

# MANAGEMENT AND PRACTICE OF TREE PLANTING AND ESTABLISHMENT OF AGROFORESTRY SYSTEMS

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MODULE 6



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## AIM OF THE MODULE



- Help livestock farmers ascertain a firm understanding of the management and practice of tree planting
- Gain a thorough knowledge and understanding of the main principles for establishing agroforestry systems
- Introduction to agroforestry design, maintenance, management measures and a brief discussion of suitable trees and shrubs



# REASONS AND MAIN PRINCIPLES FOR ESTABLISHING AGROFORESTRY SYSTEMS



- 1) Diversity and complementarity:** Like natural ecosystems, agricultural systems need a certain minimum biodiversity to optimize production and ensure problems including diseases, invasive species, and physiological stresses are controlled
- 2) Understanding the functioning of the forest:** Natural ecosystems show great resilience to disturbances and it is urgent to draw inspiration from their functioning to benefit modern agroecosystems
- 3) The Art of Transposition:** Agroforestry aims to apply principles derived from the functioning of forests to agriculture. To be more precise, it aims to mimic the processes found in natural perennial-herbaceous systems such as savannas



# REASONS AND MAIN PRINCIPLES FOR ESTABLISHING AGROFORESTRY SYSTEMS



**4) Maximize photosynthesis:** Imitating forests and savannas means using the organic carbon molecules resulting from photosynthesis as the major input of the system. It is this carbon which returns to the soil throughout the life cycle of the plants

**5) Lignin, stable anchor of humus:** Dead wood returning to the soil contains lignin and other polyphenols that stabilize the humic acids and feed soil fungi. These are essential to proper soil functioning

**6) Buffer trees:** Trees are climatic shock absorbers. By tapping and evapo-transpiring water from deep soil layers, trees refresh the atmosphere in summer. Their presence slows down the winds that result in major water losses through accelerated evaporation



# REASONS AND MAIN PRINCIPLES FOR ESTABLISHING AGROFORESTRY SYSTEMS



**7) An agronomic vision above all:** The reintroduction of trees in agricultural landscapes is the culmination of a global agroecological reflection. It is not an isolated solution. It makes no sense, for example, to start planting trees in soils that have been excessively tilled

**8) In agroforestry, there is no “exact” model:** While agroforestry is based on universal principles valid for most contexts and production systems (market gardening, viticulture, field crops, livestock farming etc.), it is not and cannot be a one-size-fits-all model. Farmers must test and adapt these principles to develop practices adapted to their needs and constraints

**9) Size is not a crime:** To fulfill the many functions expected of them, agroforestry trees are always pruned, whether for lumber, fuelwood, fruits, fodder or more. Trees on farms have always been shaped by farmers



Source: Treenation.com



# REASONS AND MAIN PRINCIPLES FOR ESTABLISHING AGROFORESTRY SYSTEMS



**10) Establishing agroforestry trees: don't overdo it:** The agroforestry tree does not behave like a forest tree. It must be protected and managed. It is not a "natural" subject growing in its usual biotope

**11) Ensuring the right connections:** It is essential for the proper functioning of an agroforestry system to connect habitats in space and time. It is therefore necessary to link landscape units and phenology to ensure the continuity of food resources for biodiversity and wildlife throughout the year

**12) Do one thing at the time:** As one starts in agroforestry, one must establish and respect priorities. First, manage existing features like hedges, groves, and stream buffers; then protect naturally regenerating vegetation; then planting



# INTRODUCTION TO AGROFORESTRY DESIGN



Well-planned agroforestry design is based on knowledge of how ecosystems work. The designs use perennial species, biodiversity and symbiosis to create productive systems where:

- nutrients are used and circulate efficiently
- plants and animals play multifunctional roles
- the biodiversity is part of the natural regulation of pests
- photosynthesis, is enhanced
- beneficial microclimates emerge, etc.



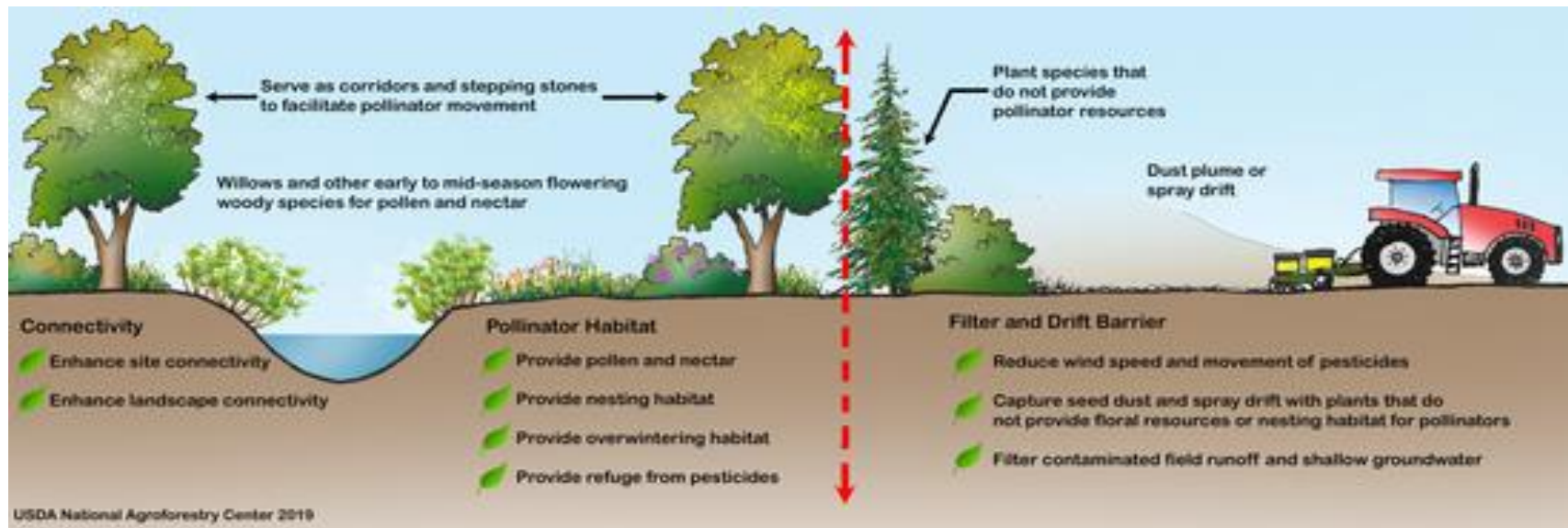


# INTRODUCTION TO AGROFORESTRY DESIGN



## AGROFORESTRY AS A MITIGATION TOOL:

Agroforestry can act as a tool to reduce GHG sources thanks to the optimization of the use of the resources it causes, avoiding or reducing GHG losses and promoting soil carbon sink in agricultural lands. Nitrous oxide comes from two main sources, livestock manure and chemical fertilizers that are linked to agricultural production enhancement. Besides better management options when fertilizers are applied or animals are managed, woody perennials can act both limiting GHG sources and promoting carbon sink.





# INTRODUCTION TO AGROFORESTRY DESIGN



## AGROFORESTRY AS AN ADAPTATION TOOL:

Adaptation can be classified as spontaneous (the system is adapted without conscious intervention), proactive and planned adaptation (FAO 2008). Adaptation aims at increasing adaptive capacity understood as the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences. Agroforestry practices can be related with all adaptation types.





# MAINTENANCE AND MANAGEMENT MEASURES IN AGROFORESTRY SYSTEMS



Planting design and management of an agroforestry practice depends on existing site conditions and the goals of the landowner (you may also refer to the section on each specific practice for more information on design considerations). Trees can be planted in single or multiple rows, on contours or in groups. Consider the products you wish to produce, any conservation or wildlife benefits desired, on-farm equipment and the needs of companion crops when planning the planting design.

As trees require some maintenance, management requirements may influence the planting design. Some important management considerations are....



# MAINTENANCE AND MANAGEMENT MEASURES IN AGROFORESTRY SYSTEMS



**Weed control** - most important in a young tree's life

**Fertilization** - depends on species selected and production objectives

**Pruning** - a must for timber production and recommended for nut production

**Thinning** - timely thinnings are critical to maintaining tree growth

**Grafting** - recommended for nut production, yet limit the number of trees requiring grafting in any given year



# MAINTENANCE AND MANAGEMENT MEASURES IN AGROFORESTRY SYSTEMS



- Weed control can reduce competition for moisture, nutrients and, in some cases, for light. Options for weed control include the use of herbicides, mulches (including living mulches such as many clovers, and fabric mulches) and cultivation. To gain the best growth from newly established trees, weed control should be maintained for a minimum of 3 years, and often for as many as 5 years
- Timely fertilization may be necessary for high-yielding fruit and nut production. In fruit and nut production, having certain nutrients available to the tree at the appropriate time of year is often essential for flower and nut set. For timber production, the cost of fertilization is usually not recovered over the time it takes for a timber tree to reach maturity
- Pruning allows room for equipment to pass below the branches and can be used to promote the production of desired products such as timber. Pruning is also a useful tool in management of fruit and nut trees. Through proper pruning, the shape of the crown and its density can be managed to facilitate and improve a trees productivity



# MAINTENANCE AND MANAGEMENT MEASURES IN AGROFORESTRY SYSTEMS



- Timely thinnings promote good tree growth by reducing competition for water, light and nutrients. As trees mature, they grow to occupy more of the space where they are being managed. As crowns of adjacent trees begin to touch or overlap, this is also a general indicator that their root systems are overlapping. When trees touch or overlap, competition for light, moisture and nutrients between adjacent trees may become a factor limiting tree growth. At this point, thinning can be beneficial
- Grafting primarily applies to fruit and nut production. By grafting scion wood to a tree, you are assured that the fruit or nut produced has the potential to exhibit the exact same characteristics as the adult tree from which the scion came. However, this does not always occur, since moisture, nutrients and management also play a significant role in fruit and nut development. Yet, it is the best way to ensure success. Spread planting over several years to limit the number of trees that will require grafting in a single year



# SUITABLE TREES AND SHRUBS FOR ESTABLISHING OF AGROFORESTRY SYSTEMS



When selecting a tree species, begin by matching the species with the site. The selected species should be capable of providing the products and services desired by the landowner. Depending on the practice selected, other considerations might include:

- Suited to the soil and site conditions
- Species compatibility trees should be compatible with the companion crop
- High value
- Fast growing or of such high value that a slower growth rate is acceptable
- Deep-rooted so the trees do not compete with companion crops for moisture
- Drought-tolerant or capable of growing on a wet site
- Produce a light rather than a heavy shade.
- What species already exist on the site?
- Marketability - What products (nuts, wood, etc.) do you want to market?
- Do markets exist?



Source: <https://foodsustainability.eiu.com/transforming-agriculture-role-agroforestry/>



# SUITABLE TREES AND SHRUBS FOR ESTABLISHING OF AGROFORESTRY SYSTEMS



**Sweet cherry**

Image: Gardening Know how



**Black Walnut**

Image: EUFORGEN



**Poplar**

Image: Cordis



**Elm**

Image: Plantsfordesigners.eu



**Hornbeam**

Image: hedgine.ie



**Dog rose**

Image: Geograph



**Elder**

Image: Hedges Direct



**Nordmann Firs**

Image: jardins du monde.be

These are just a small sampling of trees and hedges you can use...



# SUMMARY OF THE MODULE



## LESSON LEARNED

- There is a wide variety of reasons why to establish agroforestry systems. Similarly, there are many different design models and approaches one can take, and careful planning is required before one starts planting
- Maintenance and management are extremely important to the establishment of successful agroforestry systems, though as the trees develop, the process becomes easier and less time intensive
- Finally, choosing the right trees for the right purposes is vital to ensure that there are no issues (i.e. crops and trees competing for the same resources in an antagonistic manner). By practicing good preparation, establishment, and maintenance, one can have a successful agroforestry system