Module 13: Advanced Optimization

Goal

Farmers will adopt advanced optimization techniques to increase production efficiency.

Learning Objective

1. Learn new soil and water conservation techniques for sloped land, such as: terraces, boomerang berms, diversion swales.
2. Understand interactions among plants and how to group them into guilds.

Venue and Timing

This module should be given during the beginning of year four. The training should be held at a Forest Garden that has slope, if possible, in order to demonstrate using an A-frame and finding contour lines.

Relevant Technical Manual Chapters

Before this training event, the facilitator should read, review, and thoroughly understand the following chapters and sections in the Technical Manual:

- Chapter 1: Introduction to the Forest Garden
- Chapter 2: Phased Approach
- Chapter 5: Agroforestry Technologies (Contour Planting section on making an A-frame)
- Chapter 15: Optimizing Your Forest Garden Understory

Preparation

- Determine which months each module (and flexible activities where relevant) are to be facilitated using the table in Activity 5.
- Locate copies of top view map and seasonal calendar for the chosen field, if available.
- Identify various plants that make up two to three different types of guilds appropriate for the group being trained.

- Update the farmer group MoU for the year, to be signed at the end of the workshop.

Supplies

- If the original copies of the top view map and seasonal calendar are damaged: print copies of top view map and seasonal calendar or redraw on flipchart paper.
- Materials for A-frame: 3 pieces of wood/metal/poles about 1 to 1.5 meters long, 1 piece of wood/metal/pole about 1 meter long, string, rock, level (optional), nails and hammer (optional). Sticks to mark off contour lines.
- Shovel
- pick axe
- 2 copies of the Farmer Group MoU for the upcoming year (to be signed by the farmer group attending the workshop)
- Participant Farmer List template
- Roll of flipchart paper and tape
- Markers of various colors

Total Time

3-4 hours

Handouts in Farmer's Workbook

- Seasonal Harvest Calendar
- Guild Example
- Advanced Soil and Water Conservation Techniques
- Optimizing Your Forest Garden

Module 13: Advanced Optimization

Summary of Activities

Opener: Walk the field and recall top view map (30 min)
- Walk around the host farmer's Forest Garden
- Debrief and review top view map to identify gaps

Activity 1: Side view mapping the field (1 hour)
- Review side view mapping
- Small groups create side view maps of the Forest Garden
- Small groups present side view maps and select the best one

Activity 2: Seasonal crop calendar (30 min)
- Review seasonal calendar from previous year
- Update seasonal calendar from previous year
- Discuss gaps in harvesting during seasonal calendar

Activity 3: Design a guild (1 hour)
- Explain the different functions of plants in a guild
- Farmers sort plants into different categories
- Small groups design a guild

Activity 4: Advanced earthworks techniques (2 hours)
- Review earthworks techniques
- Review how to make an A-frame and how to find the contour line
- Demonstrate and practice advanced earthworks techniques

Activity 5: Plan year four activities (30 mins)
- Discuss year four plans for the group
- Read and discuss Memorandum of Understanding
- Sign Memorandum of Understanding
- Update Participant Farmer List

Take Home Activity 6: Advanced soil & water conservation techniques (15 min)
- Discuss techniques participant farmers will adopt to optimize their Forest Gardens
- Use advanced soil and water conservation techniques in your Forest Garden
- Follow-up

Opener: Walk the Field and Recall Top View Map

Description

Farmers walk around the field and recall the top view maps they created the previous year in the Field Optimization module. Then the facilitator leads a discussion around gaps in the horizontal structure of the Forest Garden and the types of plants to add to fill those gaps.

Instructions for Farmers

1. **Walk around the host farmer's Forest Garden**
   We will walk around the field and observe what is planted. Think about the following questions as you walk around the Forest Garden.

   - What Forest Garden components and techniques do you observe?
   - What has the farmer done well?
   - What could be improved? How?
   - Did you see any erosion problems? What could you do to keep more soil and water in the Forest Garden?

2. **Debrief and review top view map to identify gaps**
   Last year we drew a top view map of this Forest Garden. Let us look at it to see how the field has changed over the past year.

   - Where did you see gaps in the Forest Garden based on the top view map?
   - What do you want the field look like in 5 years?

Activity 1: Side View Mapping of the Field

Description

Small groups create a side view map of the Forest Garden. Then the facilitator leads a discussion around gaps in the vertical structure of the Forest Garden and the types of plants to add (ground cover, shrubs, tall timber trees) to fill those gaps.

Instructions for Farmers

1. **Review side view mapping**
   Last year we created a side view map to show the different layers of plants in the garden as we see them while walking along a straight line through the Forest Garden, called a transect walk. We will do the same activity today to see how the Forest Garden has changed over the last year.

   - What are the different layers of plants in a Forest Garden? (1. Root layer 2. Ground cover layer 3. Herbaceous layer 4. Bush-Shrub 5. Small tree layer 6. Large tree layer 7. Climber)

2. **Small groups create side view maps of the Forest Garden**
   In your small group, come to collect flip chart paper and markers. Take 30 minutes to draw side view maps of the Forest Garden.

3. **Small groups present side view maps and select the best one**
   Each group will come to the front and present your maps of the host farmer's Forest Garden. Then we will choose the maps will think best represent the Forest Garden.

   - Are there any gaps in the vertical structure of the Forest Garden?

Activity 2: Seasonal Crop Calendar

Description

The facilitator reviews the seasonal calendar from the previous year and revises it to show when different plants in the Forest Garden are ready to harvest. This exercise helps the farmers visualize the times of year when the Forest Garden is not producing.

Instructions for Farmers

1. **Review seasonal calendar created in Field Optimization workshop**
   We will review the seasonal calendar for the Forest Garden that we created last year to show what crops you can harvest at different times of the year.

2. **Update seasonal calendar**
   Call out the plants in the Forest Garden that have been added since last year. I will write the name/draw a picture on the flip chart paper. Let's now fill in the calendar with check marks to show when you can harvest each of the different crops from your Forest Garden.

   - What new crops did the farmer plant in the last year to optimize the use of time in the Forest Garden?

3. **Discuss gaps in seasonal calendar**

   - What time of year does the Forest Garden produce the most?
   - What time of year does the Forest Garden produce the least?
   - Do all plants need to produce food or income? Or is it good to include plants that provide benefits to your productive plants?
   - What plants can you add to your Forest Garden to harvest during the slow months? When do you harvest them? (think about the various layers discussed in Activity 1 as well)

Activity 3: Design a Guild

Description

The facilitator explains the concept of a guild and small groups design guilds to show how plants in their Forest Gardens work together to optimize use of space and sustainability.

Instructions for Farmers

Explain the different functions of plants in a guild
A guild is a grouping of complementary plants that grow well together and can become more productive than if they were on their own. As a healthy forest is one of the most productive ecosystems on Earth, we aim to mimic natural forests when designing our Forest Gardens. When planting a guild there are several things to keep in mind:

- Nature plants in steps: Large plants depend upon the smaller plants around them.
- Nature always plants a variety: Observe the large diversity of plant life that occurs in an undisturbed forest; each plant has a specific purpose.
- Nature "stacks" plants in both time and space: When you walk through a forest you see many layers of plants growing together using different spaces from below ground to the highest levels, and becoming active or dormant at different times of the year.
- The different functions of plants in a guild are:
    - Food Staples - legumes, fruits, vegetables, and fats (e.g. seeds and nuts)
    - Food for the soil - legumes and organic matter that provide nutrients to the soil
    - Climbers - important for making the most of vertical space
    - Supporters - plants that provide support to climbers
    - Miners or diggers - deep roots or tubers that open the soil and bring up nutrients from deep below the surface
    - Groundcovers - protects soil, provides shade, holds moisture, and suppresses weeds
    - Protectors - protection for others in the system (e.g. repellents, attractors, etc.)

Farmers sort plants into different categories
I have pictures of crops that are common in your Forest Gardens. I will hand these out and then I want to hear from you about the plant you are holding and how it functions in a guild.

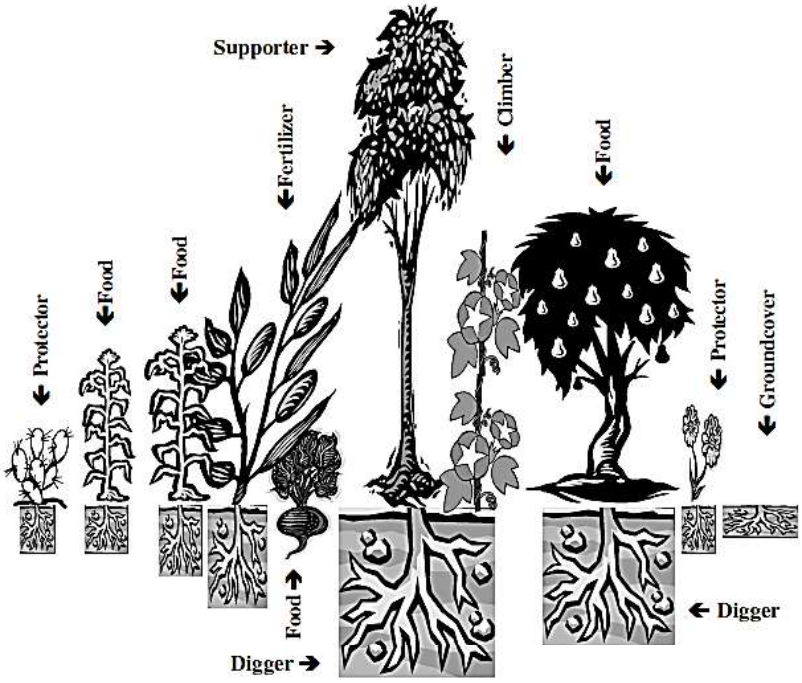
- What is the function of your plant?
- Where does the plant fit in the vertical space of the Forest Garden?
- What are good companions for your plant?

Small groups design a guild

When you optimize your Forest Garden you are creating guilds of plants that grow well together to best use the space in our field. Go and stand with farmers holding plants that would work well with your plant in a guild.

- Why did you put those plants together in a guild?
- How are you using vertical space?
- How are you using horizontal space?
- What time of year can you harvest in your guild?

Figure 1: Example of a guild in a Forest Garden



Activity 4: Advanced Earthworks Techniques

Description

The facilitator reviews construction of an A-frame and how to use an A-frame to find the contour lines on the field in order to construct earthworks such as terraces, boomerang berms and diversion swales to mitigate erosion.

Instructions for Farmers

1. **Review earthworks techniques**
   We learned about the 4 S's of water control. Today will learn more techniques to help stabilize the soil.

   - What factors influence soil erosion? What are the 4 S's of water control?
   - How do you slow water? How do you stop water?
   - How do you sink water? How do you spread water?
   - How does mulch help to conserve water?
   - If the land is sloping, how do you know where to construct SWC structures? How do you know where to plant?

2. **Review how to make an A-frame and how to find the contour line**
   If your field is sloping, then water can quickly wash the soil away. The steeper the slope, the faster the water (and soil) will move. You can use an A-frame to find contour lines to determine where to plant in your garden to reduce erosion and allow more water to sink into the ground. You will mark the contour lines with sticks.

   - How do you build an A frame? How do you find a contour with an A frame?

3. **Demonstrate and practice advanced earthworks techniques**
   Once you find the contour lines you can shape the soil and/or add plantings to reduce erosion.

   - What are living contour barriers? What are some plants that can be used as living contour barriers?
   - What are contour berms? What are some materials that can be used as non-vegetative contour barriers?
   - What are terraces?
   - What are advantages and disadvantages of living contour barriers, contour berms, and terraces?
   - How can we make contour berms more effective/stable? How do we form contour berms if trees are already planted along the contour line?
   - What techniques can we use to direct water toward our trees? (cuvettes, boomerang berms) What are diversion swales?

Activity 5: Plan Year Four Activities

Description

Farmers discuss plans for year four, including the workshop schedule, and sign the Memorandum of Understanding.

Instructions for Farmers

1. **Discuss year four plans for the group**
   I will tell you the training schedule for next year.

   - How can you work together as a group to get the most out of your Forest Gardens?
   - What are your interests and needs for Year 4? What are the priorities?
   - What are the main crops you will plant next year as a group? Do you need to plant more agroforestry trees for your green walls? Fruit trees? Vegetables? Timber trees?
   - What species will you focus on, and on average how much would each farmer hope to plant?
   - What optimization and guild species should you plant?

   I have prepared a schedule for when each module and flexible activity will be facilitated with over the course of Year 3. They are as follows:

   Timing of Training Modules for Year 4

Module	Agricultural Calendar	Module Facilitation (month)
14. Pruning and Harvesting	At the end of the dry season	
15. Sustainability Planning	Four to six months before the Graduation	
16. Graduation Planning	About one month before the Graduation	

2. **Read and discuss Memorandum of Understanding**
   I will read the Memorandum of Understanding (MoU), which you all will need to sign before we close the meeting today. We sign a new MoU each year, after reviewing the progress you have made on your Forest Garden in the previous year. An important part of the review involves an evaluation of each farmer's Forest Garden. It is important that everyone knows that your commitment to the project, which is demonstrated by adopting the skills and techniques you learn in the workshops, is a key criterion we look at when we decide to continue with the project for another year.

3. **Sign Memorandum of Understanding**
   When everyone agrees on the terms, we will all sign the MoU. I will take a copy and I will leave a copy here with the lead farmer.

4. **Update the Participant Farmer List (PFL)**
   Finally, I will pass around the Participant Farmer List sheet for farmers to fill in for year 4. If any farmers who were invited to participate in year four of the project are not present, the lead farmer will take the PFL and MoU to them to fill in and sign, and return the completed documents to the facilitator.

Take Home Activity 6: Adopt optimization and soil and water conservation (SWC) techniques in Forest Gardens

Description

Farmers construct earthworks such as contour berms, boomerang berms and diversion swales to mitigate erosion on their Forest Gardens.

Instructions for Farmers

1. **Discuss techniques participant farmers will adopt to optimize their Forest Gardens**
   Each farmer should stand up and mention two changes you plan to make to your Forest Garden in the next year.

   - How will you apply the strategies you learned today to your field?
   - How is your field similar or different from our host's field?
   - What perennials do you want to add to your Forest Garden?
   - What other trees do you want to add to your Forest Garden?

2. **Use advanced soil and water conservation techniques in your Forest Garden**
   Construct an A-frame and use it to find the slope on your field. Then build the appropriate soil and water conservation structures like contour berms, living contour barriers, swales, cuvettes, and boomerang berms to control how soil and water move through your Forest Garden.

Follow-up

The lead farmer will visit participants to answer questions and provide guidance.

Evaluation Checklist for Skills Learned in Year 4

At the end of the year you will be evaluated on the following practices that you learned and discussed over the course of the project. Those in bold are topics that we discussed or practiced today. In demonstrating that you have completed the project criteria, you will receive Master Forest Gardener Certification at the end of the year.

YEAR 4 Evaluation Criteria

- Green Wall
  - Fully surrounding the Forest Garden site
  - Gaps replanted
  - Well-managed
  - Dead fence surrounding green wall if still needed (for all projects where this is determined to be a requirement)

- Alley Cropping and/or Contour Planting
  - Optimum number planted
  - Gaps replanted
  - Well-managed

- Fruit Trees
  - At least 4 species planted
  - At least 2 species grafted
  - Well-pruned

- Timber Trees
  - At least 2 species planted
  - Proper spacing between trees planted
  - Each tree is weeded and mulched

- Compost
  - Three active piles
  - Well-managed

- Permagarden
  - Multiple species
  - Amended beds
  - Demonstrated use of the 4 S's
  - Perennials maintained on berms

- **Optimization**
  - **Optimum number of fruit trees planted**
  - **Optimum number of timber trees planted**
  - **Demonstrated use of guilds**
  - **Demonstrated use and explanation of at least 5 IPM measures**
  - **Ground cover planted among fruit and timber trees**
  - **Demonstrated use of soil and water conservation measures**

Module 13: Facilitator's Notes

The facilitator should use the following pages to note down any questions or findings from the group that should be kept for or addressed at a later time. Depending on the module this may include species selection by group, crops identified in seasonal calendars, or anything else that should be noted.