

**Natural Resources Conservation and
Development**

Level II

Learning Guide-46

**Unit of Competence: Facilitate Agro-forestry
Practices**

Module Title: Facilitating Agro-forestry Practices

LG Code: AGR NRC2 LO5-LG-46

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**LO 5: Identify component inter- action in agro forestry
system**

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Agro forestry component interactions
- Managing component interactions

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, **upon completion of this Learning Guide, you will be able to:**

- Identify Agro forestry component of positive and negative interactions
- Manage Component interactions
- Following up and evaluating Rehabilitation activity progress

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet and Sheet 2
4. Accomplish the “Self-check 1 and Self-check 2” **in page -6 and 9** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1,” **in page -10.**
6. Do the “LAP test” **in page – 11** (if you are ready).

5.1. Agro forestry component interactions

Most agro forestry parties are believed to have potentials for soil fertility improvement. The success of such improvement relies heavily on the exploitation of component interactions. These interactions can be both ecological and economic.

Component interaction refers to the influence of one component of the system on the performance of the other components as well as the system, as a whole. The interactions are mostly competitive between components for growth factors through roots (nutrient and water) and (radiant energy) intercepted through leaves. In practices it is difficult to separate above and below ground competition in agro forestry. But depending on the net effect we can say the negative net results (decreases in yield) and positive net effect (increases in yield)

$$I = F - C$$

Where I =net effect

F =fertility effect

C =competition

Based on the net result these interactions can be considered as positive (beneficial or production – enhancing) and negative (harmful or production – decreasing). These positive or negative effects can be direct or indirect. Since the woody perennials (trees) are important components of all agro forestry system, these interactions can be referred as tree-crop interactions and tree- animal interactions. These interactions can be said to represent at tree- crop interface and tree- animal interface.

The balance between these positive and negative effects determine the overall effects of the interaction .On a given agro forestry combination; an understanding of where and how interactions occur indicates possible system–modification domains that can be addressed through management activates. Interaction between trees and none tree components in agroforestry system can be expressed as complementary, competitive or

neutral. In complementary integrations, the total production from a system is greater than that obtained from growing the trees and crops respectively. In neutral interactions, there is no difference and, and in competitive interaction, the agroforestry system produces less than the two plants produce separately (Figure 5.1).

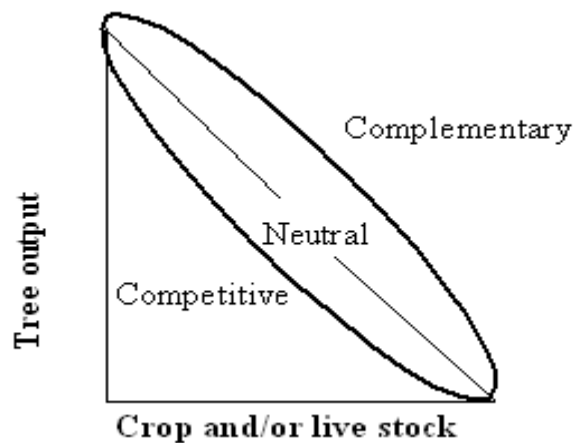


Figure 5. 1 Nature of common types of biological interaction in agro forestry systems

Other common terms that can be used in component interaction are:

- a) Commensalisms (+, 0) When one is benefited with out affecting the other
- b) Amensalistics (-, 0): -when one affects the other with out getting benefit
- c) Monopolistic (+, -) when one is benefited but the other is affected
- d) Inhibitory (-, -) when the two components affect each other
- e) Synergistic (+, +) when both components benefit each other

5.1.1. Positive interactions

It is called Production-enhancing.

At the tree-crop interface

- a) Nutrient addition to the soil by trees: biological nitrogen fixation is inexpensive and environmentally sound manner for meeting the needs of nitrogen from the vast reserves of atmospheric nitrogen most important element in agricultural production. Nitrogen fixation takes place through symbiotic association of plant roots with nitrogen fixing microorganisms. Green leaf manure and root decomposition: fallen leaf, litter or cut incorporated, decomposes realizing humus and nutrients by the press of nutrient pumping.

b) Micro-climate amelioration: Organic matter acts like a sponge, increases the soil ability to absorb and retain water. Also windbreaks and mulch reduce evaporation from soil surface and reduction of temperature fluctuations as well.

c) **Conserving soil:** trees reduce soil erosion in many ways. The roots hold the soil together, leaf litter on the soil surface and tree crown reduce the force of rainfall. Hedges planted along the contour act as a physical barrier thereby reducing soil erosion

At the tree- animal interface

Livestock forms a major component of agricultural productivity in many of developing countries including Ethiopia. The most obvious positive effects at tree-animal interactions are that some part of autographic production that is of no direct to the farmers (such as tree fodder) can be transformed into animal biomass with high nutritional value. The other effect is that the productivity of crops can be increased through the transfer of manure as fertilizer source. Shade provision is also another positive interaction, which reduce the energy spent for animal thermoregulations and the animal provide manure for tree

5.1.2. Negative interactions

Negative (production-decreasing) interactions

A) At tree crop interfaces

- ❖ Competition for light
- ❖ Competition for nutrient
- ❖ Competition for water
- ❖ Allelopathic effects Micro-climate modification for pest and diseases

B) At tree- animal interfaces

- ⇒ Production of toxic subsistence by the fodder
- ⇒ Mechanical damage of trees by animals
- ⇒ Trees or shrubs harboring diseases or pests
- ⇒ Deterioration of soil properties through compaction



Self-Check -1	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page: 3 pts each

Match column "B" with column "A"

A

- Commensalisms
- b) Amensalistics
- c) Monopolistic
- d) Inhibitory
- e) Synergistic

B

- A. when one is benefited but the other is affected
- B. when both components benefit each other
- C. When one is benefited with out affecting the other
- D. when the two components affect each other
- E. when one affects the other with out getting benefit

Note: Satisfactory rating - 8 points

Unsatisfactory – below 8 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____
2. _____
3. _____
4. _____
5. _____



Information Sheet-2	Managing component interactions
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5.2. Managing component interactions

The magnitude of interactive effect between the trees and other components of agro forestry systems depends on: -

- The characteristics of the species
- Their planting densities
- The spatial arrangement
- Management practices

Manipulating densities and arrangements is probably the most powerful method for capitalizing on beneficial effects of trees while reducing negative ones .e.g. pruning, thinning, pollarding, lopping, fertilizer application, application of mulch and manure, and etc. The different manipulations can be grouped as growth enhancing or growth reducing according to their effects on the targeted.

Table 5. 1 Summary of different Management Option

Management options to achieve	
1) Increased growth	2) Decreased growth
Microclimatic amelioration	pruning
Fertilization	pollarding
Application of mulch /manure	Root pruning
Irrigation	Trenching
Soil tillage	Excesses shading
Adapted species	Herbicides
supplemental feeding	grazing / harvesting

Management of Trees in Agroforestry

The major role of tending operation in agroforestry is restoration of health co-existence among integrated crops of a given land use system. Because woody perennial usually have well structured and strengthened rooting and branching systems as compared to other adjoining systems, the negative influence comes form tree and shrubs.

Pollarding

- ⇒ It is removal of the crown total.
- ⇒ Pollarding occurs when the adjoining crop is in its pick growing period.



- ⇒ It helps the adjoining crop by removing the shading effect.
- ⇒ It is usually practiced in Agri-silvi-culture and agri- silvi-pasture systems.

1. Pruning

It is an act of removing the branches wood perennial close to the stem and roots of woody perennial.

- Pollarding can be exercised after the woody crop develop coppicing stem. In free grazing areas branches are pruned beyond the animal reach like in the Case of Acacia albida tree enter-crop. Such management practice enables farmers to provide fodder depending on the need.
- Pruning is practiced in all AF systems.
- Side pruning is practiced to maximize term growth, facilitate access to a passer by, and reduce competition for light and moisture against adjoining crops.
- It is better practiced when the branch basal diameter is no exceeding 1 inch.
- Pruning cuts are close to the stem and it is worth doing for quality tree species.

2. Thinning

It is reduction of stock density to an optimal level.

- Low Thinning (German Method)
- High Thinning (French Method)

3. Lopping

It is removal of portion of branches of woody perennial.

- It may be practiced in AF systems.

Note: The overall aim of component management practices in agro forestry system is to increase the production enhancing (positive) interaction and to reduce the production decreasing (negative) interaction



Self-Check -2	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the magnitude of interactive effect between the trees and other components of agro forestry systems (5pts)
2. What is the different between pollarding and lopping (3pts)

Note: Satisfactory rating - 4 points

Unsatisfactory - below 4 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____
_____.
2. _____



Operation Sheet 1	Managing component interactions
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Objective To know component of agro forestry

To know the concept of component interaction in AF.

Materials, tools and equipment: Paper, pen note pad, pruning shear, chain saw, meter, Axe, digging hoe

Procedure:

- Wear safety cloths
- Select tree
- Conduct Pruning, pollarding, thinning
- Managing the conducted activities



LAP Test	Practical Demonstration
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Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within --- hour.

Task 1- Managing component interactions



Reference:

- Azene Bekele Tesemma. 1993. Useful Trees and Shirubs for Ethiopia. Identification, Propagation and Management for Agricultural and Pastoral communities.
- _____.2009. Training, Teaching and Learning Material (TTLM) on Applying Farm forestry Techniques for Natural Resource Development Technique, Soddo
- Bashir Jama, Abednego Kiwia and Annah Njui. 2004. Market-oriented agroforestry: options and strategies for their dissemination in East and Central Africa. World Agroforestry Centre (ICRAF), Nairobi
- Dechasa Jiru. 2006. Agro-forestry Training Manual. SUSTAINABLE LAND USE FORUM (SLUF) Part 2: Methods and Techniques for Improved Land Use (Unpublished)
- Nair, P.K.R. 1993. An introduction to Agroforestry. Kluwer Academic Publishers, The Netherlands.
- Young, A. 2002. Agroforestry for Soil Management. 2nd Edition. CAB International, UK
- Baumer, M. 1990. Agroforestry and Desertification. The Neatherlands.
- FAO. 1978. Forestry for Local Community Development. FAO, Forestry Paper 7. FAO, Rome
- Samra, J. and H. Eswaran (2000). Challenges in ecosystem management in watershed context in Asia. In:Lal, R.(Ed.) Integrated Watershed management in the global ecosystem. New York: CRS press
- Surash, R. (2002). Soil and water conservation Engineering. New Delhi: standard publisher.