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Venture
Agroforestry
Program

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Forest & Wood Products
Research & Development Corporation

Land & Water Australia

Murray-Darling
Basin Commission

Introduction to

Tropical agroforestry for Indigenous communities

a report for the Joint Venture Agroforestry Program
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Foreword

Indigenous people in northern Australia want to develop sustainable commercial enterprises on their land to create local employment, reduce imports and support community development. By its nature agroforestry offers considerable potential to meet environmental, economic and social requirements.

As part of a project that will help define the research and development needs for indigenous agroforestry, this report presents the terms and concepts of tropical agroforestry for indigenous people in northern Australia.

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This report is an addition to RIRDC's diverse range of over 1,000 research publications and forms part of our Agroforestry and Farm Forestry R&D program, which aims to integrate sustainable and productive agroforestry within Australian farming systems.

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Simon Hearn

Managing Director
Rural Industries Research and Development Corporation



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Preface

Agroforestry is a sustainable approach to land use in which trees and crops, with or without livestock, are integrated into the same area of land. As more and more indigenous communities have secured recognition of ownership to parts of their country there is a growing interest in developing sustainable employment opportunities in communities. Agroforestry projects have potential to become business ventures while being environmentally and culturally appropriate in sensitive areas such as Cape York Peninsula and the Wet Tropics regions of northern Queensland, the Northern Territory, and northern Western Australia. The development of commercial activities can enable communities to develop employment, local income, in some cases locally produced goods and services, e.g. timber for house building or traditional foods (bush foods or bush tucker), and contribute greatly to improving living standards in areas where few such opportunities are available.

In this report we introduce agroforestry to indigenous communities in tropical Australia, with a focus on north Queensland. The words and concepts used in agroforestry are presented through simple explanations, diagrams and pictures of examples of agroforestry systems. An explanation of terms, or Glossary, and a further reading section have been added for reference at the end of the document. Words in *italics* in the text are explained in the Glossary on page 21.



Figure 1: Learning about agroforestry by planting trees for timber and bush tucker at Napranum community, Cape York Peninsula.

Introduction

What is agroforestry?

Agroforestry is about combining trees, shrubs and forests with agricultural systems. The word agroforestry is made up of two parts: “agro” from agriculture, which refers to farming systems such as cropping, growing fruit trees, or grazing livestock; and “forestry”, which refers to growing, using and managing trees and forests. Agroforestry systems have been around for a long time. Trees and farm crops, and in some cases livestock, have been grown together in systems to provide food and forest products, like wood, bush medicines, essential oils, vines, and honey.

Trees in farming systems can be planted or regenerate naturally from natural forests. Types of agroforestry can range from the growth of a single tree species with grass or another farm crop, to areas of country which include a large number of planted trees, shrubs and herbs of different species for a range of different forest products (fruits, foods, medicines, fibres, resins, fodder, etc.), and which look like natural forest.

Figure 2. Agroforestry is agriculture and forestry together in one system.



Why agroforestry?

Agroforestry can be more productive than agriculture and forestry alone. Agroforestry can be a solution to both the problems of **land degradation** and shortage of forest products. Agroforestry systems can more efficiently use resources such as sunlight, soil nutrients and water, than pasture alone.

By growing more than one product, agroforestry could provide foods, forest materials and income all year round. Short-term products could consist of root and grain crops, fruits and nuts, edible flowers and leaves, firewood, medicines and feed for livestock. Long-term products might include timber for housing and bridge construction and other wood products such as valuable furniture timbers. Worldwide, agroforestry is recognised as a means of meeting the needs of rural people for income, social and cultural benefits, while at the same time being a form of ‘healthy country’ that is environmentally sustainable. In many parts of the tropical world, agroforestry is providing indigenous people with means to raise their living standards, generate income from rural industries, satisfy their cultural needs for traditional foods and medicines, etc., and to improve their social status and community aspirations.

People plant and look after, or manage, trees for many reasons. Some people want to make money from the timber in the trees, some want to harvest foods from their trees. Many people plant trees for visual purposes, wanting to put something back into the environment. Some people see planting trees as an investment for the future. All of these reasons can be incorporated in agroforestry. In time it is possible to cover the cost of planting and managing the trees through the production, harvesting and potentially sale of timber and other **non-timber products**. Meanwhile the trees help care for country, can provide shade for livestock, crops and people and habitat for wildlife.

Agroforestry can:

1. Provide timber and non-timber products. Products could be sold to other regions, or used for local communities to replace the imports from southern farmers, e.g. timber for bridge building, or traditional bush tucker foods.
2. Help create healthy country. Growing trees and managing forests can provide habitat for wildlife, while producing foods and materials for people.
3. Help develop healthy communities. Agroforestry can set up employment and business opportunities such as the production of indigenous foods for a bush tucker industry.
4. Provide healthy country and **ecosystem services**, which create a better lifestyle, caring for country. Increasingly people are valuing healthy country, both in indigenous and non-indigenous communities. Markets are developing that put a money value on these environmental benefits. Also governments are becoming interested in rewarding communities and farmers for such services. Ecosystem services are those that:
 - Provide shade, shelter and habitat. Planted trees and natural forests provide a cool, shady place for livestock to graze and good habitat for other animals to live in. Filtered shade keeps topsoil cool, increases helpful **soil microbes** and reduces water loss.



Figure 2: Cattle grazing under gums

- Secure and enrich the soil. Tree roots bind the soil preventing soil from being washed away. This keeps the soil available for better crops and pasture. Tree roots acts like pumps, soaking up ground water. This can reduce problems with salt, or **salinity**, in soils. Leaves from trees fall to the ground and break down (with the help of soil microbes) to become organic humus that enriches the soil and provides nutrients to crops and pastures.

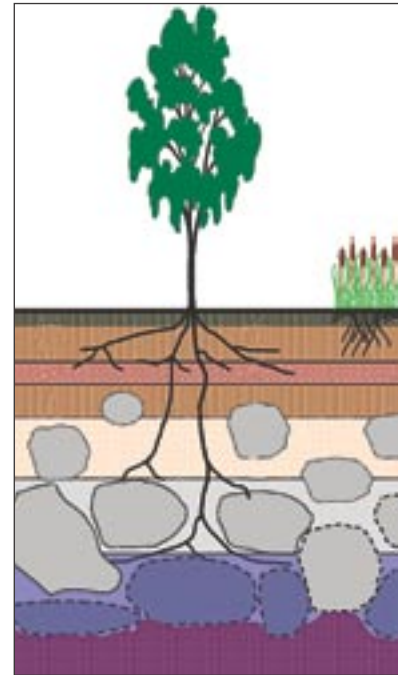


Diagram 1:
Tree holding soil/soaking up nutrients

- Provide wind protection. Trees protect the soil and crops from damaging and drying winds that cause erosion.



Diagram 2:
Trees protecting crops. (Source: Adapted from Design Principles for Farm Forestry; RIRDC Pub. No. 97/048)

- Take up carbon from the air. While growing, trees and shrubs take up carbon in the form of carbon dioxide gas, through their leaves from the air around them. They use this carbon to make wood. In this way, trees and forests help reduce harmful carbon in the air (called **carbon sequestration**). Trees in agroforestry have the ability to act as a carbon sink or store.



Diagram 3:
CO₂ sequestration—Plant trees to combat carbon emissions.



Figure 3: In some places where resources have been used unwisely and land is degraded it can be important to plant trees to protect waterways and to hold soil in place. In this photo, the young trees might not ever be harvested. But they will protect the creek, their leaves will add nutrients to the soil and they will provide habitat for birds, animals and fish; helping to create healthy country.



Diagram 4: Trees provide shade and shelter.
(Source: adapted from *Design Principles for Farm Forestry*; RIRDC Pub. No. 97/048)

Types of agroforestry systems

Windbreaks

Windbreaks are planted to give wind protection or shelter. Windbreaks are made up of trees and shrubs generally planted in lines to protect an area like a paddock of crops from wind damage. Windbreaks can be used to help reduce dust and protect communities from strong winds. Another example could be planting of trees around sporting fields to provide a shady spot to watch the football and protecting the grass and players from wind damage. In time it is possible to harvest timber from windbreak trees.

Windbreaks need to be:

- Tall - the taller the trees in the windbreak, the greater the area of crop protection
- Porous - trees need to be evenly spaced to allow the wind to be filtered through gently without breaking the trees. Trees should be not too sparse, not too crowded and the windbreak should have no gaps
- Long - the longer the windbreak, the more protection
- Even - branches need to be spaced evenly up the height of the trees
- Facing towards the oncoming wind.

Windbreak position is important to give maximum protection

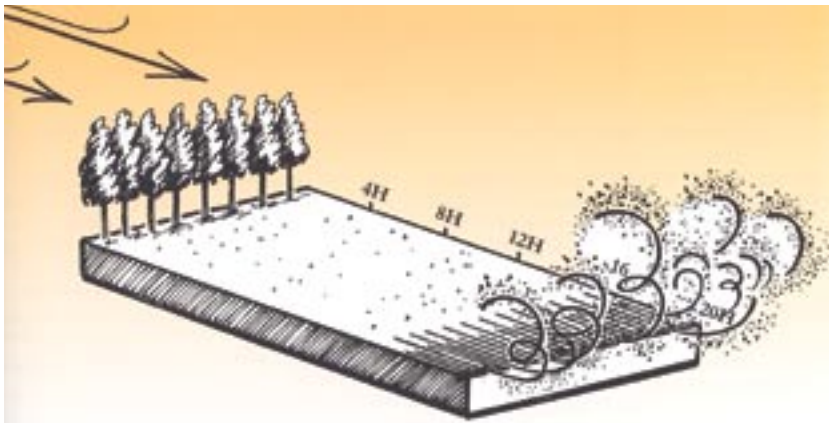


Diagram 5:
Wind blowing 90° to windbreak
(Source: *Design Principles for Farm Forestry*; RIRDC Pub. No. 97/048)

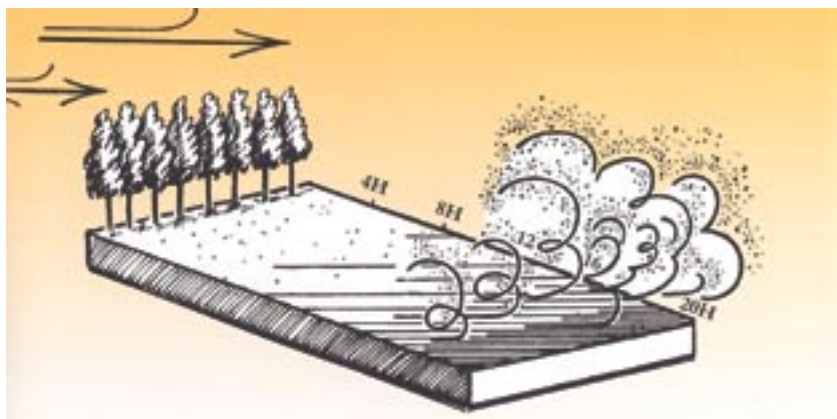


Diagram 6:
Wind blowing 45° to windbreak
(Source: *Design Principles for Farm Forestry*; RIRDC Pub. No. 97/048)

Benefits of windbreaks:

Windbreaks can be planted around crops like potatoes, corn, peanuts and fruit trees like avocados and mangoes can protect the crop from wind damage to the leaves and fruits. Protected crops to produce more. The trees and shrubs of a windbreak can create habitat for wildlife, increasing **biodiversity**. Windbreaks also make shady spots where it is possible to graze cattle and reduce heat stress for animals. In time, timber, or cattle feed (from leaves) could be harvested from trees in the windbreak. Windbreaks can help reduce dust.

Limitations of windbreaks:

Windbreaks take time to grow. They may not offer much protection until the trees are tall. Windbreaks take up some of the productive land so there would be less land to grow crops. It is a good idea to use tree and shrub species that will be useful, for example shrubs that produce flowers or nuts, or taller trees that may have leaves that could be used to feed livestock.



Figure 4: This picture shows a windbreak on the Atherton Tablelands. Trees, and the shrubs behind, in this windbreak are evenly spaced with no gaps. This means the wind is gently filtered through the trees and the crop of peanuts is protected from wind damage.

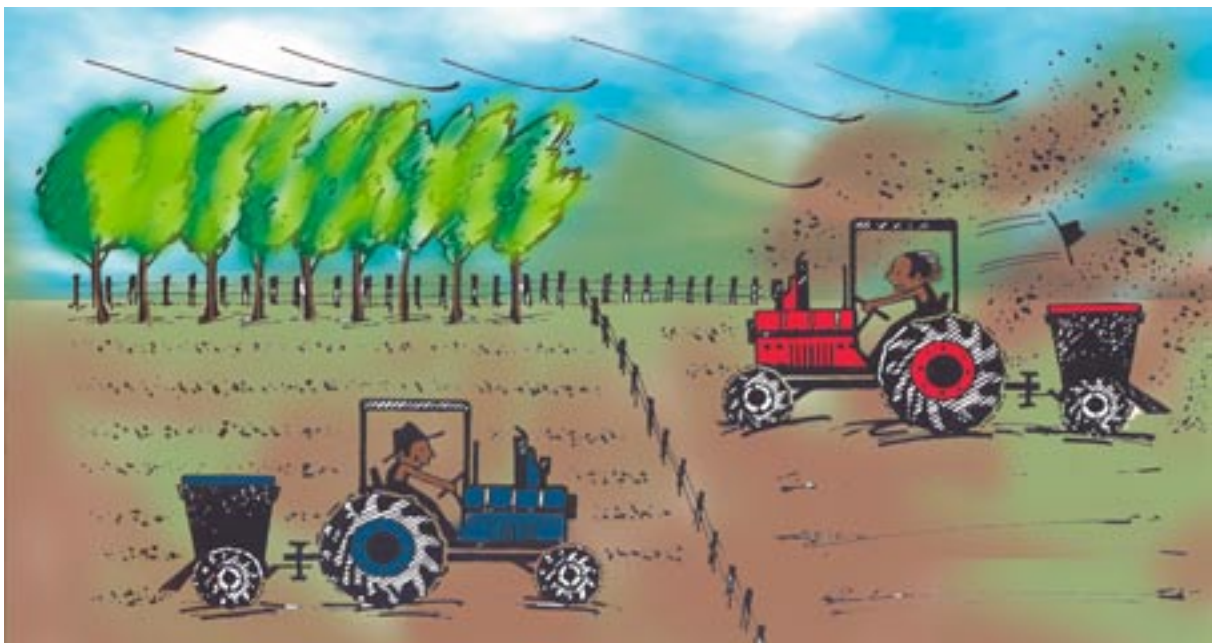


Diagram 7: Trees assist in retaining fertile soil on the farm where you need it most by regulating the flows of wind and water. They also reduce wind-blown dust. (Source: adapted from *Design Principles for Farm Forestry*; RIRD C Pub. No. 97/048)

Silvopastoral systems

Silvopastoral systems are a type of agroforestry where trees are grown in a paddock with pastures and livestock. In the word silvopastoral, “silv” comes from **silviculture** which refers to the growing of trees, and “pastoral” is about growing of pastures, putting them together is about growing both trees and pastures at the same time.



Diagram 8: Tall trees pruned for timber production provide shelter for paddocks, wildlife habitat, crops and aesthetic values. (Source: *Design Principles for Farm Forestry*; RIRD Pub. No. 97/048)

Silvopastoral systems can be made up of different tree and pasture species. The tree provides shade for the livestock, but still allows enough sunlight through so that the pasture can grow. All over Cape York Peninsula cattle graze the grasses under natural forests. This is a type of silvopastoral system. Some of the trees in silvopastoral systems could be harvested for firewood, feed for livestock or timber products.

Benefits of silvopastoral systems:

Shade is important to dairy and beef cattle. Even in the cool upland environment of the Atherton Tablelands dairy cows suffer from heat stress on hot days. Heat stressed cows are not as healthy and produce less milk. With trees providing shade during the hottest part of the day, dairy cows graze underneath and can produce more milk of a better quality.

Limitations of silvopastoral systems:

There needs to be balance between the trees and the pasture. If there are too many trees, then no sunlight gets through to grow pasture, and there is no feed for livestock. If there are too few trees, then there is no shade for livestock, and not enough trees to harvest.

Figure 5. Wide-spaced trees in a paddock with pastures growing underneath. The trees provide shade/shelter for livestock while they graze, and can be managed for timber or non-timber production in the long-term. In this photo if more trees were planted in this paddock it would provide more shade, keeping the cows cooler, add more habitats for wildlife and in time produce timber products.



Alley cropping or intercropping

Alley cropping or intercropping is about growing trees and food crops in a mixed system. Often a crop is grown in the alleys between rows of trees. The trees grow up tall providing shade for the crop underneath. This system could suit trees for fruits and nuts, firewood, feed for livestock, or timber. In the picture below, the leaves of the crop (in this example it is tea) are picked for food. The crops grown beneath the trees produce food in the short term. The taller trees provide other products in the long term.

Benefits of alley cropping or intercropping:

The trees provide shade for the crops. By growing trees and crops in the one paddock its possible to create a more diverse range of products, some for the short term, and some for the long term.

Limitations of alley cropping or intercropping:

Just like silvopastoral systems, too many trees will shade the crop too much or be too competitive for soil water. It is important to choose tall trees that let lots of sunlight through, or crops that like to grow in the cool shade.



Figure 6: Alley cropping with valuable silky oak timber trees growing amongst a crop of tea. The tea leaves are picked many times through the year producing short term income to the community. In time the silky oak trees will be big enough to harvest for their valuable timber, which could be sold to a furniture market.

Figure 7: Agroforestry is about trees on farms. This photo shows a **plantation** of timber trees in the front paddock, rows of fruit trees in another paddock, and sugar cane in the paddock on the other side of the creek. Trees along the creek are planted for visual reasons and as habitat for wildlife. Sugar cane will produce income each year, as will the fruit trees when they are old enough. In the long term, the timber trees will be harvested for long term income.



Bush tucker production from agroforestry

Bush tucker can work well within agroforestry. There is the potential in Australia for a new food industry of international importance to be developed from indigenous plants and animals. Already there are several large companies starting to produce sauces and flavourings for supermarket shelves. Through agroforestry indigenous communities could be producers of many of the raw products used in these food products.

For example, communities could develop nurseries and become the providers of improved planting materials that they could sell to farmers wishing to diversify their farming systems. Perhaps even more importantly, there are internationally recognised rights protecting the traditional knowledge of indigenous people to be the guardians of indigenous species of traditional importance.



Figure 8: Ma Mu trainees at Johnstone TAFE College, Innisfail, using traditional knowledge of local rainforest species and learning new techniques to develop bush tucker species.



Figure 9: Bush tucker products that are now entering the national and potentially international markets.

Enrichment planting and biodiversity

Enrichment planting is about planting preferred tree species to increase the amount of valuable species in a forest or **plantation**. Enrichment planting can be used in regrowth forests, or following mine site rehabilitation to change the forest to have more desirable timber or non-timber species. Trees and shrubs use sunlight, water and nutrients differently and can provide different products for people, and different habitats for wildlife. Some have useful wood and others might have edible seeds. Enrichment planting with different species adds **biodiversity** to a plantation or forest.



Figure 10: Napranum community put an enrichment planting into a rehabilitated ex-mine site by adding valuable sandalwood trees. This will add more biodiversity to the regeneration forest and when the sandalwood trees are big enough, it will be more valuable for the community.

Native forest management

Native forest management is about looking after, or managing, natural forests for a variety of uses while not damaging them. **Sustainable native forest management** uses traditional forest management guided by more recently developed forest management codes of practice. To harvest useful products from the forest you firstly need to know how much you can take, and how often you can take them without damaging the forests' values. This means knowing how much wood is in the forest, how fast it grows and where the seedlings and small trees are. It is important to plan how to use and conserve the forests.

Native forest management is not forest clearing or unsustainable logging. It can include cutting around 4 to 6 trees per hectare for timber, or the collection of building or craft materials, bush foods or traditionally used medicines. Native forest management also includes traditional forest management use for cultural and social reasons. It is about managing and using naturally occurring forests (rainforests in the wetter areas and open woodlands in drier areas) to meet needs and values, without impacting on the ability of the next generation to do the same. Native forest management includes fire management.

Native forest management includes managing and using the forest plants and animals for:

- food and medicines,
- shelter,
- building and craft materials,
- essential oils,
- cultural and education purposes,
- conservation or tourism purposes,
- habitat for wildlife,
- a source of seeds and animals that could be used to rehabilitate degraded areas,
- and much more.

Figure 11: Injinoo and Umagico people look at maps and talk about forest planning in the northern peninsula area.



Figure 12: Wise management of native forests can provide many values from generation to generation. This photo shows a messmate or stringybark forest. With careful planning, including fire management, this forest could be managed for many values including timber, habitat for wildlife and cultural and educational reasons.

Examples of indigenous tropical agroforestry

Silvopastoral systems, windbreaks, sustainable management of native rainforests for timber production, growing bush foods and production of native rainforest flowers and foliage have all been suggested as good opportunities for agroforestry in the Wet Tropics of north Queensland.



Figure 13: It is possible to selectively harvest valuable timber for furniture markets, like this brown salwood harvested from privately owned rainforest in the Wet Tropics.



Figure 14: Fruits and seeds of rainforest trees from the Wet Tropics that could have potential in the bush tucker or native flowers and foliage markets.

There is a range of agroforestry opportunities in the dry tropics and Cape York Peninsula regions including the use of native forests, plantations and using ex-mine site rehabilitated land.



Figure 15: New Mapoon community plants a small plantation of timber and bush tucker trees as an example of *community forestry*.



Figure 16: Native forest sandalwood logs from Mt Croel, near Coen. With careful planning, fragrant timber from this tree can be harvested and sold into a valuable world market.



Figure 17: Portable sawmill processing of carefully selected native forest logs for bridge construction in the Injinoo community.



Figure 18: Sustainable native forest management at Injinoo community allows local native forest timbers to be used for bridge construction.

Glossary

Forestry	The wise use and management of trees and forests so that the values and products are there from generation to generation
Land degradation	When soils, forests and water are not looked after and get unhealthy, the land is called degraded. Planting trees, managing forests, reducing soil erosion and protecting from fire can help fix land degradation.
Non-timber products	The forest products other than timber, such as fruits, nuts and other foods, medicines, flowers, foliage, essential oils, firewood, vines and craft materials and other building materials.
Ecosystem services	The environmental benefits from healthy trees and forests. These include clean air to breathe, clean water to drink and healthy land to grow animals and foods. Caring for country helps care for ecosystem services by making where you live feel better.
Soil microbes	The micro (very small) animals and plants that break down soil organic matter, enriching the soil and making nutrients available to other plants. Soil microbes are important to maintain healthy soil.
Salinity or salty soils	When there is lots of salt in the soils, creeks, billabongs or water underneath the soil (soil water) there can be problems with salinity. In some areas clearing forests creates salinity in soils and soil water, which can kill nearby trees, shrubs and pastures. Carefully planting trees and wise management of natural forests can prevent and help salinity problems.
Carbon sequestration	While growing, trees and shrubs take up, or sequester, carbon dioxide from the air and store this in their wood. By doing this they make the air clean and healthy for us to breathe.
Silvopastoral	Growing and managing trees and pastures together at the same time so that livestock can graze under shady trees, and in time, trees can be harvested for timber and non-timber products.
Silviculture	About how to grow trees in natural forests and plantations to meet the range of needs and values on a long term basis.
Biodiversity	The number of different animals and plants living in an area. For example, a rainforest has more biodiversity than a dry woodland because the rainforest has more different types of animals and plants.
Alley cropping	Growing trees or shrubs in rows, together with growing crops in the alleys between the tree rows. Trees provide shade, nutrients and wind protection to the crops, while the crops provide short-term food or income as the trees grow timber for the long-term.
Plantations	Plantations are planted forests. Plantations can appear man-made because they are generally planted in rows. Plantations are usually established on land that is previously cleared and has been used for other farming practices, e.g. growing sugar cane, or ex-mining land.
Enrichment planting	Adding new plants to either natural forests or plantations by planting other valuable or desirable timber or non-timber species.
Sustainable forest management	Sustainable forest management means to wisely plan, use and manage natural forests in a way that creates healthy country and healthy communities from generation to generation.
Sustainability	To plan, use and manage resources for the long-term. Caring for country is about being sustainable.
Community forestry	Growing and managing trees and forests to meet the needs of all the people that make up the community. For example, growing trees near a river will protect the riverbanks from erosion; provide products (e.g. timber, fruits, vines) from the trees, and habitat for wildlife. The trees help create healthy waterways for others in the community downstream. Many people in the community plan and make decisions about how to do the forestry.
Farm forestry	Forestry on farm lands, where the farmer makes the plans and decisions.

