

CLASSIFICATION OF AGROFORESTRY SYSTEMS

Mirza Hasanuzzaman

Assistant Professor

Department of Agronomy,

Sher-e-Bangla Agricultural University

Concept

In order to get clear and complete understanding on agroforestry and its different systems as well as for their further improvement, it is necessary to classify them according to some modern criteria. Since all agroforestry systems refer distinct agroforestry practices in which agriculture (crops), forestry (trees) and pastures (animals) uses of land are combined either temporally or spatially where the arrangement of different types of components e.g., crops, animals perennial trees etc and the level of interaction between the components are distinct for individual agroforestry systems. However, one system differs from the other in respect of structure, composition, age, intensity, technologies, inputs etc.

The main purposes of classification should be provide a practical framework for the synthesis and analysis of information about existing systems and the development of new and promising ones. Therefore any classification scheme should include the following criteria:

- Include a logical way of grouping the major factors on which productions of the system will depend.
- Indicate how the system is managed.
- Offer flexibility in regrouping the information.
- Be easily understood and readily handled.

Basis of the Classification

Nair (1987) used four basis for classification of different agroforestry systems. These are:

- the structure of the system (composition and arrangement of components)
- function of the system (role and output of components)
- the socio-economic scale and level of management
- ecological spread (ecological zones where the system exists)

Later on Dwivedi (1992) reorganizes this basis into seven as follows:

- Structure
- Physiognomic
- Function
- Floristic
- Socio-economic
- History
- Ecological

For Bangladesh conditions, the working scientists include "land utilization" as another basis for classification of agroforestry.

- **Structural basis:** refers to the composition and arrangement of the components including spatial and temporal arrangement of the different components.
- **Functional basis:** refers to the major function or role of the components, usually furnished by the woody components.
- **Socio-economic basis:** refers to the level of inputs management (low input, high input) or intensity or scale of management and commercial goals (subsistence, commercial and intermediate).
- **Ecological basis:** refers to the environmental condition and ecological suitability of systems based on the assumption that certain ecological conditions; i.e., there can be separate sets of agroforestry systems for arid and semi-arid lands, tropical highlands, lowlands humid tropics etc.
- **Physiognomic basis:** physiognomy refers to characters of vegetation, such as xeromorphic, mesomorphic and hydromorphic.
- **Floristic basis:** refers to species composition widely adopted in different regions may be taken into consideration for floristic classification.
- **Historical classification:** refers to the agroforestry systems that evolved over time due to the spread of knowledge.
- **Land use basis:** land use pattern in the course of adoption of agroforestry under Bangladesh condition is being used as a basis of classification of agroforestry.

A. Structural classification

Structure refers to composition, stratification and dimension of crops.

a. Based on the nature of the composition:

- i. **Agrosilvicultural system:** Agrosilvicultural system refers to the use of land for the production of agricultural and forest crops, either simultaneously or alternately, e.g., intercropping of a forest plantation with agricultural crops, growing agricultural tree crops with forest trees.
- ii. **Silvopastoral system:** Silvopastoral system refers to a land management system in which forests are managed for the production of wood, as well as, for rearing of domestic animals, e.g. Forests with grasses.
- iii. **Agrosilvopastoral system:** Agrosilvopastoral system is the combination of Agrosilvicultural and Silvopastoral system, e.g. Forest with agricultural crops and grazing lands.
- iv. **Others (multipurpose tree plantation system):** This group refers to the management of forest to yield fuel wood, timber, fodder, fruits, medicine etc. there are different types of trees to yield different products.

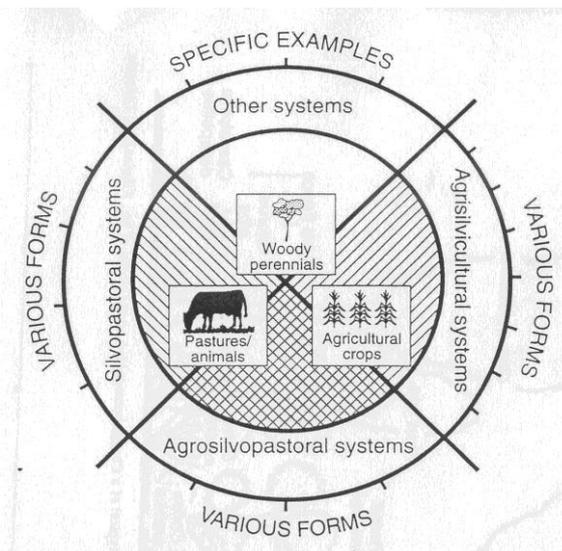


Fig: Classification of Agroforestry systems based on the nature of composition

b. Classification based on dominance of components:

On the basis of dominance of components, the system is further classified into the following categories:

- i. **Silvoagricultural:** Here silviculture is the primary aim of land use. Trees constitute the major component while agricultural crops are integrated with them, e.g., shifting cultivation, taungya cultivation.
- ii. **Agrosilviculture:** Agriculture is the primary (major) components and the trees are secondary, e.g., multi purpose trees on farm land, hedgerow or alley cropping, intercropping of trees, home gardens.
- iii. **Silvopasture:** Trees constitute the primary (major) component of land use with pastures as secondary, e.g., most grazing land in forests.
- iv. **Pastoral silviculture:** pasture is a primary component while the tree is secondary, e.g., grazing lands.
- v. **Agrosilvopasture:** It is a combination of crops trees and pastures. Both crops and trees are dominant over pasture.
- vi. **Silvoagropasture:** It is a combination of trees, crops and pastures; trees are dominant over other components.

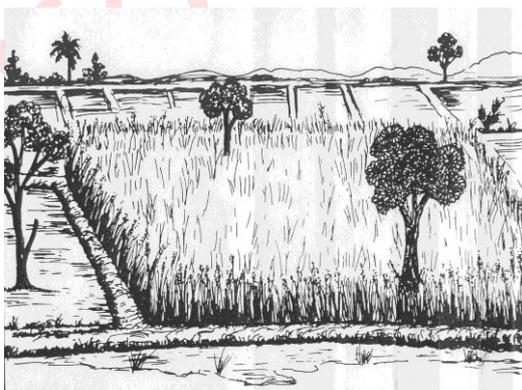


Fig. Trees in crop field

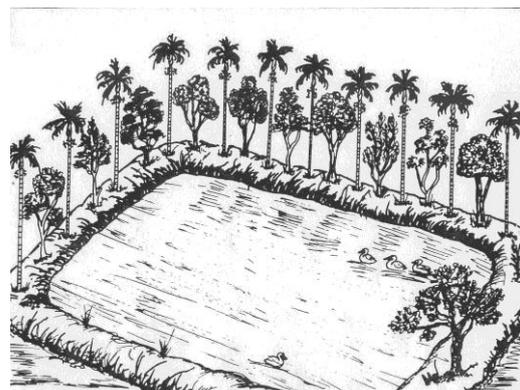


Fig. Trees with fish culture

c. Based on the arrangement of the components:

Arrangement of components can involve the dimensions of space and time. Based on the arrangements of the components Agroforestry systems can be classified as:

- In space or spatial arrangement
- In time or temporal sequence
- Vertical stratification of components

i. Classification of Agroforestry systems on the basis of in space or spatial arrangement:

- **Mixed dense:** different components are arranged together with high density, e.g., home garden.
- **Mixed sparse:** different components are arranged together with low density, e.g., most systems of trees in pastures, scattered trees on agricultural lands.
- **Strip plantation:** width of strip to be more than one tree e.g., Alley cropping. Boundary plantation: trees on edges of plots/fields.

ii. Classification of Agroforestry systems on the basis of in time or temporal sequence:

- **Coincident:** it occurs when different crops occupy the land together, e.g., Tea/Coffee under tree, pasture under trees.
- **Concomitant:** when different components stay together for certain period, e.g., Taungya system.
- **Intermittent:** when annual crops are grown with perennial ones, e.g., Rice under coconut trees or other MPTs, seasonal grazing of cattle in pastures under trees.
- **Interpolated:** when different components occupy the space during different times, e.g., Homegarden.
- **Separate:** when components occupy space at different times, e.g., improved „fallow“ species in shifting cultivation.

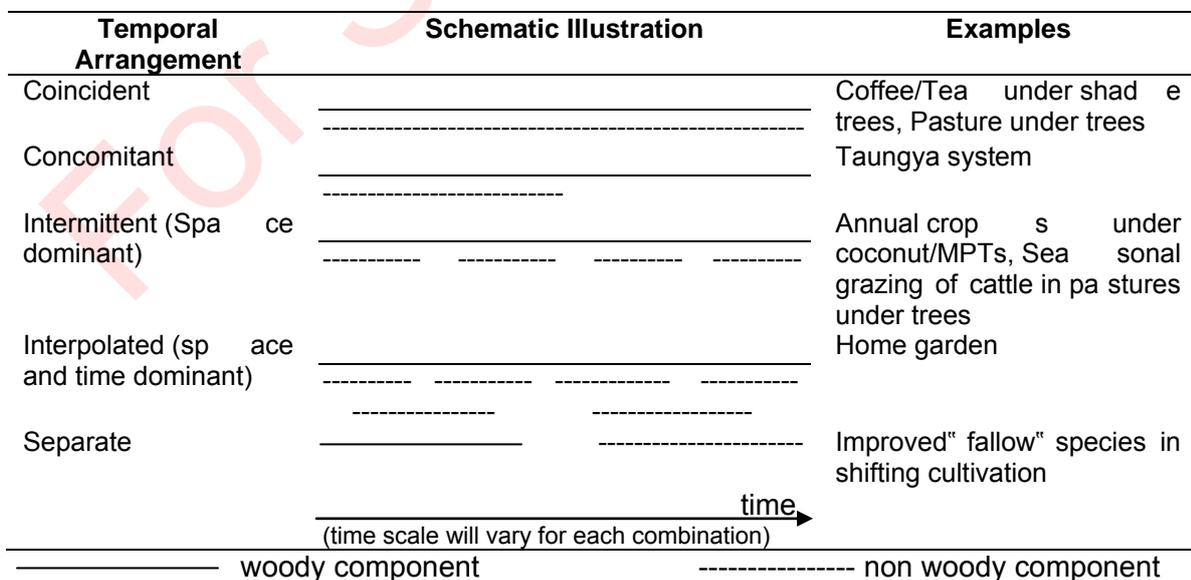


Fig. 2. Arrangement of components (in time) in Agroforestry systems.

d. Classification based on stratification:**a. On the basis vertical stratification:**

- **Single layered:** the major components usually grow in one layer or storey, e.g., tree garden.
- **Double layered:** the components are grown in two layers, e.g., tea/coffee under shade tree.
- **Multilayered:** different components are grown in different layers, e.g., homestead agroforestry.

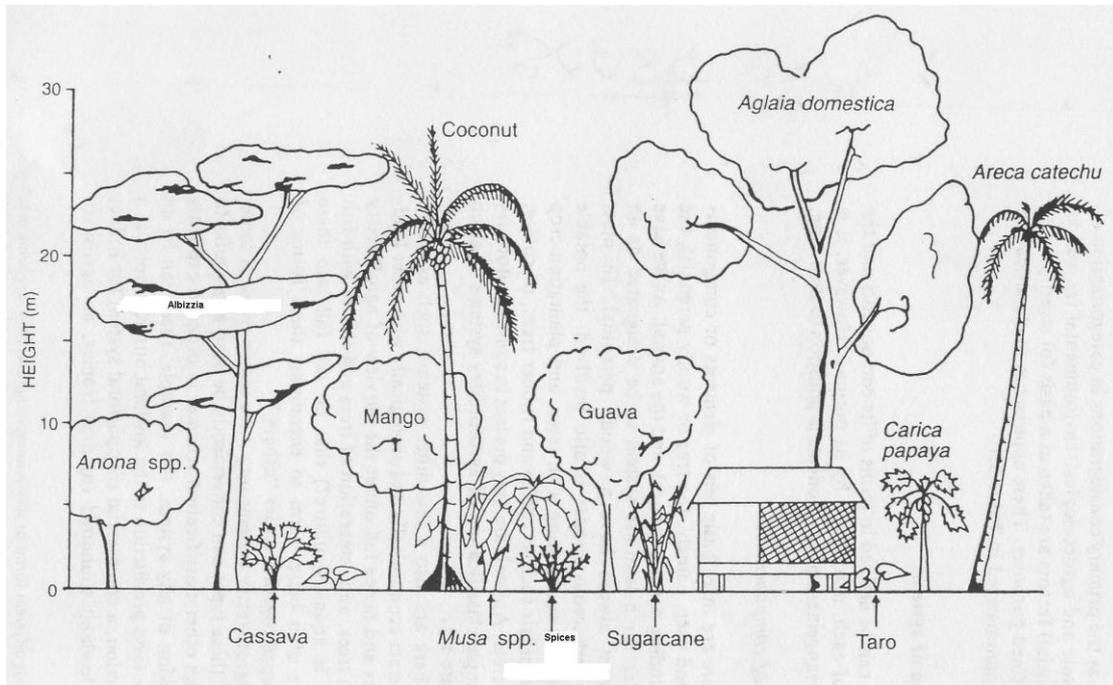


Fig. A multilayered Agroforestry System

b. On the basis of spacing

- **Dense:** The plant population is high per unit area, e.g., monoculture plantation forest, boundary plantation.
- **Scattered:** The components are grown sparsely or scattered, e.g., agrosilviculture.
- **Mixed intercropping:** Different components are grown together, e.g., growing of field crops and horticultural crops in dryland forest.

B. Functional classification

On the basis of various functions the Agroforestry systems are classified into followings:

a. Productive Agroforestry system: this system refers to the production of essential commodities, required to meet the basic needs of the society. It includes intercropping of trees, home gardens, plantation of trees in and around the crop field, production of animals and fishes in association with trees. Productive functions are as follows:

- Food
- Fodder
- Fuel wood
- Other woods
- Other products

b. Protective Agroforestry system: This system refers to protect the land, to improve climate, reduce wind and water erosion, improve soil fertility, provide shelter, and other benefits, e.g., windbreaks. Protective functions are as follows:

- Windbreak
- Shelter belt
- Soil conservation
- Moisture conservation
- Soil improvement
- Shade (for crop, animal and man)



Fig. Living fences

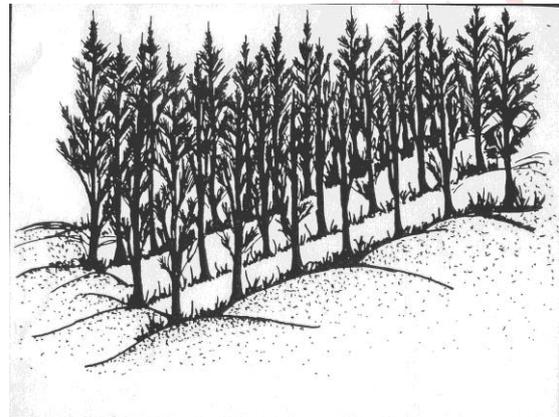


Fig. Shelter belt

c. Multipurpose agroforestry system: It ensures multipurpose production through optimizing both productive and protective functions, e.g., hedgerow intercropping, Home garden.



Figure: Home garden (A multipurpose Agroforestry System)

C. Physiognomic classification

Physiognomic classification is based on the characteristics of vegetation in relation to water. This classification includes the following system:

- i. **Hydromorphic agroforestry system:** It refers to agroforestry in the wet lands or in waterlogged areas, e.g., aquaforestry, paddy cultivation with fish culture.
- ii. **Xeromorphic agroforestry system:** It is the dryland agroforestry in arid and semi-arid areas, e.g., Agroforestry practices in Africa.
- iii. **Mesomorphic agroforestry system:** It is the agroforestry system where water is available in optimal quantity, e.g., Agroforestry followed in Bangladesh.

D. Ecological classification

The Agroforestry system is related to various ecological factors. It can be classified on the basis of important ecological parameters (climatic, edaphic and physiographic ones). On the basis of ecological parameters, it can be classified as:

- a) **Tropical:** vegetation in extreme climate, such as, high temperature, low humidity, and scarcity of water etc., e.g., Tropical silvopasture.
- b) **Sub-tropical:** vegetation in suitable climatic condition, e.g., Agroforestry practices in the sub-tropical regions including Bangladesh.
- c) **Temperate:** vegetation in low temperature, e.g., silvopasture or pastoral silviculture in temperate regions.
- d) **Sub-alpine:** vegetation in low and medium mountainous regions, e.g., natural or artificial forest vegetation in low or medium mountains.
- e) **Alpine:** vegetation in high mountainous regions, e.g., natural forest vegetation in high altitude.

E. Socio-economic classification

On the basis of socio-economic considerations, the Agroforestry systems are classified as:

- a) **Subsistence Agroforestry system:** It aims at meeting the basic needs of small family having less holding and very little capacity for an investment. There may be some marginal surplus production for sale, e.g., shifting cultivation, scattered trees in the farms, homestead Agroforestry.
- b) **Commercial Agroforestry system:** It refers to large-scale production on commercial basis. The main consideration is to sell the products, e.g., tea/coffee under shade tree.
- c) **Intermediate Agroforestry system:** It is an intermediate between commercial and subsistence systems. It is practiced on small medium sized farms. The system aims at the production of items, which are not only enough to meet the needs of the family, but to earn money the surplus can be sold.

The socio-economic Agroforestry system may further be classified on the basis of management and technology used.

On the basis of management:

- i. **Intensively managed system:** Agroforestry systems are intensively managed for more production per unit area, e.g., Home gardens, trees with agricultural crops.

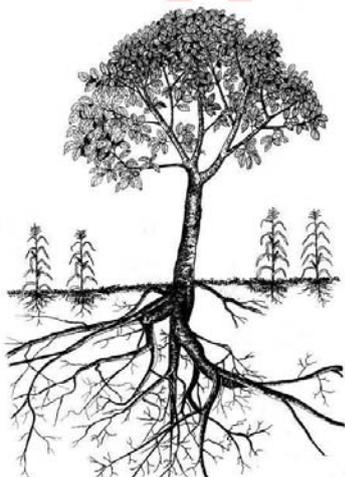
- ii. **Extensively managed system:** It includes shifting cultivation, silvopasture, pastoral silviculture etc. Production is less here.

On the basis of technology:

- i. **Low technology system:** the technology used in this system is primitive as in shifting cultivation.
- ii. **High technology system:** This system depends on modern technology for production of forest and agricultural crops, e.g., Use of tissue culture in forest management.
- iii. **Intermediate technology system:** This system is an intermediate between low and high technology system, e.g., Agrosilviculture.

F. Classification based on utilization of land

- a) **Homestead agroforestry:** Production of MPTs in homestead.
- b) **Forestland agroforestry:** Production of crops in the vacant spaces of the forest.
- c) **Crop-farm-forestry:** Production of crops and trees in the crop land.
- d) **Fish-farm-forestry:** Production of fishes and trees in the fish farm.
- e) **Animal-farm-forestry:** Production of animals with forest trees.
 - i. **Poultry-farm-forestry:** Farming of poultry birds and trees.
 - ii. **Dairy-farm-forestry:** Farming of milch cattle and trees.
 - iii. **Beef cattle-farm-forestry:** Farming of beef cattle and trees.
 - iv. **Goat-farm-forestry:** Farming of goats and trees.
- f) **Integrated-farm-forestry:** Production of crops, animals, fishes along with trees.
- g) **Road side agroforestry:** Production of deep rooted tall trees with narrow canopies and soil building grasses or crops along the sides of roads, highways, railways and embankments.
- h) **Public place agroforestry:** Production of suitable trees only or along with decorative herbs, vegetables in place like markets, premises of school, college, university, etc.



Compiled By:

Mirza Hasanuzzaman

Assistant Professor

Department of Agronomy

Sher-e-Bangla Agricultural University

Sher-e-Bangla Nagar, Dhaka-1207

e-mail: mhzsaug@yahoo.com

Web: www.hasanuzzaman.webs.com