



POPULAR ARTICLE

Agroforestry: Growing trees with crops for a greener and safer environment

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Intricacies of the subject

Agroforestry is a land-use system in which trees or shrubs are deliberately integrated with agricultural crops and/or livestock on the same farm or landscape. It combines the benefits of agriculture and forestry and can improve farm productivity while conserving natural resources. For small and marginal farmers, agroforestry can provide food, fodder, fuelwood, fruits, timber, income and environmental protection from the same piece of land.

Introduction

Agroforestry is important because it provides several environmental, economic, and social benefits. Tree roots bind the soil and reduce erosion caused by rain and wind, while leaf litter adds organic matter and improves soil structure. Trees also recycle nutrients from deeper soil layers, and leguminous tree species can improve soil fertility through biological nitrogen fixation. Agroforestry helps conserve water by improving water infiltration, reducing surface runoff, and maintaining soil moisture through tree canopies and litter. It contributes to climate-change mitigation by absorbing carbon dioxide and storing carbon in tree biomass and soil, while also increasing climate

resilience by providing shade, reducing wind speed, and moderating the farm microclimate. Trees support biodiversity by providing food and shelter for birds, beneficial insects, pollinators, and other organisms. Farmers can also earn additional income from fruits, fodder, fuelwood, timber, poles, fibre, and other tree products. By combining crops, trees, and livestock, agroforestry reduces production risks and provides alternative sources of food and income when one component performs poorly. Fodder trees and shrubs can support livestock, especially during periods when green fodder is scarce. Furthermore, tree-based systems can help rehabilitate degraded land by improving vegetation cover, soil organic matter, and water management. Overall, agroforestry promotes sustainable agriculture while improving soil health, conserving natural resources, supporting livelihoods, and protecting the environment.

Different agroforestry systems

Agroforestry systems can be classified according to the combination of trees, crops, pasture and livestock. Agroforestry systems can be classified according to the combination of trees, crops, pasture, and livestock. The agri silvicultural system combines agricultural crops and trees, for example, maize + trees,



cotton + trees, sorghum + trees, and pulses + timber/fodder trees. Trees may be planted field boundaries, in rows, or at suitable spacing within agricultural fields, providing food crops along with timber, fuelwood, fodder, and environmental services. The silvopastoral system combines trees, pasture or forage, and livestock, such as fodder trees + grasses + cattle and trees + pasture + sheep/goats. Trees provide shade and fodder, while pasture provides grazing material for livestock, resulting in improved livestock production, fodder availability, shade, and soil conservation. The agrosilvopastoral system combines trees, agricultural crops, and livestock or pasture. For example, farmers may grow crops between suitable trees while maintaining fodder grasses and livestock, providing food, fodder, fuelwood, timber, and livestock products from the same farm. The Agri-Horticultural System combines agricultural crops and fruit trees, with examples such as mango + pulses, aonla + cereals, guava + vegetables, and citrus + intercrops. During the early years of fruit-tree establishment, suitable annual crops can be grown between the tree rows, providing both annual crop income and long-term income from fruits. The horti-silvicultural system combines fruit trees with timber or multipurpose trees and is useful for obtaining

both fruit and tree products, while the silvi-horticultural system combines timber or multipurpose trees with horticultural crops such as fruits and other horticultural plants. The multipurpose tree production system involves deliberately growing trees that provide several products and services, such as fodder, fuelwood, timber, fruits, poles, green manure, and shade, and is particularly useful for small farms where one tree can serve several purposes. The home-garden system is a highly diverse agroforestry system around the household and may contain fruit trees, vegetables, spices, medicinal plants, timber/fodder trees, and livestock. It provides food and useful products throughout the year and makes efficient use of household space. In the boundary plantation system, trees are planted along the boundaries of agricultural fields while the main area is used for crop production. Windbreaks and shelterbelts: windbreaks and shelterbelts are agroforestry systems in which trees and shrubs are planted in rows to protect agricultural fields from strong winds. They help reduce wind speed, thereby reducing soil erosion and protecting crops from wind damage. They also improve the microclimate of the farm and help conserve soil moisture. Overall, windbreaks and shelterbelts provide an effective method of protecting agricultural land and crop growth.

Table 1: Classification of agroforestry system

Agroforestry system	Main components
Agrisilvicultural	Crops + Trees
Silvopastoral	Trees + Pasture + Livestock
Agrosilvopastoral	Crops + Trees + Livestock
Agri-horticultural	Crops + Fruit trees
Horti-silvicultural	Fruit trees + Timber trees
Silvi-horticultural	Timber trees + Horticultural crops
Home garden	Trees + Crops + Vegetables + Livestock
Boundary plantation	Trees on field boundaries
Windbreak/Shelterbelt	Trees + Shrubs in protective rows



Agroforestry and farmers' livelihoods

Environmental protection becomes more sustainable when farmers also receive economic benefits. Agroforestry can provide farmers with multiple products such as fruits, timber, fodder, fuelwood, fibre and other tree products. The combination of different crops and tree products can also diversify farm income and reduce dependence on a single agricultural commodity.

Suitable agroforestry practices

Depending on soil, rainfall, climate, market demand and farm size, farmers can consider:

- Boundary plantation – trees planted along field boundaries.
- Windbreaks and shelterbelts – rows of trees to reduce wind speed.
- Agri-horti systems – fruit trees combined with agricultural crops.
- Agri-silvicultural systems – trees grown along with annual or seasonal crops.
- Silvopastoral systems – trees integrated with livestock and pasture.
- Home gardens – a mixture of fruit, vegetable, medicinal and multipurpose plants.
- Farm woodlots – trees grown for timber, fuelwood or other products.
- Alley cropping – crops cultivated between suitable rows of trees or shrubs.

Choose the right tree – a key to success

Agroforestry does not mean planting any tree anywhere. The right tree in the right place is essential. Before planting, farmers should consider soil type and rainfall, rooting pattern of the tree, canopy size and shade intensity, competition for water and nutrients, crop compatibility, local market demand,

availability of quality planting material, growth period and expected returns, and local regulations, where applicable. Poorly designed systems can create excessive competition between trees and crops and may reduce crop yields. FAO therefore emphasizes that agroforestry systems need to be appropriately designed and managed according to local conditions.

Agroforestry: A green investment for the future

The real strength of agroforestry is that it connects production with conservation. A farmer can produce food while simultaneously building soil health, conserving water, increasing tree cover, supporting biodiversity and storing carbon. Agroforestry should not be viewed simply as “planting trees on farmland.” It is a planned farming system in which trees, crops, livestock, soil, water and farmers work together.

Conclusion

Agroforestry is a sustainable land-use approach that combines trees with crops, livestock and other farm components. It helps improve soil health, conserve water, reduce erosion and support biodiversity. At the same time, farmers can obtain additional income through fruits, timber, fodder, fuelwood and other tree products. Proper selection of tree species and suitable system design are essential to avoid competition with crops. Agroforestry can also improve farm resilience to climate variability and environmental stresses. With scientific planning and proper management, it can contribute to both farm productivity and environmental protection. Thus, agroforestry offers a practical pathway towards greener, more diverse and sustainable farming systems.



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