by Abellanas *et al.*, (2000) who obtained 35 percent graft survival using the traditional cleft technique. In this study, however, the use of cleft grafts obtained lower success rates (7.1%) (Table 3).

Fig. 5 Packed pine nuts.

Fig. 6 Sweets from pine nuts.

Grafts done in the *Pinus radiata* plantation reached 35.2 percent success rate. The double scion cleft graft (apical bud on last year's tissue) achieved 100 percent success rate, but considering only one repetition (Table 4.)

Gallardo and Gallardo de Prado (1981) studied the behavior of stone pine grafts on rootstocks of the same species in a population of more than 46 000 trees. Results showed that basal cleft graft obtained 52.5 percent success rate. In this study, the use of basal clef graft obtained 41 percent in the Bopar nursery, while 45 percent success rate was obtained in Constitución.

Table 3. Grafts survival in nursery according to rootstock and graft type.

Nursery	Rootstock	Graft type	Total grafts (N°)	Alive grafts (N°)	Success rate (%)
Viverosur	*Pinus radiata*	Whip and tongue	541	187	34.6
Bopar	*Pinus ponderosa*	Cleft (apical bud on apical bud)	838	128	15.3
	Pinus pinea	Cleft (apical bud on apical bud)	969	23	2.4
		Side	135	81	60
		Cleft (apical bud on basal tissue)	28	6	21.4
		Total	1 132	110	9.7
	Pinus radiata	Cleft (apical bud on apical bud)	162	11	6.8
		Cleft (apical bud on basal tissue)	11	10	90.9
		Total	173	21	12.1
	Pinus contorta	Cleft (apical bud on apical bud)	813	35	4.3
Total alive grafts			3 497	481	13.7

Table 4. Graft survival in plantations according to graft and scion type.

Rootstock	Graft type	Scion type*	Total grafts N°	Alive grafts (N°)	Success rate (%)
Pinus radiata (3-year-old plantation)	Cleft (apical bud on apical bud)	Same diameter	169	73	43.2
		Lateral scion	117	27	23.1
		Double scion	7	2	28.6
	Cleft (apical bud on last year tissue)	Single scion	19	8	42.1
		Double scion	1	1	100
	Side	Masculine flower scion	2	0	0
Total alive grafts			315	111	35.2

* Scion type: "Same diameter apical" refers to scions with the same diameter as the rootstock when grafted. "Lateral scion" refers to scions with thinner diameter than rootstocks, which are laterally grafted. "Double scion" refers to two scions that were grafted.

Conclusions

In general, graft survival in the three sites reached an average of 26.5 percent success rate, although results obtained in Constitución presented better results (35.2 percent). The same results were found by De la Parra (1980) who grafted stone pine on *P. halepensis* and obtained an average of 78 percent success rate. Castaño and Oliet (2004) indicated that the technique must be precise, clean cuts must be made, and the tape must be perfectly adjusted to protect the graft union.

The study also found that the knowledge, skills, and training of personnel who undertake the grafting techniques are relevant and may heavily influence the rate of survival.

The use of grafted stone pine plants not only increases fruit production but also promotes the plantation of stone pine in relatively poor, eroded areas with relative low water availability as a source of livelihood.•

The authors can be contacted at the Chilean Forest Institute, INFOR (www.infor.cl).

References: (1) Abellanas, B.; Butler, I; Monteagudo, F. 2000. Estudio de la Rentabilidad Económica de una Parcela de Injertos de Pino Piñonero a los 9 Años de su Instalación. Primer Simposio del Pino Piñonero (Pinus pinea). Valladolid (España). Pp. 101-110; (2) Castaños, J. Y.; Oliet, J. 2004. Puesta en valor de los recursos forestales Mediterráneos. El injerto de pino piñonero (Pinus pinea L.). Manuales de restauración forestal Nº 9. 248 p.; (3) Gallardo M. J.; Gallardo de Prado, J. 1981. Cinco estudios sobre injertos en pino piñonero. ICONA, Madrid. Ecología. Nº 5. Pp.: 197-209; (4) Parra, J.L. 1980. Creación de huertos semilleros de pino carrasco e injertos de pino piñonero sobre carrasco, en la provincia de Murcia. Boletín de la Estación Central de Ecología 9(18): 15-23.

Fig. 7 Cleft graft (scion substitution).

Fig. 8 Side graft (under lateral bark).

Fig. 9 (Clockwise) Cleft graft on (a) (b) last year's tissue and (c) on basal tissue.

Improving the regeneration of *Ficus roxburghii* Wall.

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Ficus roxburghii, of the family Moraceae, is known as the giant Indian fig. *Ficus roxburghii* Wall. and is one of the popular multipurpose agroforestry trees in the Western Himalayas. The species grows well in areas with an elevation of 1800 m. The tree grows on a wide variety of soil types. It particularly favors deep soils with adequate moisture supply.

The fruits of *Ficus roxburghii* are edible and the leaves are used as fodder during winter. The branches are used as fuelwood.

Challenges in propagation

In many regions of the world, the cultivation of various tree species in agroforestry is often constrained by poor regeneration through seeds, a long juvenile phase and lack of standardized propagation techniques. Vegetative propagation, using branch cuttings from ontogenetically mature trees, is considered the fastest means of multiplying trees in the reproduction phase (Hartmann *et al*. 1997; Sadhu 1996). This results in the shortening of the tree's juvenile phase. In the case of *Ficus roxburghii*, regeneration through seeds is a challenge. Further, the vegetative propagation of the species needs to be standardized under nursery conditions.

Different propagation techniques

In the study, 22 cm long branch cuttings of *Ficus roxburghii*, measuring < 1.25 cm and 1.25-2.5 cm diameter respectively, were treated with different concentrations of hormones (IAA, IBA, NAA each at 5 levels viz. 50, 100, 200, 500 and 1 000 ppm + one control) for 24 hours. The cuttings were planted in the experimental site of Sher-e-kashmir University of Agricultural Sciences and Technology, Jammu (India). The experimental site is situated at 32° 39´N latitude and 74° 58´ E longitude at an altitude of 332 m asl. The rainy season is in July, while the spring season is in March.

Results show that *Ficus roxburghii* can be propagated using branch cuttings treated with IBA 100 ppm for 24 hours in the spring and rainy seasons. Growth and development of the branch cuttings were found to be better during spring.

Meanwhile, seedlings grown from stem cuttings transplanted in the field started bearing fruits after two years as compared to seedlings grown from seeds, which started bearing fruits after 8-10 years.

Recommendations

The study recommends the use of branch cuttings to regenerate *Ficus roxburghii* to generate superior true-to-type planting stock and shorten the fruit bearing period of the species.•

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References: (1) Hartmann, H.T; Kester, D.E; Davis, Jr. F.T and Geneve, R.L. 2002. Hartman and Kester's plant propagation: principles and practices. 7th ed. Prentice Hall. Upper Saddle River, N.J.; (2) Sadhu, M.K. 1996. Plant propagation. New Age International Publishers. New Delhi.

Ficus roxburghii tree.

Vegetatively propagated seedling of Ficus roxburghii.

Vegetatively propagated two-year-old sapling of Ficus roxburghii bearing fruits.

Analyzing the performance of *Colocasia esculenta* in poplar-based agroforestry system

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Fig. 1 Colocasia esculenta is a partial shade-loving crop that can be potentially cultivated under poplar trees.

Populus deltoides Bartr. Ex Marsh, commonly called poplar or eastern cottonwood, is indigenous to North America and was introduced in Europe, Australia and many countries in Southeast Asia during the 20th century. Poplar trees are harvested in short rotations of 5-8 years in India and in extended duration of 25-30 years in European countries.

The wood obtained from poplar trees is used to manufacture match splints, veneer products, artificial limbs, interior panels, furniture, packing cases, etc. Poplar trees have straight and cylindrical boles, and moderate conical crowns of a deciduous nature, and can be integrated well with agricultural crops. Because of this versatile feature, poplar trees have become the most integrated tree species in agroforestry systems, especially in the irrigated tracts of northwestern India.

To achieve high productivity, large-scale plantations of poplar trees were established in Punjab, Haryana, Uttar Pradesh and Uttarakhand in the last two decades. Although often integrated in agroforestry systems, poplar trees attain crown closure within three to four years. This results in severe resource competition between the poplar trees and the agricultural crops in the agroforestry system. A study has been done to evaluate the microclimatic changes and their effect on the physiological parameters of *Colocasia esculenta* or *arbi* intercropped under poplar trees as compared to open areas.

Colocasia is a partial shade-loving crop that can be potentially cultivated under poplar trees.

Effects of tree canopy closure

The poplar tree canopy modifies the microclimate and influences the physiological processes of understorey crops. As the tree canopy becomes wider, the photosynthetic active radiations (PAR) and temperatures decrease, while humidity under the canopy increases as compared to open conditions. PAR under canopy is crucial in vegetative as well as reproductive growth. However, some rhizomatous crops may be more suitable as understorey crops than grain crops. The study aims to explore the performance of colocasia, a vegetable crop in India, under three-year-old poplar trees (Figure 1).

Photosynthesis rate

Photosynthesis is a physiological process affected by environmental factors. Using the USA-made portable photosynthesis system, photosynthesis, transpiration and stomatal conductance were studied. In colocasia, the rate of photosynthesis under poplar canopy was maximum at 12 pm as compared to the rate of photosynthesis obtained in open areas, which is at 9 am.

Results showed that under poplar canopy, the photosynthesis rate was proportional to the available PAR (Table 1). The same was not observed in open areas where photosynthesis and stomatal conductance was minimum at noon.

The results indicate that photosynthesis under canopy occurred more at noon than in the morning and evening. In Table 1, the net photosynthesis and transpiration was found to be higher in open areas, whereas stomatal conductance was higher under shaded conditions. This was due to the microclimatic changes caused by the closure of the poplar canopy. The reduced rate of transpiration, higher relative humidity under the tree canopy and effective utilization of PAR to achieve sufficient production of photosynthate throughout the growth stages of under storey crops are important characteristics in intercropping.

The economic and ecological advantages of growing trees with crops depend equally on the efficient use of tree resources and the ability of the trees to provide a conducive microclimate to the understorey crop. Colocasia responded well to the modified microclimate under the poplar trees. The poplar trees reduced the

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Analyzing the performance...

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fraction of water transpired by the understorey crop and countered the adverse effects of reduced transpiration. The stomatal behavior was controlled properly under the canopy at noon as compared to the open areas.

To minimize resource competition and improve the physiological processes of understorey crops, such as colocasia, it is essential to manage the canopy of overstorey crops, such as poplar trees, to ensure better yield under poplar-based agrisilvicultural systems. While it has been observed that the yield of many cereals, pulses and other crops is substantially reduced under canopy, it is necessary to explore other suitable crops that are physiologically adaptable under canopy to achieve improved profits.•

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Table 1: Diurnal variation in eco-physiological parameters of colocasia crop.

Time of observation	PAR (μmolm-2s-1)	Transpiration rate (mmolm-2s-1)	Stomatal conductivity (mmolm-2s-1)	T air (°C)	T leaf (°C)	Photosynthesis rate (μmolm-2s-1)	Internal CO_2 (ppm) (Ci)
		(E)	(C)			(Pn)	
Colocasia under canopy							
9:00 AM	276.78	0.53	156.87	31.30	32.18	0.75	374.85
12 Noon	529.34	2.73	277.14	35.16	36.96	2.12	368.03
04:00 PM	125.83	1.04	124.03	33.00	35.75	1.61	335.70
Mean	310.00	1.43	186.01	33.15	34.96	1.49	359.53
Colocasia without canopy							
9:00 AM	676.20	3.52	161.27	34.23	38.63	12.82	341.97
12 Noon	1110.8	4.26	82.27	39.57	43.67	5.12	190.33
04:00 PM	538.13	2.80	181.88	35.43	38.60	9.44	374.07
Mean	775.04	3.53	141.81	36.41	40.30	9.13	302.12

EcoHealth 2012

The *4th Biennial conference of the International Association for Ecology and Health* (EcoHealth 2012) will be held on 15-18 October 2012 in Kunming, P.R.China.

The EcoHealth 2012 conference will be organized around six themes. Each of the themes is designed to address a major challenge confronted by ecohealth professionals and practitioners.

EcoHealth policy, practice and education: opportunities and challenges

This conference identifies two especially important challenges for the field of ecohealth: the first is to increase recognition of the rights of indigenous peoples and community members, within our approaches to natural resources and health systems; the second is to increase policy support for ecohealth approaches as the basis of credible schemes for coping with global and local environmental change. Ecohealth researchers, practitioners and educators are challenged to work together with the increased strength and interconnectedness among indigenous and local community organizations, and to factor these considerations into ecohealth practices and local education. Fundamental questions include: How do researchers and practitioners employ ecohealth to address the challenges of local empowerment, capacity building, knowledge transfer, and equitable decision making? What opportunities and challenges arise when we integrate ecohealth into research, education, practice, and policy in different contexts?

Ecology and emerging infectious diseases

The emergence of new (and re-emergence of known) infectious diseases among humans, wildlife, livestock, crops, forests, and marine life can be viewed as a primary indicator of change or instability in the relationship between the environment and society. Many infectious agents, vector organisms, and non-human reservoir species are sensitive to climatic conditions and environmental change. Therefore climate change, land use, and land cover often create conditions conducive to infectious disease emergence and spread. Population dynamics, particularly migration and urbanization, as well as increasing ecological interactions between humans, and vertebrate hosts or arthropod vector species, may result in new patterns of infectious disease incidence. What are the specific disease transmission pathways from domestic and wild animal populations to human

populations? What correlations can we draw between climactic variability of the recent past and associations with infectious disease occurrence? What about the long-term trends of climate change and emerging infectious disease occurrence?

Ecosystems and health: risks, benefits and relationships

Ecosystems provide our food, water, natural resources, and ecosystem services that are the foundation for life, but also present health risks for humans. Diseases are often linked to heavy metals, toxic substances, and other contaminants. Human activities have increased exposure to such materials, yet well functioning ecosystems can absorb and remove contaminants. What are the potential health effects of these environmental hazards and the health benefits of ecosystem services? What climatic, socioeconomic, and environmental information is needed to inform the design of health systems, to assess the cumulative health risks and benefits from environmental change, and foster sustainable health of people, wildlife, and ecosystems?

Epistemology and transdisciplinary studies

The nature and scope of knowledge in ecohealth varies among the different disciplines and different people involved. For example, the theory and approach of knowledge development differs between the natural sciences and social sciences; yet both are critical to ecohealth. Additionally, local knowledge differs from "western" or "scientific" knowledge in the ways it explains and establishes knowledge claims. The challenge is to take advantage of the relative strengths of all stakeholders, and their knowledge systems, and foster connections among them. How can scientific research strengthen the capacity to build and make use of both scientific and local knowledge, in ecohealth management? How can ecohealth experts better disseminate information on emerging health risks and ecosystem management to locals? How certain are we of what we know, and what we do not know?

Food security and human health

Food security refers not only to adequate diet and clean food, but also refers to the need for food to be made in an environmentally sustainable way, and socioeconomically accessible to all people. In developing countries, diseases associated with agriculture and raising livestock have serious impacts. Zoonotic diseases; fungal, plant, and synthetic toxins; agricultural and livestock wastewater, agricultural chemicals, and antibiotic use; and ecosystem degradation are all hazards or negative effects associated with agriculture and raising livestock. What are the roles of agriculture and livestock in diseases, and what are their economic, social and environmental costs? What are the integrated approaches to managing agriculture-associated diseases?

One health

This conference theme will explore evidence and methods for cross-sector collaboration that builds on exchange among animal and human health experts, to also take into account economic, social, and ecological factors. What can we achieve from linking ecological, social and one health approaches that could not be achieved if the sectors work separately?

For more information, visit http://www.ecohealth2012.org/.•

United Nations Conference on Sustainable Development

RIO+20
United Nations Conference on Sustainable Development

The *United Nations Conference on Sustainable Development (UNCSD)* is being organized in pursuance of General Assembly Resolution 64/236 (A/RES/64/236). The Conference will take place in Brazil, 20-22 June 2012, to mark the 20th anniversary of the 1992 United Nations Conference on Environment and Development (UNCED), in Rio de Janeiro, and the 10th anniversary of the 2002 World Summit on Sustainable Development (WSSD) in Johannesburg. It is envisaged as a Conference at the highest possible level, including Heads of State and Government or other representatives. The Conference will result in a focused political document.

The Conference aims to secure renewed political commitment for sustainable development, assess the progress to date and the remaining gaps in the implementation of the outcomes of the major summits on sustainable development, and address new and emerging challenges.

The Conference will focus on two themes: (a) a green economy in the context of sustainable development and poverty eradication; and (b) the institutional framework for sustainable development. For more information, visit http://www.uncsd2012.org/rio20/.•

International symposium on mountain resource management in a changing environment

The Aquatic Ecology Centre, Kathmandu University, and Institute of Forestry, Tribhuvan University in collaboration with the Department of International Environment and Development Studies (Noragric), University of Life Sciences, Norway, invite papers and posters from scholars and researchers to be presented at the symposium on *Mountain resource management in a changing environment* to be held in Kathmandu, Nepal, 29-31 May 2012. Papers and posters are called for presentation under the following thematic areas:

- Forests, biodiversity and ecosystem carbon sequestration;
- Socioeconomic and interdisciplinary issues on environmental change;
- Soil physiochemical and biological quality and ecosystem health;
- Water resources and quality;
- Watershed rehabilitation, upstream/downstream linkages and payment for ecosystem services;
- River and lake physiochemical and bio-monitoring;
- Geoinformatics/remote sensing applications in natural resource management; and
- Climate change impacts and adaptive/mitigative strategies.

For more information, visit http://www.forestrynepal.org/event/5339.•

9th World bamboo congress

The *World bamboo congress* is a unique event that encourages global interaction by providing a platform for direct networking and the sharing of ideas and information.

The six-day event will be held 10-15 April 2012 in Antwerp, Belgium, to feature lectures and trade shows divided into distinct categories relating to science and society (culture and economics) and design, innovation and architecture (construction and products). For more information, visit http://www.worldbamboocongress.org/.•

Climate change mitigation with local communities and indigenous peoples

The first workshop focused on adaptation and vulnerabilities, and was held in Mexico City, 19-21 July 2011. This second workshop will be held 26-28 March 2012 in Cairns, Australia and aims to:

- Reflect the wide and diverse range of perspectives concerning indigenous peoples/local communities and climate change responses (including mitigation);
- Support the build-up of understanding and peer-reviewed literature in the field of indigenous peoples, local communities and climate change mitigation;
- Compile regional and local data and grey literature that are relevant for understanding climate change mitigation involving local and Indigenous knowledge holders, local populations, and developing country scientists;
- Support indigenous peoples', local communities'and developing country scientists' engagement and research in international climate dialogues;
- Provide policy-makers with relevant information on the mitigation potential of indigenous peoples and local communities; and
- Outline a publication in a special issue of a peer-reviewed scientific journal.

Planned sub-topics being considered include:

- Mitigation policies and indigenous peoples (potentials, barriers, opportunities and implementation);
- Forestry mitigation options (including REDD+);
- Indigenous peoples and carbon sink enhancement;
- Biomass burning, fire management and indigenous peoples;
- Indigenous peoples, renewable energy and technology;
- Traditional agriculture;
- Blue carbon; and
- Governance for mitigation.

For more information, visit http://www.unutki.org/default.php?doc_id=214.•

Second international conference on biodiversity in forest ecosystems and landscapes

To be held 28-31 August 2012 at the University College Cork, Ireland, the conference will provide an international forum for researchers, practitioners and students to discuss the challenges of maintaining and enhancing biodiversity in forests, and consider emerging trends in the sustainable management of forest ecosystems and landscapes. This conference will build on the success of the first conference which was held in Kamloops, British Columbia, Canada in 2008.

Symposia

Ten symposia covering different aspects of forest biodiversity research will be hosted at this conference. There will also be several open sessions for relevant contributions that do not fall into any of the planned symposia.

Conference format

Concurrent sessions will not be held at the conference. This will allow participants to attend all the presentations and participate in multi-disciplinary sessions. The programme will include a one-day field trip and an optional post-conference tour. For more information, visit http://www.ucc.ie/en/iufro2012/.•

Tackling climate change: the contribution of forest scientific knowledge

Climate change is emerging as the major concern for society in the 21st century and beyond. This is particularly true for forest management and the forest-based sector. Forests will be impacted by climate change but the forest-based sector has the capacity to react through both adaptation and mitigation measures.

Although many scientific activities have been initiated in this field, uncertainties remain as to tested strategies for moving forward. Several recent scientific approaches aim at helping decision makers in their elaboration of strategies for action regarding climate change and forest impacts, including adaptation and mitigation management.

To be held 21-24 May 2012 in Tours, France, this international conference will focus on the current state of knowledge on climate change impacts on forest ecosystems, services and activities. It will highlight methods and challenges to mitigate or tackle climate change impacts, both before they arise and once they have occurred. It will show how climate change and forest sciences address the issues facing forest managers.

Two broad topical categories are:

- the assessment of the current knowledge and understanding of climate change impacts;
- the identification of appropriate measures that are likely to reduce the impacts, exploit beneficial opportunities, increase the adaptative capacities or reduce the forcing of the climate system.

The description and understanding of climate change impacts addresses several kinds of questions:

- How to analyze observed and expected impacts of climate change?
- How are forests affected by a change in the disturbance regime?
- What are the recent and future trends in forest productivity and species distribution?
- How and how much does ecosystem resilience buffer climate change impacts?
- How does climate change affect forest ecosystem services?
- How could forest management integrate risks and uncertainties?
- What strategies would be suited for adapting forests to climate change?
- How and how much does the forest-based sector mitigate climate change?
- How to tackle the economic and social consequences of climate change?
- How to make information exchange faster and more transparent?

For more information, visit http://www.gip-ecofor.org/tours2012/?q=presentation.•

International conference on sustainable forest management adapting to climate change

Forests are main components of the terrestrial ecosystem whose functions include supplying forest products, mitigating climate change, preserving biodiversity, and conserving water and soils. Sustainable forest management is critical for regional economic, social and environmental benefits. However, with the fast-growing economy and the increasing population, the overexploitation of land resources has caused increasing pressure on forests. Demands for products from forests such as clean air, good water resources, biodiversity and adjustment of climate have been rising in recent years. Therefore, sustainable forest management is increasingly recognized as an important means to mitigate and adapt to climate change.

The Second Forest Science Forum—*International conference on sustainable forest management adapting to climate change* will be held 13-16 October 2012, in Beijing, China, with the theme "forest management in response to climate change." It will discuss papers on: (1) sustainable forest management and multi-function forests; (ii) techniques for sustainable forest management; (iii) policy foundations for sustainable forest management; and (iv) multiple services of urban forests. For more information, visit http://www.gfsf2010.org/.•

New information resources

Forests for people: community rights and forest tenure reform

This book assesses the experience of what appears to be a new international trend that has substantially increased the share of the world's forests under community administration. Based on research in over 30 communities in selected countries in Asia (India, Nepal, Philippines, Laos, Indonesia), Africa (Burkina Faso, Cameroon, Ghana) and Latin America (Bolivia, Brazil, Guatemala, Nicaragua), the book examines the process and outcomes of granting new rights, assessing a variety of governance issues in implementation, access to forest products and markets and outcomes for people and forests. The chapters explore the nature of forest reform, the extent and meaning of rights transferred or recognized, and the role of authority and citizens' networks in forest governance. They also assess opportunities and obstacles associated with government regulations and markets for forest products and the effects across the cases on livelihoods, forest condition and equity. Available: http://www.earthprint.com/.

Green manure/cover crops and crop rotation in conservation agriculture on small farms

Written by M. A. Florentin, M. Peñalva, A. Calegari and R. Derpsch, this book offers up-to-date and richly illustrated information that strives to facilitate the adoption and diffusion of No-Tillage, the use of green manures, and the practice of crop rotation on small farms. The publication describes the principal species of green manures and, at the same time, informs in detail how to insert green manures into small farm production systems according to soil fertility and major crops. It also analyzes the economic implication of these practices. Available: http://www.fao.org/.

Innovation in forestry - territorial and value chain relationships

Innovation is increasingly recognized as a key factor in environmental protection and balanced sustainable development within the forestry sector. This volume provides a comprehensive theoretical foundation for the analysis of innovation processes and policies in a traditional, rural sector as well as presenting empirical analyses of innovation processes from major innovation areas. Territorial services of the forest sector are examined, including carbon sequestration or recreation and wood value chains, including timber frame construction and bioenergy. This book is edited by G. Weiss, D. Pettenella, P. Ollonqvist, and B. Slee. Available: http://bookshop.cabi.org.

International consultation on integrated crop-livestock systems for development

Trees in crop-livestock systems often add significant synergistic values. Innovations that can strengthen the multi-dimensional role of integrated crop-livestock-trees systems and their resilience are taking place. There is a need to share this knowledge more efficiently and to build jointly owned research and development programmes to achieve critical mass of expertise and financial resources focused on helping farmers in major agro-ecologies. Available: http://www.earthprint.com/.

Organic farming

Beginning as a small protest to the industrialization of agriculture in the 1920s, organic farming has become a significant force in agricultural policy, marketing, and research. No longer dismissed as unscientific and counterproductive, organic techniques are now taken seriously by farmers, consumers, scientists, food processors, marketers, and regulatory agencies

in much of the world. Organic farming is both dynamic and forward-looking but is also rooted in tradition. It is these traditions that can provide valuable starting points in debates over how organic farming should meet new challenges such as globalization, the emergence of new production techniques, and growing concern over equity and social justice in agriculture. Complementing general discussions with case histories of important organic institutions in various countries, this comprehensive discussion is the first to explore the development of organic agriculture. The book is edited by W. Lockeretz. Available: http://bookshop.cabi.org.

Promoting the growths and development of smallholder seed enterprises for food security crops - best practices and options for decision making

Agriculture is the mainstay of the economies of developing countries and the source of livelihood for the majority of their populations. Toward this aim, improved seeds have been widely recognized as a key ingredient for enhancing farm productivity and overall crop production. This publication aims to raise awareness among decision makers and provides guidelines of best practices and policy options for promoting and supporting the growth and development of smallholder seed enterprises. Available: http://www.fao.org/.

Save and grow - a policymaker's guide to sustainable intensification of smallholder crop production

Sustainable crop production intensification can be summed up in the words save and grow. Sustainable intensification means a productive agriculture that conserves and enhances natural resources. It uses an ecosystem approach that draws on nature's contribution to crop growth and applies appropriate external inputs at the right time, in the right amount. FAO's aim over the next 15 years is to assist developing countries in adopting save and grow policies and approaches. This book presents a new paradigm: sustainable crop production intensification, which produces more from the same area of land while conserving resources, reducing negative impacts on the environment and enhancing natural capital and the flow of ecosystem services. Available: http://www.fao.org/.

State of food and agriculture 2010-11

Women make significant contributions to the rural economy in all developing country regions. Their roles differ across regions, yet they consistently have less access than men to the resources and opportunities they need to be more productive. Increasing women's access to land, livestock, education, financial services, extension, technology and rural employment would boost their productivity and generate gains in terms of agricultural production, food security, economic growth and social welfare. Closing the gender gap in agricultural inputs alone could lift 100-150 million people out of hunger. No blueprint exists for closing the gender gap, but some basic principles are universal: governments, the international community and civil society should work together to eliminate discrimination under the law, to promote equal access to resources and opportunities, to ensure that agricultural policies and programmes are gender-aware, and to make women's voices heard as equal partners for sustainable development. Achieving gender equality and empowering women in agriculture is not only the right thing to do. It is also crucial for agricultural development and food security. Available: http://www.fao.org/docrep/013/i2050e/i2050e00.htm.

State of the world's forests 2011

The ninth biennial issue of *State of the world's forests*, published at the outset of 2011, the International Year of Forests, considers the theme "Changing pathways, changing lives: forests as multiple pathways to sustainable development." It takes a holistic view of the multiple ways in which forests support livelihoods. The chapters assembled for this year's *State of the world's forests* highlight four key areas that warrant greater attention: regional trends on forest resources; the development of sustainable forest industries; climate change mitigation and adaptation; and the local value of forests. Considered together, these themes provide insights on the true contribution of forests to the creation of sustainable livelihoods and alleviation of poverty. Available: http://www.fao.org/docrep/013/i2000e/i2000e00.htm.

Sustainable land management: learning from the past for the future

Soil quality is threatened by many human-induced activities, but can also be improved by good land management. In the relatively short history of mankind on earth, the landscape and soils of the world have been drastically modified from their "natural " state. Landscapes altered by man's activities are termed "Anthroscapes" which are inextricably linked to culture and history. The challenges for today's scientists are to devise and implement sustainable land management strategies in order to preserve the land for the benefit of future generations. This book is a valuable compendium of the research experiences so far gained in studies of the context and concept of the "Anthroscape" and highlights the potential future contributions of such research to sustainable development. Available: http://www.earthprint.com/.•

Useful websites

ECHO Asia Regional Office

http://asia.echonet.org/

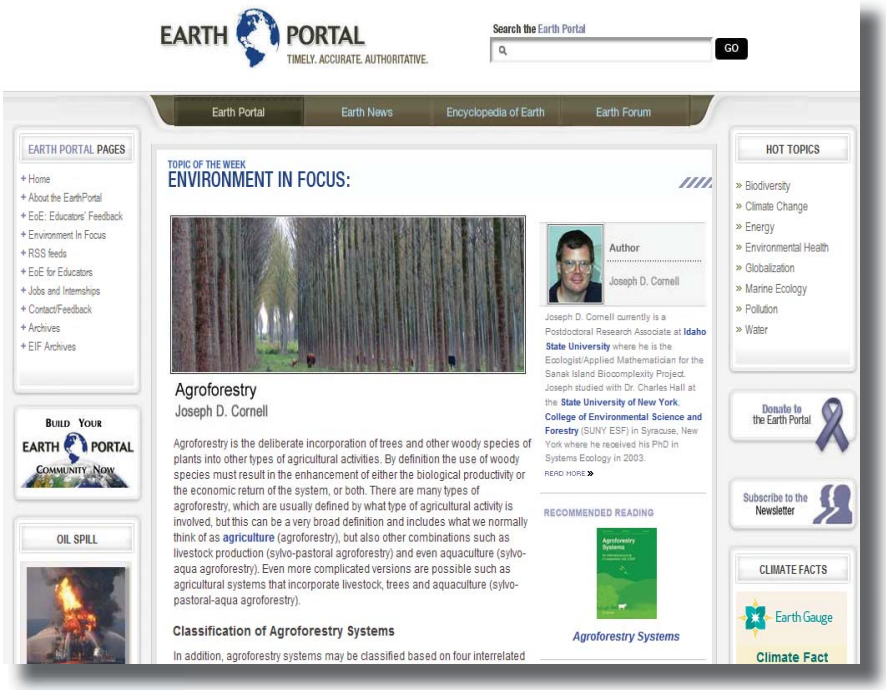
The ECHO Asia Regional Office aims to: (i) represent ECHO and promote its ministry and services in the Asia-Pacific region; (ii) make appropriate technical information more widely available among persons and organizations who serve to alleviate hunger and improve the condition of the poor in Asia; (iii) increase awareness of regionally important crops, animal breeds and farming systems by seeking out, sharing and promoting effective indigenous innovations related to food sufficiency and poverty alleviation; (iv) increase the availability of seeds of select regionally important crops among development workers, encourage regional seed saving and sharing and determine the availability of other significant plant material; and (v) encourage networking and information sharing among Asian development workers.

International Analog Forestry Network

http://www.analogforestrynetwork.org/en/index.html

Analog forestry is a system which seeks to establish analog ecosystems with architectural structures and ecological functions similar to the original climax or sub climax vegetation. It also seeks to strengthen rural communities, socially as much as economically, through the use of species that provide commercial products.

Analog forestry is a complex and holistic form of agroforestry that seeks to maintain a functioning tree-dominated ecosystem while providing marketable products that can sustain rural communities, both socially and economically.



Earth Portal

http://www.earthportal.org/?p=1092

The Earth Portal is a comprehensive resource for timely, objective, science-based information about the environment. It is a means for the global scientific community to come together to produce the first free, expert-driven, massively scaleable information resource on the environment, and to engage civil society in a public dialogue on the role of environmental issues in human affairs. It has three components:

- The Encyclopedia of Earth;
- The Earth Forum; and
- The Earth News.

New Agriculturist

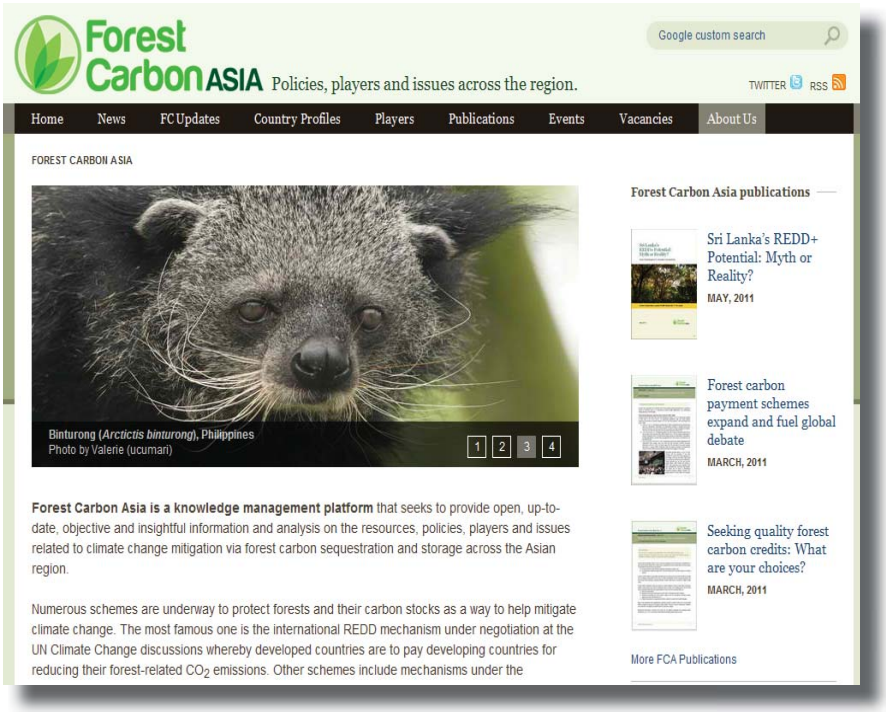
http://www.new-ag.info/en/index.php

New Agriculturist offers books, references, photos, and other relevant information resources in agriculture, livestock raising, coastal livelihoods, forestry, and related areas.

Forest Carbon Asia

http://www.forestcarbonasia.org/

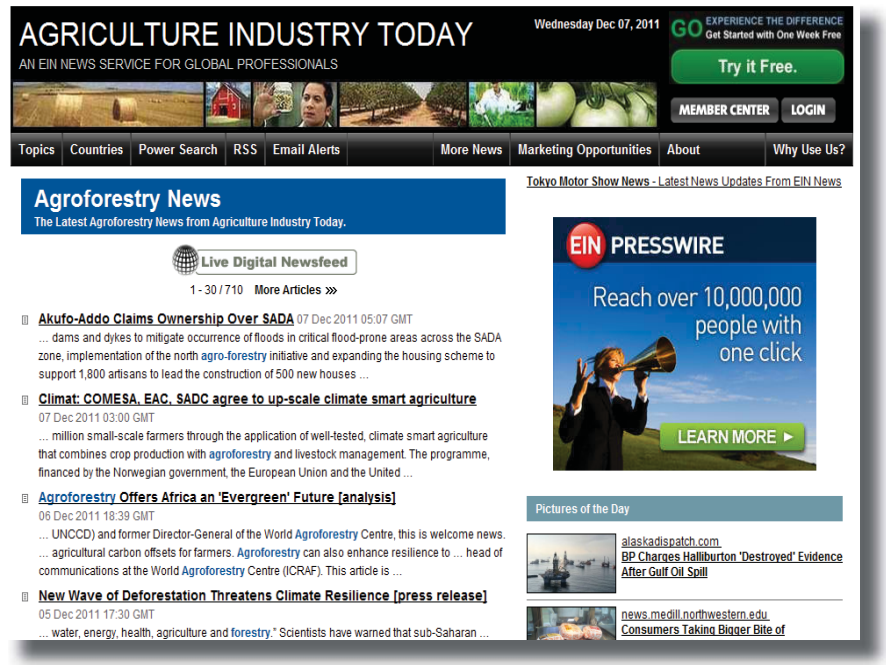
Forest Carbon Asia is a knowledge management platform that seeks to provide open, up-to-date, objective and insightful information and analysis on the resources, policies, players and issues related to climate change mitigation via forest carbon sequestration and storage across the Asian region. It aims to: (i) raise awareness and understanding about forest carbon-related issues; and (ii) promote sustainable forest carbon activities and investments across Asia that are good for the environment and local communities.



Agroforestry News

http://agriculture.einnews.com/news/agroforestry

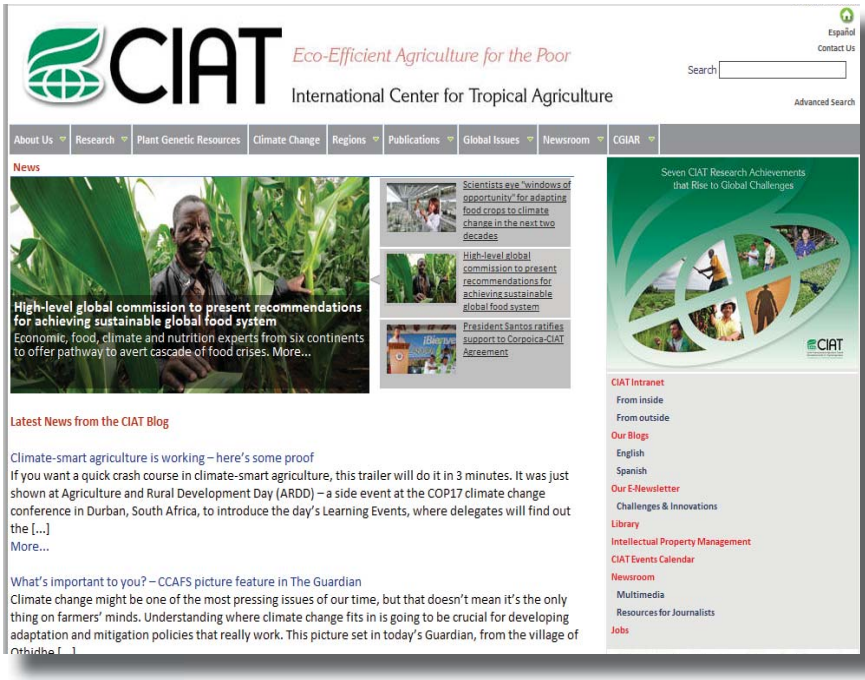
Founded in 1995, EIN News is an international leader in real-time news tracking and digital information services. The systems continuously scan the web, indexing news from thousands of worldwide sources. The data is then filtered and organized into news streams. The process is supervised by a team of professional news editors.



ClimateTechWiki

http://climatetechwiki.org/

ClimateTechWiki offers a platform for a wide range of stakeholders in developed and developing countries who are involved in technology transfer and the wider context of low emission and low vulnerability development. ClimateTechWiki offers detailed information on a broad set of mitigation and adaptation technologies.



International Center for Tropical Agriculture

http://www.ciat.cgiar.org/Paginas/index.aspx

CIAT is an agricultural research institution. It focuses on scientific solutions to hunger in the tropics. It believes in eco-efficient agriculture—developing sustainable methods of food production—which is considered the best way to eradicate hunger and improve livelihoods in the region.

CIAT undertakes research in:

- Agrobiodiversity;
- Climate change and capacity strengthening; and
- Tropical soil fertility.

Call for Contributions

We are inviting contributions for the 40th and 41st issues of the Asia-Pacific Agroforestry Newsletter (APANews) on or before 28 February and 30 June 2012, 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;
- agroforestry and livelihood;
- agroforestry and farmers' income and livelihood;
- agroforestry enterprises and/or marketing
- agroforestry and mining area rehabilitation;
- agroforestry and climate change;
- agroforestry and biodiversity conservation;
- agroforestry and desertification; and
- other key development issues in agroforestry.

Announcements on new information resources, useful websites, and upcoming relevant events are also welcome.

Interested contributors must keep the articles straight and simple to cater to as many audiences as possible. 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 and apanews0718@gmail.com.•

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