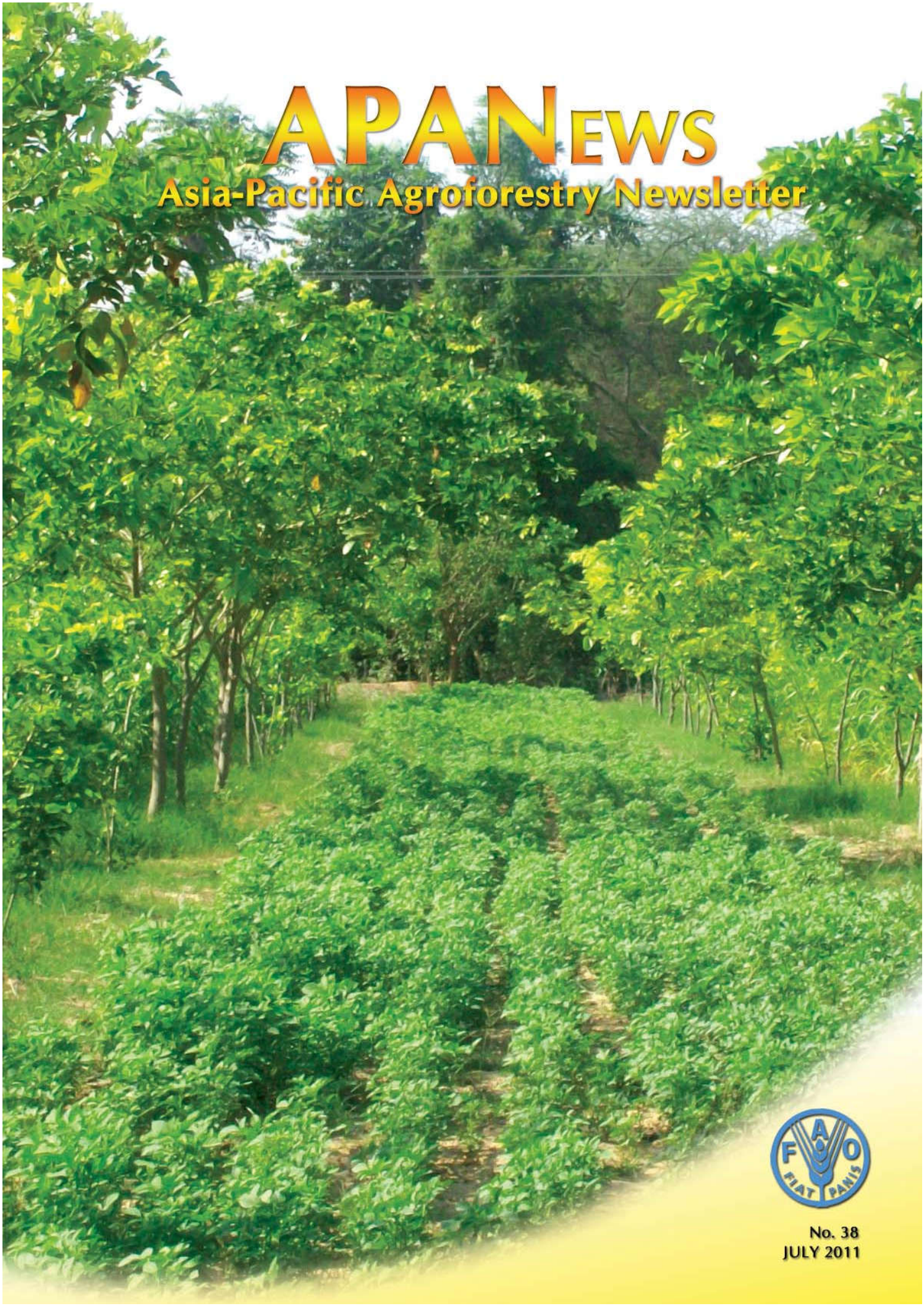

APANews

Asia-Pacific Agroforestry Newsletter

No. 38
JULY 2011

Dear Readers

Welcome to the 38th issue of APANews! This issue features interesting articles on potential species that could be integrated in agroforestry systems and findings of documentation on agroforestry models in Viet Nam and India.

One article presents the profiles of different agroforestry models that exist in northern and central Viet Nam, including the mangrove areas. The article discusses agroforestry models based on landscape, and available knowledge and policies in implementing agroforestry. Find out how the findings of this study were used to identify the challenges and gaps that would further improve Viet Nam's agroforestry research and development in the next five years. Areas of focus are agroforestry approaches, land-use planning based on landscape and sociocultural economy, agroforestry techniques, functions of agroforestry in environmental services, and policy development.

Two articles from India present species that could pose additional income to farmers if successfully integrated in agroforestry systems.

One article features *Salvadora oleoides*, a small multipurpose tree that produces desert grapes. Aside from its fruits, the tree is also tapped for oil, fodder and wood. Read more about the important uses of this species including its origin, distribution and how it can be propagated and protected. The article also discusses how the species can be conserved *ex situ* and through gene banks and cryogenebanks.

The other article, meanwhile, discusses *Pongamia pinnata* as an alternative source of biofuel. Find out how *Pongamia pinnata* can be tapped as a biofuel and consequently help augment the global supply of petrofuel.

Another article from Viet Nam discusses Agarwood (*Aquilaria crassna)*, a popular source of wood chips, incense and essential oils. The article discusses agarwood's morphology, ecology and distribution, propagation, transplanting techniques and inoculation. Read more about the benefits of agarwood and how it can be integrated successfully in agroforestry farms.

You might also find interesting an article that discusses how agroforestry can help address the plight of farmers in India. The author provides a refresher on the benefits of agroforestry and its capabilities to provide basic needs, restore land productivity, reduce soil erosion and improve soil fertility. Read more on how the adoption of agroforestry can help improve the quality of life of farmers in India as they have improved the lives of others who have practiced its different systems.

As always, we feature interesting events, websites and information resources that you might find useful as you adopt and practice agroforestry and its various support technologies.

Thank you once again to all the contributors. Let us continue sharing knowledge in agroforestry research, promotion and development, and education. As we share knowledge, we also learn from it, and more importantly use it to improve lives. —*The Editors*

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COVER. *Pongamia pinnata* is a nitrogen-fixing tree tree that produces seeds containing 45 percent oil. The oil is tapped as a substitute for biodiesel (*see story on page 14*).

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State of agroforestry research and development in Viet Nam

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Evaluating agroforestry research and development in Viet Nam is a difficult undertaking. The results of agroforestry studies in the 20th century are mainly grey literature comprising scientific reports, theses and conference reports. Very few studies have been published.

Further, there is a lack of documentation on the diversity and improvements made to the practice of agroforestry in the country, limited research and systematic reviews on the effectiveness of different agroforestry models, and very little information on the sustainable use of water and land resources in the different agroforestry systems. This study tried to summarize existing research on agroforestry and consolidate the practical experiences of farmers as a basis for further research and development initiatives.

Agroforestry models

Khoa *et al*. (2006) reviewed and classified different agroforestry models in Viet Nam according to location.

In the mountains of northern Viet Nam, farmers were found to practice: (i) forest + farm or pasture + rice terraces + vegetable garden; and (ii) forest + farm + garden + rice terraces. These areas are prone to erosion, resulting in thin soil layers. The soil is acidic with moderate to high humus content. Farmers practice rotational cropping of cereals and legumes.

In the hilly areas of Viet Nam's northern midland and central provinces, farmers established 1-2 ha of forests in the steep slopes. Farms of upland rice are found along the hillside areas which comprise 0.5-1 ha. Meanwhile, 0.2-0.3 ha of gardens have been established at the foothills, near valleys and roads.

The soil in the mid-central areas often experience erosion resulting in thin topsoils and low soil fertility. Only sparse vegetation can be found in these areas. Because of the situation, farmers established garden-based agroforestry with livestock-raising and fish production.

Areas in the central highlands are 400-900 m asl. The soil is fertile. These areas also experience shortages of water supply.

Most forests in these areas were initially cleared to establish industrial tree plantations. Nowadays, farmers intercrop industrial trees with agricultural crops.

The Cuu long delta, meanwhile, has high soil fertility because of the Mekong River, and is therefore suitable for establishing fruit orchards. Farmers in these areas intercrop fruit trees with agricultural crops.

Agroforestry is also practiced in the coastal mangroves of Viet Nam. These areas are submerged lands and wetlands with tidal salt water. The area also experiences flooding of fresh water during the rainy season.

Farmers in these areas primarily practice: (i) mangrove + shrimp, crab or fish culture; (ii) agriculture (wetland rice) + forestry (Indigo forest) + fishery + apiary + VAC (V: Garden, A: Fishpond, C: Pigpen); and (iii) vegetable garden + fish pond + fish breeding in the residential land. Farmers have adopted these systems according

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to the aquatic species to be used, water temperature, water type (salt and fresh water), water turbidity, and alum chemical processes.

Improvements in agroforestry research

Over the years, diagnostic tools have been developed to classify agroforestry models using participatory technology development (Bao Huy *et al*. 2003). Analyses on the impact of environmental policies on the development of agroforestry in the country; the practice of agroforestry on land use, landscape and socioeconomic environment; and adoption of agroforestry are also being done. Recent research are now combining new methods, particularly in the areas of soil science, plant physiology, ecology, systems science and modeling, quantitative analysis, etc.

Agroforestry models based on landscape

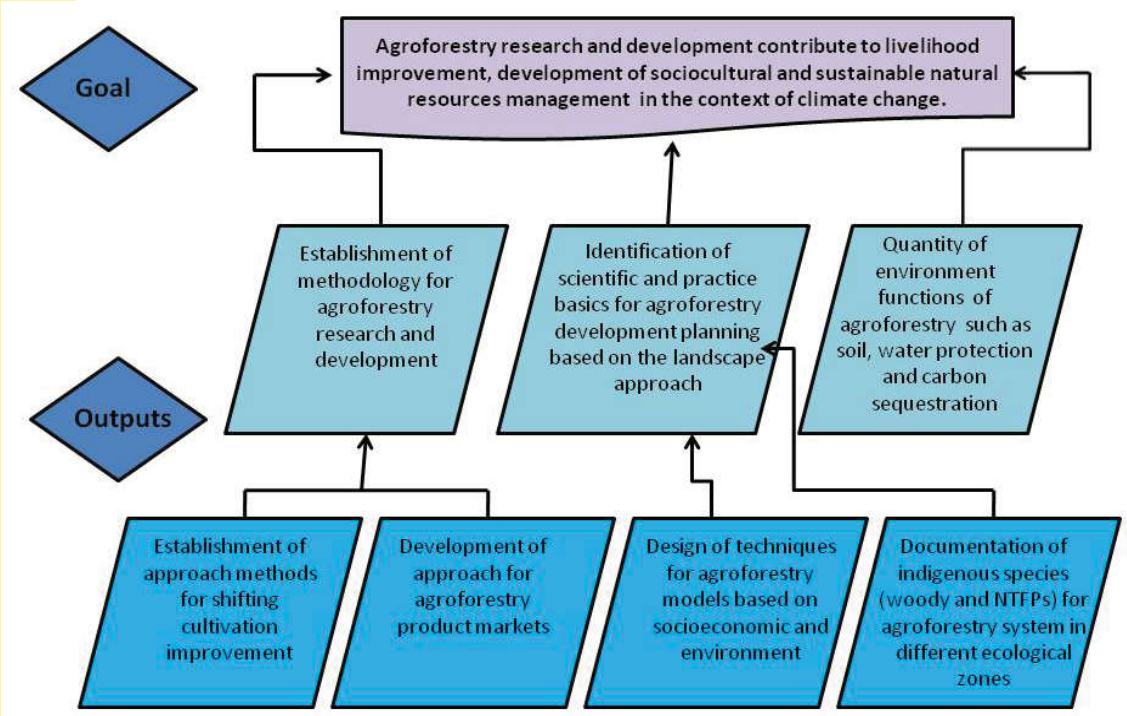
Research on the concepts and approaches of agroforestry models based on landscape is relatively new in Viet Nam. In the last five years, research on agroforestry landscapes were considered in evaluating the relationships between natural and socioeconomic factors which are the basis of arrangements of the agroforestry landscapes.

In 2008, with the support of the Viet Nam Network on Agroforestry Education, investigation, research and documentation on three model agroforestry landscapes in three ecological zones were conducted. They were: (i) agroforestry landscape of forest-tea-rice-crops-livestock in Xuan Phuc, Thai Nguyen City, Thai Nguyen province; (ii) agroforestry landscape of coffee crops-cashew-fruit trees-crops-livestock in Cu Pui, Krong Bong district, Dak Lak province; and (iii) agroforestry landscape of forest gardens-perennial crops-fruit trees Tanh Linh, Tanh Linh district, Binh Thuan province.

Agroforestry research

Focus. In the next two to three years, research in agroforestry will focus more on the impacts of climate change and the role of agroforestry systems in carbon dioxide absorption. At present, studies have been conducted on the capabilities of agroforestry for carbon sequestration, such as the rapid assessment of the ability to accumulate carbon in agroforestry, in the buffer zones of Tam Dao National Park, Vinh Phuc province. A recent study by Bao Huy *et al*. (2009) estimated the absorption of CO_2 in by litsea (*Litsea glutinosa*) in an agroforestry model of litsea + cassava in Mang Yang district, Gia Lai province. Results showed that the total economic value of cassava and litsea in five years is 2 024 USD (42.5 million VND) per hectare, and CO_2 absorption is 24.7 tons per hectare valued at USD424 (VND8.9 million). Further research along this area is needed to provide critical information on the contribution of agroforestry in mitigating climate change.

In the next five years, further research on agroforestry development is needed, particularly in the areas of approaches and methods, agroforestry planning based on ecological landscape and policy development, sustainable management of upland resources, technical issues, indigenous crops, role of agroforestry in payment for environmental services, improvements in production,



economic efficiency and development of markets for the products of different agroforestry models (Figure).

Gaps. The table summarizes the research gaps and needs based on literature reviews.

Conclusions and recommendations

The study documented some different agroforestry models existing in Viet Nam. Techniques in trees species selection, arrangement of different agroforestry components and nursery establishment were found being taught in secondary schools and universities. The focus of research has also changed to highlight practice rather than concept. In addition, recent research findings have affirmed agroforestry's role in economic development, soil and water conservation and protection, biodiversity conservation and carbon dioxide absorption.

However, the study also listed several gaps and limitations in agroforestry research and development under the areas of approaches, land-use planning based on landscape and sociocultural economy, agroforestry techniques, functions of agroforestry in environmental services, and policy development. These include the missing link of recent research and development initiatives to sustainable land-use planning, insufficient information on marketing models, lack of documentation on indigenous knowledge, and lack of further research on the systematic domestication of forest trees, production of non-timber forest products, and crop diversification. Other areas that need to be studied are the contribution of agroforestry systems to climate change, conversion of areas under shifting cultivation to agroforestry, and contribution to livelihood improvement, sociocultural development and sustainable

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Table. Research gaps and needs in agroforestry research and development in Viet Nam.

Expected research results	Available knowledge and policies	Research gaps and needs
Complete methodology and approach in agroforestry research and development	Participatory technical development	Methodologies on the technical, economic, social, humanitarian and environmental approaches
Established approach and methodologies to improve the practice of shifting cultivation	Documentation of indigenous knowledge on shifting cultivation	Methodologies to improve shifting cultivation based on local ecological knowledge
		Development of policies on fallow land management
Developed markets for agroforestry products	Evaluation of market chains in remote areas	Evaluation methods to assess agroforestry markets
		Methods to develop sustainable markets for agroforestry products
Established scientific basis in support of agroforestry planning based on landscape	Development of agroforestry landscapes	Establishing scientific basis for land-use planning based on the landscape approach
	Participatory land-use planning	Complete participatory methodology on forest land allocation
		Development of policies/laws on sloping land management towards agroforestry
Complete agroforestry systems based on socioeconomic and environmental factors	Techniques for designing space and timing of crops and forest trees in some ecological zones	Methods and structure for the design of agroforestry systems based on economic and environmental factors
Integration of indigenous forest trees and non-timber forest species in agroforestry systems according to different ecological and human culture zones	List of forest trees and non-timber species in some ecological zones	Updated list of forest trees and non-timber forest species that could be integrated in agroforestry systems
	Cultivation techniques of some forest trees and non-timber species in some ecological zones	Cultivation techniques of timber and non-timber that have potential to be integrated in agroforestry systems
Environment functions of agroforestry systems, such as soil and water conservation and protection, and CO_2 sequestration	Initial research on CO_2 sequestration of agroforestry systems	Extent of water conservation and protection of agroforestry systems
		Extent of soil conservation and protection of agroforestry systems
		Extent of estimated CO_2 sequestration of agroforestry systems
		Policy development payment for environment services of agroforestry systems

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natural resource management in the context of climate change.

The study therefore recommends long-term research on this topic, incorporating the knowledge and experiences of experts and practitioners, and identification of further research topics in coordination with the state, ministry, and provincial levels of government.•

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Promoting agarwood-based agroforestry systems in north central provinces of Viet Nam

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Agarwood (*Aquilaria crassna*) is considered one of the ecologically and economically valued timber trees in Viet Nam. It is popularly known as *cay tram huong* or *do bau* in Vietnamese. Agarwood is naturally distributed in the central highlands, north central and the southeastern areas. It is widely grown in the north central area, particularly from Ha Tinh to Thua Thien Hue provinces. It is known to provide many valuable products such as wood chips, incense and essential oil. Agarwood oil is used as raw material for perfume and as traditional medicines. Agarwood is sold for USD 20 000-30 000 per kilogram.

Morphology

Agarwood is a medium-sized tree of 15-20 m high or more. The trunk diameter is 40-60 cm to 1 m dbh. The bark is tough and fibrous, while the leaves are simple, alternate, oblong and 3-5 cm wide and 6-15 cm long. The leaves are green at the top and pale yellow underneath.

The flowers are racemose, umbelliform, and bisexual. The calyx are tubular. Petals are absent in the flowers. There are two stamens in two whorls. The ovary is scale-like, annular or cup-shaped. The fruits are loculicidal capsule, mostly indehiscent. The seeds exist with or without the endosperm.

Agarwood has dark resinous heartwood that forms in Aquilaria trees, which are large evergreen trees that are native to southeast Asia and Viet Nam. The heartwood of agarwood is relatively light and pale. However, once it becomes infected with mold, the tree produces a dark aromatic resin which results in a very dense and dark heartwood. The resin-embedded wood is commonly called gaharu, aloeswood, agarwood or oud and is valued in many cultures for its distinctive fragrance. The resin-embedded wood is also used as raw material for incense and perfumes. It is for this reason that aquilaria trees have been listed as a potentially threatened tree species since 1990.

Plant ecology and distribution

Agarwood is naturally distributed in semi-deciduous to evergreen forests at altitudes of 50-1 200 m asl on a large range of light- to medium-textured soils of feralite, schist, granite and basalt. It also survives in well-drained soils with thick A-B layers, 0.6-1 m deep or more, 5-20 degrees of slope, with a yearly average temperature of 20-28^{0}C and annual rainfall of 1 500-2 500 mm.

Agarwood has been widely grown in the forests and agroforestry farms of the north central provinces of Quang Binh, Quang Tri and Thua Thien Hue since the 1990s. It is primarily grown to reduce soil erosion.

Propagation

Seedlings are prepared in nurseries for 3-5 months. The sizes of plastic bags are 10-12 cm wide and 15-18 cm high. The medium comprises 87-90 percent soil, 8-10 percent organic manure, and 1-2 percent nitrogen-phosphorous-potassium fertilizers.