Tool and Guideline # 6

Practical Tools on Agroforestry

Rwanda Environment Management Authority
Government of Rwanda
Kigali, 2010

PREFACE

In 2010, REMA prepared 11 practical technical tools intended to strengthen environmental management capacities of districts, sectors and towns. Although not intended to provide an exhaustive account of approaches and situations, these tools are part of REMA's objective to address capacity-building needs of officers by providing practical guidelines and tools for an array of investments initiatives.

Tools and Guidelines in this series are as follows:

#	*TOOLS AND GUIDELINES*
1	Practical Tools for Sectoral Environmental Planning : A - Building Constructions B - Rural Roads C - Water Supply D - Sanitation Systems E - Forestry F - Crop Production G - Animal Husbandry H - Irrigation I - Fish Farming J - Solid Waste Management
2	Practical Tools on Land Management - GPS, Mapping and GIS
3	Practical Tools on Restoration and Conservation of Protected Wetlands
4	Practical Tools on Sustainable Agriculture
5	Practical Tools on Soil and Water Conservation Measures
6	Practical Tools on Agroforestry
7	Practical Tools of Irrigated Agriculture on Non-Protected Wetlands
8	Practical Tools on Soil Productivity and Crop Production
9	Practical Technical Information on Low-cost Technologies: Composting Latrines & Rainwater Harvesting Infrastructure
10	Practical Tools on Water Monitoring Methods and Instrumentation
11	11.1 Practical Tools on Solid Waste Management of Imidugudu, Small Towns and Cities : Landfill and Composting Facilities
	11.2 Practical Tools on Small-scale Incinerators for Biomedical Waste Management

These tools are based on the compilation of relevant subject literature, observations, experience, and advice of colleagues in REMA and other institutions. Mainstreaming gender and social issues has been addressed as cross-cutting issues under the relevant themes during the development of these tools.

The Tool and Guideline # 6 provides practical information on agroforestry practices and methods.

These tools could not have been produced without the dedication and cooperation of the REMA editorial staff. Their work is gratefully acknowledged.

Dr. Rose Mukankomeje
Director General, Rwanda Environment Management Authority

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1. INTRODUCTION

1.1 Overview

Agroforestry is an integrated approach of using the interactive benefits from combining trees and shrubs with crops and/or livestock. It combines agricultural and forestry technologies to create more diverse, productive, profitable, healthy and sustainable land-use systems. In agroforestry systems, trees or shrubs are intentionally used within agricultural systems, or non-timber forest products are cultured in forest settings. Knowledge, careful selection of species and good management of trees and crops are needed to optimize the production and positive effects within the system and to minimize negative competitive effects.

Agroforestry systems can be advantageous over conventional agricultural and forest production methods through increased productivity, economic benefits, social outcomes and the ecological goods and services provided. Biodiversity in agroforestry systems is typically higher than in conventional agricultural systems.

Figure 1

Agroforestry also has the potential to help reduce climate change since trees take up and store carbon at a faster rate than crop plants.

Alley cropping in radical terraces is a form of intercropping, and can be applied by farmers as a strategy to combat soil erosion, to increase the diversity of farmland, as a means for crop diversification and to derive other integrated benefits. In this practice, crops are planted in strips in the terraces between rows of trees and/or shrubs. The potential benefits of this design include the provision of shade, retention of soil moisture, and increased in the structural diversity of the site for wildlife habitat. The woody perennials in these systems can produce fruit, fuel wood, and fodder.

Farmers have practised agroforestry for years. Agroforestry focuses on the wide range of working trees grown on farms and in rural landscapes. Among these are:

- Trees for land regeneration, soil health and food security;
- Fruit trees for nutrition;
- Fodder trees that improve smallholder livestock production;
- Timber and fuel wood trees for shelter and energy;
- Medicinal trees to combat disease; and
- Trees that produce gums, resins or latex products.

Many of these trees are multipurpose, providing a range of benefits. Agroforestry provides many livelihood and environmental benefits, including:

- Enriching the asset base of poor households with farm-grown trees;
- Enhancing soil fertility and livestock productivity on farms;
- Accessible fuel wood for farmers, protecting other areas from deforestation or depleted woodlands
- Linking poor households to markets for high-value fruits, oils, cash crops and medicines;
- Balancing improved productivity with the sustainable management of natural resources;
- Maintaining or enhancing the supply of environmental services in agricultural landscapes, for water, soil health, carbon sequestration and biodiversity.

In this era of global warming, fast degradation of land productivity and other environmental hazards, agroforestry is indeed a stake for natural resources and socio-economic sustainability.

Agroforestry can be found to be the most desirable strategy for maintaining social, economic and ecological sustainability in Rwanda. Agroforestry can be considered more as an approach than as a single, finished technology. Although several finished systems have been devised and tested, such technology may require adjustment for particular situations. The flexibility of the agroforestry approach is one of its advantages.

1.2 Purpose

The objective of this guide is to provide provides practical information on agroforestry practices and methods.

Although not intended to provide an exhaustive account of approaches and situations, this tool is intended to address capacity-building needs of officers by providing information on agroforestry. This tool can be used as field guides or as checklists of elements for discussion during training and during implementation of soil and water conservation approaches and forestry investments.

This document was produced to address REMA's proposed policy action to strengthen the resource capacity of environmental and related institutions at national and district level for environmental assessment, policy analysis, monitoring, and enforcement.

1.2 Gender and Social Issues

The different roles and responsibilities of women and men in agriculture are closely linked to environmental change and well-being. This is true both for how women and men affect the environment through their economic and household activities and how the resulting environmental changes affect people's well-being. Understanding these gender differences is an essential part of developing policies aimed at both better environmental outcomes and improved health and well-being.

Women play a critical role in the field of environment, especially in the management of plants and animals in forests, arid areas and wetlands. Rural women in particular maintain an intimate interaction with natural resources, the collection and production of food products, fuel biomass, traditional medicine and raw materials. Poor women and children especially may collect grasshoppers, larvae, eggs and birds' nests to sustain their families.

As their knowledge is transmitted through generations, girls and women often acquire a thorough understanding of their environment, and more specifically of its biodiversity. Their experience gives them valuable skills required for the management of the environment. Women have an important role to play in preserving the environment and in managing natural resources to achieve ecologically sustainable production. Despite women's assumed special relations to nature it should be stressed that all people depend on the environment and all should share the responsibility for sustainable use of water and other natural resources.

Challenges

- *Environment vulnerability:* The impacts of the degradation of the environment on people's everyday lives are not the same for men and women. When the environment is degraded, women's day-to-day activities, such as fuel and water collection, require more time, leaving less time for productive activities. When water becomes scarce, women and children in rural areas must walk longer distances to find water, and in urban areas are required to wait in line for long hours at communal water points. Despite their efforts, women living in arid areas tend to be categorised among the poorest of the poor, and have absolutely no means to influence real change. They are often excluded from participating in land development and conservation projects, agricultural extension activities, and policies directly affecting their subsistence. Men make most decisions related to cattle and livestock, and even in households headed by women, men still intervene in the decision-making process through members of the extended family. However, because of the important contribution of women, the fight against the degradation of arid areas requires a gender-inclusive approach.

- *Access To and Control over Resources:* Land tenure influences how different groups use natural resources. Women, the poor, and other marginalised groups are less likely to invest time and resources or adopt environmentally sustainable farming practices on land they do not own. Women's food crops are relegated to rented, steeply sloped land with eroding soils. Because tenure is not secure, women have little incentive to invest in soil conservation measures.

- *Watershed management:* Women do sometimes participate in watershed management, for example, by maintaining forest cover to reduce soil erosion which often floods and silts reservoirs and waterways. Training programmes on the technical and scientific aspects of watershed development including soil and water conservation measures and techniques on wetland restoration must include women. Women need the necessary skills, knowledge and confidence to participate in community decision-making and to assume leadership roles in management of watershed development. Gender analysis is need for all components of most watershed development activities.

Towards the Integration of Gender

Women's status in conserving biodiversity may be enhanced through the following types of actions to integrate gender concerns into environmental planning:

- Improve data collection on women's and men's resource use, knowledge of, access to and control over resources. Collecting sex-disaggregated information is a first step toward developing gender-responsive policies and programmes.
- Train staff and management on the relevance of gender issues to water resources and environmental outcomes.
- Establish procedures for incorporating a gender perspective in planning, monitoring, and evaluating environmental projects.

- Ensure opportunities for women to participate in decisions about environmental policies and programmes at all levels, including as designers, planners, implementers, and evaluators. Women need official channels to voice their environmental concerns and contribute to policy decisions.

Women and men around the world play distinct roles in managing plants and animals, in use of forests, drylands, wetlands and agriculture. Moreover, gender roles are differentiated in collecting water, fuel, and fodder for domestic use, and in generating income. Due to their distinctive engagements with the natural environment, women's experience and knowledge are critical for environmental management. Using a gender perspective and enabling the integration of women's knowledge of the environment will increase the chances of environmental sustainability.

2. AGROFORESTRY PRACTICES

2.1 Component of an Agroforestry System

In simplest language, agroforestry is the production of trees and of non-tree crops or animals on the same piece of land. The crops can be grown together at the same time, can be grown in rotation, or can even be grown in separate plots when materials from one are used to benefit another. However, this simple definition fails to take into account the integrated concepts associated with agroforestry that make this system of land management possibly the most self sustaining and ecologically sound of any agricultural system. Thus, a second definition of agroforestry would be the integration of trees, plants, and animals in conservative, long-term, productive systems.

Agroforestry systems make maximum use of the land. Every part of the land is considered suitable for useful plants. Emphasis is placed on perennial, multiple purpose crops that are planted once and yield benefits over a long period of time. Such benefits include construction materials, food for humans and animals, fuels, fibers, and shade. Trees in agroforestry systems also have important uses such as holding the soil against erosion and improving soil fertility (by fixing nitrogen or bringing minerals from deep in the soil and depositing them by leaf-fall).

Furthermore, well-designed systems of agroforestry maximize beneficial interactions of the crop plants while minimizing unfavourable interactions. The most common interaction is competition, which may be for light, water, or soil nutrients. Competition invariably reduces the growth and yield of any crop. Yet competition occurs in monoculture as well, and this need not be more deleterious in agroforestry than monoculture systems. Interactions between components of an agroforestry system are often complementary. In a system with trees and pasture, with foraging animals, the trees provide shade and/or forage while the animals provide manure.

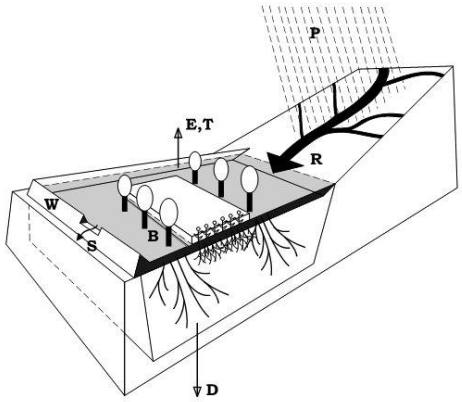

Figure 2

Figure 2 represents a schematic presentation of an agroforestry system under runoff conditions. Precipitation (P) generates surface runoff (R) on hill slopes, which accumulates into natural tributaries feeding a level runoff basin (B). The collected runoff water is trapped by a retaining wall (W) allowing the water to percolate into the soil profile (D). The stored water is transpired (T) by deep rooting trees and shallow rooting annuals, while looses by evaporation (E) and deep percolation are minimized. The built-in spillway (s) controls surplus water.

Agroforestry systems limit the risks and increase sustainability of both small- and large-scale agriculture. Agroforestry systems may be thought of as principle parts of the farm system itself, which contains many other sub-systems that together define a way of life.

The components of the agroforestry system practiced by the farmers are mainly woody perennials (forest and fruit trees) and agricultural crops (rice, vegetables) with grass in fallow areas. Woody perennials are raised in farm forests/tree farms on the upper slopes, along farm boundaries, within the home lots, or on the edges of terraces, bunds or alleys. Agricultural crops are planted on the terraces, bunds or paddies found on level areas and along the lower to middle slopes. Trees are grown for their productive and protective functions. Farmers plant trees as sources of timber, fuel wood, and food both for home consumption and for commercial purposes.

The protective services of trees include restoring or maintaining soil fertility through nutrient cycling; soil and water conservation; preventing excessive soil erosion; modifying microclimate and providing shade; and as live fence and wind breaks. Agricultural crops are grown on the terraces mainly for food and cash at subsistence levels. Some terraces along the middle slopes are left to fallow with grass as the main vegetation to allow the soil to regain its fertility and until the farmer has enough resources (labour and capital) to cultivate them again. They do not have specific time frames for leaving the grassy terraces under fallow.

Figure 3

These are the main components:

- *Land:* Agroforestry is a system by which land is managed for the benefit of the landowner, environment and long-term welfare of society. While appropriate for all landholdings, this is especially important in the case of hillside farming where agriculture may lead to rapid loss of soil. If the farmer owns the land, he or she has a vested interest in thinking conservatively, how the land can be maintained over long periods of time. Unfortunately, farmers who rent land may have less interest in the long-term benefits of agroforestry and may even fear that making improvements will raise the rent or result in the lease being terminated.

- *Trees:* In agroforestry, particular attention is placed on multiple purpose trees or perennial shrubs. The most important of these trees are the legumes because of their ability to fix nitrogen and thus make it available to other plants. The roles of trees on the small farm may include the following:
    - Sources of fruits, nuts, edible leaves, and other food.
    - Sources of construction material, posts, lumber, branches for use as wattle (a fabrication of poles interwoven with slender branches etc.) and thatching.
    - Sources of non-edible materials including sap, resins, tannins, insecticides, and medicinal compounds.
    - Sources of fuel.
    - Beautification.

- Shade.
- Soil conservation, especially on hillsides.
- Improvement of soil fertility.

Figure 4

In order to plan for the use of trees in agroforestry systems, considerable knowledge of their properties is necessary. Desirable information for each species includes its benefits, adaptability to local conditions (climate, soil, and stresses), the size and form of the canopy and root system, and suitability for various agroforestry practices. Some of the most common uses of trees in agroforestry systems are:

- Individual trees in home gardens, around houses, paths, and public places.
- Dispersed trees in cropland and pastures.
- Rows of trees with crops between (alley cropping).
- Strips of vegetation along contours or waterways.
- Living fences and borderlines, boundaries.
- Windbreaks.
- Improved fallows.
- Terraces on hills.
- Small earthworks.
- Erosion control on hillsides, gullies, channels.
- Woodlots for the production of fuel and timber.

- *Non-trees:* Any crop plant can be used in agroforestry systems. The choice of crop plants in designing such systems should be based on those crops already produced in a particular region either for marketing, feeding animals, or for home consumption, or that have great promise for production in the region. In keeping with the philosophy of agroforestry, however, other values to be considered in crop selection include proper nutrition, self-sufficiency and soil protection. Thus, selection of crops requires a judgment based on knowledge of the crops, adaptations, production uses, as well as family needs, opportunities for barter, and markets.

Any farm animal can be used in agroforestry systems. The choice of animal will be based on the value the farmer places on animal-derived benefits including income, food, labour, non-food products, use of crop residues, and manure.

2.2 Common Agroforestry Species in Rwanda

The next table provides information on common Agroforestry species used in Rwanda. These species are common in Rwanda and in accordance with technical production capacities such as the characteristics of soils, climate, and natural ecosystems.

Table 1 : Common Agroforestry Species

SPECIES	*FACTSHEET & REFERENCES*	*PHOTO*
Calliandra calothyrsus	- *Calliandra calothyrsus* is a small, thornless, often multi-stemmed shrub. Under optimum conditions it can attain a height of 12 m and a trunk diameter of 30 cm, but its average height is 5-6 m and diameter 20 cm. - A multipurpose species grown primarily for forage as a supplement to low quality roughages for ruminant livestock. - *C. calothyrsus* can be used to rehabilitate erosion-prone areas and recover land exhausted by agriculture, where it easily dominates undesired weeds such as *Eupatrium spp*., *Saccharum spp*., and *Imperata cylindrica*. - Roots are able to fix atmospheric nitrogen because of the symbiosis with Rhizobium bacteria (to which root nodules bear witness) and the symbiosis with root fungus. - High leaf biomass production and high yields of protein leaf material on less fertile soils make it very suitable as a green manure and it is used in alley-cropping systems. - C. calothyrsus is compatible with crops, with both deep roots and extensive fibrous roots. Additional information: http://www.worldagroforestry.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=410	
Cedrela serrata	- *Cedrela serrata* is a moderate-sized deciduous tree, in favourable situations attaining a height of 30 m and a girth of up to 3.3 m. - The leaves and young shoots are lopped for cattle fodder. - The wood is used for furniture, poles, and other uses. - Planted as a shade tree in tea plantations and also in coffee plantations. Additional information: http://www.worldagroforestry.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=496	
Grevielle robusta	- *Grevillea robusta* is a deciduous medium-sized to large tree 12-25 (max. 40) m tall; crown conical, dense, with branches projecting upwards. - The golden flowers are attractive to bees, making it an important honey plant. - Used as shade tree in coffee and tea plantations. Its spreading branching system makes it ideal for windbreaks or shelterbelts against wind-induced mechanical damage, high rates of transpiration and surface evaporation. - A deep rooting system causes little interference with shallow-rooted crops, and it can be successfully intercropped with banana, tomato and other agricultural crops.	 Additional information: http://www.worldagroforestry.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=921

Leucaena diversifolia	- *Leucaena diversifolia* is a tree or erect shrub, 3-20 m tall, with a single-stemmed bole 20-50 cm in diameter, slender and clear up to 10 m in height, ascending branches with horizontal twigs. - Soil erosion can be controlled effectively by planting *L. diversifolia*. - Its light crown makes *L. diversifolia* an ideal species for shade over perennial crops such as coffee. - Planted for soil amelioration and stabilization i.e. nitrogen fixing. Additional information: http://www.worldagroforestry.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=1068	
Mimosa scabrella	- *Mimosa scabrella* is a small- to medium-sized tree 4-12 (max. 20) m high, with a tall, straight, slender trunk 10-50 cm in diameter in forest, or short and branched, with dense rounded crown of grey foliage, or a large shrub. - Abundant flowering make it excellent for honey production. - Produces high-quality firewood; however, the charcoal produces a large amount of ash. - Shade or shelter: *M. scabrella* is used as a shade tree for highland coffee plantations. - The tree is able to fix atmospheric nitrogen. - Throughout the year, it sheds large quantities of nitrogen-rich leaves that decompose rapidly and form rich humus. - Often found growing in association with maize and beans.	 Additional information: http://www.worldagroforestry.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=1157
Moringa oleifera	- *Moringa oleifera* is a small, graceful, deciduous tree with sparse foliage, often resembling a leguminous species at a distance, especially when in flower, but immediately recognized when in fruit. The tree grows to 8 m high and 60 cm dbh. - The leaves, a good source of protein, vitamins A, B and C and minerals such as calcium and iron, are used as a spinach equivalent. - *M. oleifera* is suited to areas where strong winds and long, dry spells occur simultaneously, causing serious soil erosion. The green leaves make a useful mulch. - *M. oleifera* provides wind protection, shade and support for climbing garden plants. - The tree provides semi-shade, useful in intercropping systems where intense direct sunlight can damage crops.	 Additional information: http://www.worldagroforestry.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=1169
Alnus acuminate	- *Alnus acuminata* grows to 30 m and 50 cm diameter at breast height at 30 years of age. - The palatable, nitrogen-rich leaves make a useful source of emergency fodder. - Reputed to be good for firewood. - Useful for reforestation, soil reclamation on slopes and reclamation of unstable soils, as it grows well on slopes and the roots are lateral and extended rather than deep and confined. - *A. acuminata* is a nitrogen-fixing species. - *A. acuminata* are the supply of organic matter and the control of soil moisture due to its shade.	 Additional information: http://www.worldagroforestry.org/sea/Products/AFDbases/af/asp/SpeciesInfo.asp?SpID=194

The next table provides with cost estimates for each of these species based on the ISAR (Institut des Sciences Agronomiques du Rwanda) 2010 price list.

Table 2 : 2010 Price List

SPECIES	*LOCAL PRICE (RFW)*
1. Calliandra calothyrus	12 420
2. Cedrela serrata	10 000
3. Grevillea robusta	25 000
4. Leucaena diversifolia	5 240
5. Mimosa scabrella	33 000
6. Moringa oleifera	15 000
7. Alnus acuminata	43 520

2.3 Management of Agroforestry Species

The trees and scrubs are managed to reduce the competition with crops for nutrients, water and light. The management methods differ from one species to another. Generally, scrubs and trees are cut at 20-50cm from the ground level and will rejuvenate every six months. The cut products can serve many purposes such as:

- Stakes a used for climbing beans;
- Leaves are used as fodder for livestock;
- Leaf biomass are used as green manure; and
- Wood biomass is used for firewood.

2.4 Agroforestry Planning Steps

Steps are required to plan and provide landowners and farmers how to successfully integrate an Agroforestry Practice to their farm. The planning process will help develop a familiarity with the management that is required in order to reach the goals, objectives, benefits and economics that are desired. The development of a plan for integrating agroforestry practices to the farm system is as important as the actual establishment of the practice itself. Planning – and the development of a timeline -- will help maximize the chances for the success of the agroforestry practice. Planning will not only assist in understanding how the practice and its placement on the landscape can accomplish specific on farm goals, but will provide assistance in identifying market opportunities for products that may be grown in the practice. These are the key planning process questions that are required in order to plan an agroforestry practice and productive component of the farm system.

1. Decide whether agroforestry systems are appropriate:
   - Describe farmer and community needs.
   - List the needs that could be met with an agroforestry system.
   - List the potential benefits, and their relative importance, of an agroforestry system in the region in question.
   - Find the limiting constraints in agriculture, including markets and marketing.
   - Consider whether the people of the region are willing or capable of adopting a system.
   - Then decide if it is worth the effort to develop one.

2. Design a system:
   - Select the area.

- Characterize its strengths and weaknesses with respect to existing soil, water, and crops.
- Select the trees, shrubs, or grasses to be used (refer to Section 2.2 for common species in Rwanda)
- Characterize the minimum space requirements, water and fertilizer needs, and shade tolerance of the desired crops.

3. If the system is temporary:
   - Plan the features of soil erosion control, earthworks, and gully maintenance first.
   - Plan spacing of scrubs or trees according to final spacing requirements.
   - Plan a succession of annual or short-lived perennials, selecting the most shade tolerant
   - Crops for the final years of intercropping.

4. If the system is permanent:
   - Plan the proportion of the permanent fruit and lumber trees on the basis of relative importance to the farmer.
   - Plan the spacing of long-term trees on the basis of final space requirements.
   - Plan succession of annual and perennial understory crops, including crops for soil
   - Protection and enrichment.
   - As large permanent trees grow, adjust planting plan to place shade tolerant crops in most shady areas.

5. With both temporary and permanent systems:
   - Always keep the ground covered, using various crops-to protect soil from sun and erosion.
   - Try the system on a small scale first.
   - Measure the inputs and outputs of the system.
   - Evaluate whether the benefits expected have been achieved.
   - Expand or extend any new system cautiously.

2.5 Benefits of Agroforestry

The concept of sustainable forest management recognizes the connections among the health of forests, communities, the economy, and the environment. Sustainable forest management implies viewing the forest as an integrated whole rather than as the source of any one economic product or service (for example, timber or climate regulator). Sustainable forest management respects and integrates the full range of forest environmental, social, and economic values. The introduction and strengthening of sustainable forest management schemes, includes meaningful participation and benefit sharing by forest users, clear and respected tenure and use rights, sustainable market chain, development and implementation of forest management plans, and reforestation. Rwandan national policies and strategies provide a framework for increased efforts, including the development and strengthening of institutions and programs for forest management, protection, and sustainable development.

Figure 5

While the woody perennials and agricultural crops individually provide productive and protective services to the farmers, they also interact with each other as components of the agroforestry system. The woody perennials in farm forests may conserve and sustain water supply as a watershed while preventing massive soil erosion and landslides that would otherwise adversely affect the terraces below.

In turn, the terraces provide short-term economic services to the farm forests through the cash income that allows the farmers to continue maintaining the forests instead of cultivating the upper slopes. The terrace farms interact with fallow areas also through the short-term economic benefits from the terrace products that allow the farmers to leave the fallow areas to regain soil fertility. Grass fallows, in turn, provide ecological benefits through improved soil fertility in the long run that would increase farm productivity once they are again cultivated. Grass in fallow areas also helps prevent excessive movement of soil down to the lower terraces. Some fallow areas provide grass for livestock that some farmers raise for food and cash income. The forests can also provide economic benefits in the long-term with the cash income from products that will be sold and provide additional financial capital for the farmers to improve terrace farm productivity.

These are some of the benefits for agroforestry systems:

- Improved year-round production of food and of useful and salable products;
- Improved year-round use of labour and resources;
- Improved biodiversity;
- Reduction in water pollution;
- Protection and improvement of soil (especially when legumes are included) and water sources;
- Increased efficiency in use of land;
- Short-term food production offsetting cost of establishment of trees;
- Furnishing of shade for vegetable or other crops that require or tolerate it;
- Medium and long-term production of fruits;
- Long-term production of fuel and timber.

Annex 1: References and Useful Resources

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- Agroforestry Extension Manual for Kenya, 1994, International Centre for Research in Agroforestry (ICRAF), (http://opentraining.unesco-ci.org/cgi-bin/page.cgi?g=Detailed%2F2619.html;d=1)
- World Agroforestry Tree Database, The World Agroforestry Centre (formerly the International Center for Research in Agroforestry, or ICRAF) is located in Nairobi, Kenya, and provides information on including a tree component in farming systems. Like CIFOR, this center is a member of the CGIAR system. Its offerings include an "agroforestree" database, useful for screening specific tree species' suitability for application in different countries. http://www.worldagroforestry.org/
- 43 agroforestry species grown in Rwanda are found in the World Agroforestry Tree Database. *Click on the current name for information on species.*

Acacia koa	Albizia adianthifolia	Albizia lebbeck
Alnus nepalensis	Artocarpus heterophyllus	Azadirachta indica
Bridelia micrantha	Calliandra calothyrsus	Cedrela serrata
Chamaecytisus palmensis	Chrysophyllum cainito	Coffea arabica
Crotalaria juncea	Croton megalocarpus	Dichrostachys cinerea
Ekebergia capensis	Erythrina abyssinica	Euphorbia tirucalli
Ficus glumosa	Ficus sycomorus	Ficus thonningii
Flacourtia indica	Hagenia abyssinica	Kigelia pinnata
Leucaena diversifolia	Macaranga kilimandscharica	Maesopsis eminii
Millettia dura	Mimosa scabrella	Newtonia buchananii
Olea capensis	Parinari curatellifolia	Persea americana
Podocarpus falcatus	Polyscias fulva	Sapium ellipticum
Schefflera volkensii	Securidaca longepedunculata	Sesbania sesban
Tecoma stans	Vernonia amygdalina	Ximenia americana
Zanthoxylum chalybeum		

- The Forest Stewardship Council (International) http://www.fsc.org/en/ have extensive information on forest certification.
- The Center for International Forestry Research (CIFOR) is located in Bogor, Indonesia. It is part of the Consultative Group on International Agricultural Research (CGIAR) system, and is a useful source of up-to-date information on sustainable forest management. http://www.cifor.cgiar.org
- The World Wildlife Fund-World Bank Forest Alliance is a partnership to promote forest conservation and best practices in forest management. http://www.worldwildlife.org/what/globalmarkets/forests/worldbankalliance.html

- The UN Food and Agriculture Organization (FAO) Forestry Department in Rome has long been a center of excellent information for forestry sector development in the developing world. Their INFOSYLVA database offers a summary of forestry sector statistics and information on a country-by-country basis. See the database at http://www.fao.org/forestry/infosylva/en/ or contact the Forestry Department, Community Forestry-Oriented Forests, Trees and People Programme at http://www.fao.org/forestry/index.jsp
  The FAO also has a list serve on Reduced Impact Logging that is conducted in French. Subscribe at:
  http://www.fao.org/forestry/foris/webview/forestry2/index.jsp?siteId=1100&sitetreeId=1980&langId=1
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