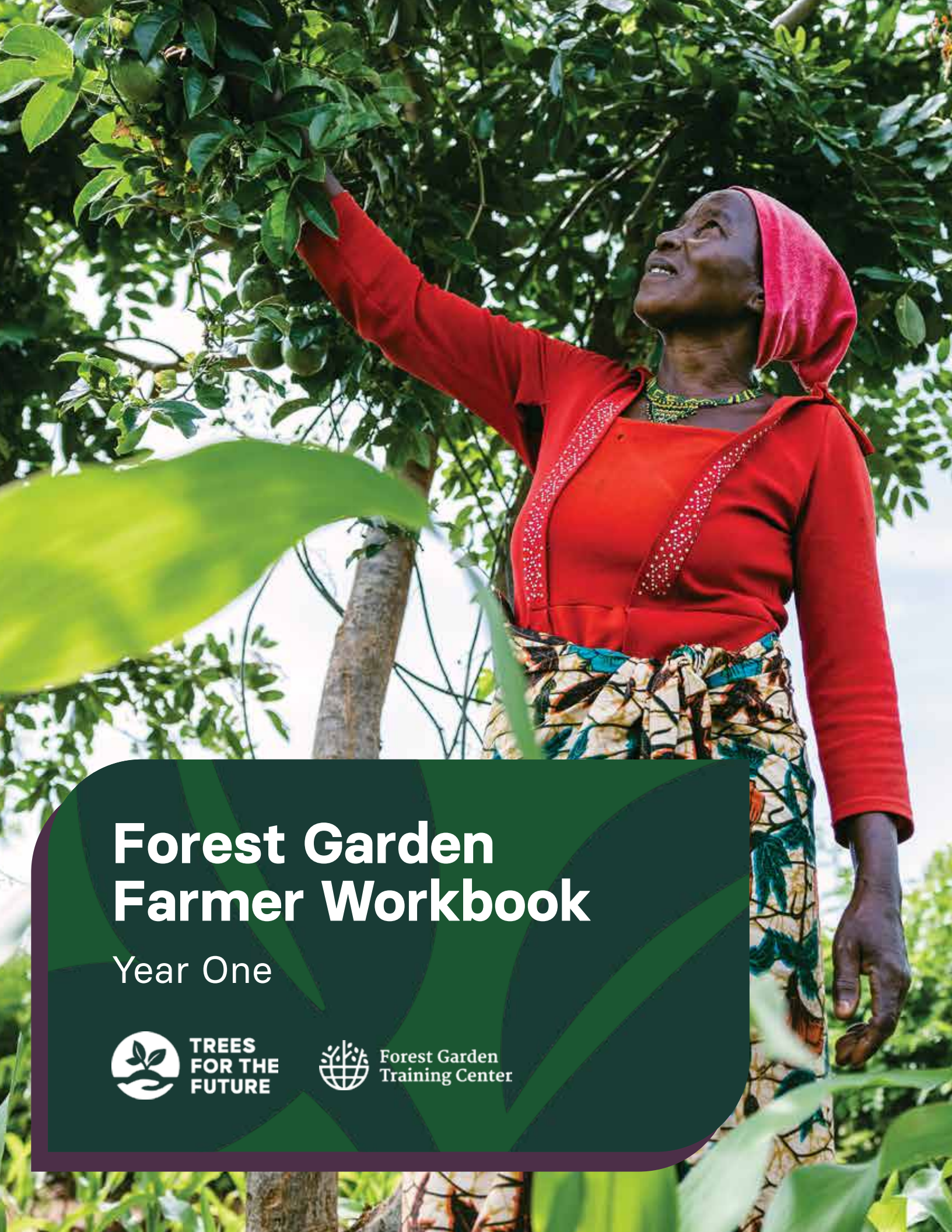


Forest Garden Farmer Workbook

Year One

TREES FOR THE FUTURE

Forest Garden Training Center

Forest Garden Farmer Workbook
YEAR ONE

Dear Farmer,

Welcome to the Forest Garden training program!

By joining this training program, you have taken the first step to growing a steady source of nutritious food and income. Over the next four years you will learn to grow a Forest Garden by protecting, diversifying, and optimizing your farm with trees and other crops.

The first year of this training program consists of six workshops delivered by facilitators trained by Trees for the Future. They will guide you and your farmer group, helping you attain the knowledge and skills you need to create your own Forest Garden. You will learn to grow and plant thousands of agroforestry trees, fruit trees, and timber trees; and you will learn to grow a variety of new crops.

Each year you will receive a new Farmer Workbook, each one will include activities and resources to use throughout the four-year training program. We hope you will keep it clean and safe and bring it to all the Trees for the Future workshops.

There are evaluation checklists for each of the four years of the program. We have provided these checklists for you to do a self-assessment and our technicians will use the same checklists when they visit your farm for annual assessments.

If you participate in the workshops, implement the techniques you learn on your own farm, and meet the evaluation criteria, you will earn a Forest Garden Certificate at the end of the program. Please do not hesitate to tell your facilitator, trainer, or extension agent how this resource has helped you or how it can be improved. We want you to be successful and wish you luck as you progress through the program.

Good luck,
The team at Trees for the Future

This Workbook is Made up of Six Workshops:

Workshop 1 – Forest Garden Planning
Workshop 2 – Forest Garden Design
Workshop 3 – Tree Nurseries
Workshop 4 – Outplanting
Workshop 5 – Permagardening
Workshop 6 – Compost

Workshop 1: Forest Garden Planning

Introduction

Forest Garden Planning will allow you to decide what you will grow in your Forest Garden. You will think about what your family needs and what market opportunities there may be and develop a plan of trees, vegetables and other plants that will help meet those needs.

Take Home Activity Checklist:

Crop selection confirmation research and Top View Map Information

- ❑ Discuss and confirm your Forest Garden plans with your family
- ❑ Fill in lists of crops you would like to grow
- ❑ Sketch a Top View Map of the field you will convert to a Forest Garden

Notes:

Calendars

Planning Calendar:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Season												
Fruit Trees												
Vegetables (Nutrition)												
Vegetables (Market)												
Lean Season												

Market Analysis Calendar

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Holidays & Festivals												
Product 1:												
Product 2:												
Product 3:												
Product 4:												
Product 5:												

Family Conversations & Planning

Fruit Trees for the Home and for Sale
Many Forest Garden farmers plant two or three types of trees in large numbers in their Forest Gardens. These trees will take up a lot of space, for a long time. It is important that you think carefully about this decision. Discuss the questions below with your family to get their approval. Talk to your neighbors, friends, and market vendors. Think about the fruits that your fellow group members prioritized in the planning workshop. Write the top choices for the priority trees you would like to plant in the box on the lines under “for market.”

- Which fruits/trees have the most potential for income?
- Do you know how to produce them, or will you need to learn?
- Does it require significant investment, labor, or production costs after planting? Will you be able to cover them?
- Are the market opportunities and prices stable?
- Are there specific varieties or types that fetch the highest prices? Which?
- What are the quality standards for this product? Can we meet them?

Next, look at all the fruit trees your group listed on the planning calendar. Remember it is good to have trees that produce fruit each month of the year. Discuss these with your family, and write the trees you want to plant on the lines below, under “for family.”

Planning fruit trees for the home and sale
What trees will you plant for market and for your family?

For Market:

1. _____
2. _____
3. _____

For Family

4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

Vegetables for Family Nutrition
These are the most important food types to grow and include in your diet for nutrition:

Dark Green Leafy Greens and other Vegetables 	Legumes 
Red and Purple Vegetables and Fruit 	Orange Vegetables and Fruit 

Discuss nutrition together with your family and identify nutrients that may be lacking in your diets. Write the crops you would like to grow for nutrition in the table below:

- What are women in the house interested in growing to eat? What about men, and youth?
- What are the vegetable and fruit colors you normally eat? Which colors do you not have to eat very often?
- Do you have a variety of the important dark green, orange and dark yellow, red, and proteins (especially legumes and nuts) available all year?
- What can we grow to provide nutritious foods in the lean season?
- Where will we find the seeds of the things we would like to grow for our household?

Planning Main Vegetables for Family Nutrition
What 5 vegetables and fruit will you grow for your family's nutrition this year?

13. _____

14. _____

15. _____

16. _____

17. _____

Vegetables for Market

In the Planning Workshop you discussed and prioritized market vegetables with your fellow group members. Refer to your planning calendar to list the vegetables you plan to grow as a group for market. Remember, your decision of market vegetables to plant can change from season to season, unlike the trees you will plant.

Planning Main Vegetables for Market
What 5 vegetables and fruit will you grow for market this year?

1. _____

2. _____

3. _____

4. _____

5. _____

Lean Season

Next, look at the 'Lean Season' line on the planning calendar with your family. Discuss the products you can grow during the lean season to ensure you have things to eat and sell. List what you would like to produce for the lean season below.

Planning Lean Season Products

What products will you produce to ensure food and income during the lean season?

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

Market Crops

Finally, you discussed various market products with your group and assessed prices throughout the year. Recall these discussions with your family. Write the five products you and your family would like to prioritize. These products should include a mix of vegetables, fruit, and other timber and non-timber forest products.

Planning Priority Market Products

What fruits, vegetables, and other products will you prioritize this year for market?

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

Preparation for Top View Mapping:

1. Draw the shape of your field with perimeter border.
2. Measure the distances of each side of the border by pacing and write them on the map.
3. Include the orientation (North) on the map.
4. Mark the highest and lowest points.

5. Include as possible the current locations of existing trees, structures or other important or immovable features.

Forest Garden Top View Map

Workshop 2: Forest Garden Design

Introduction

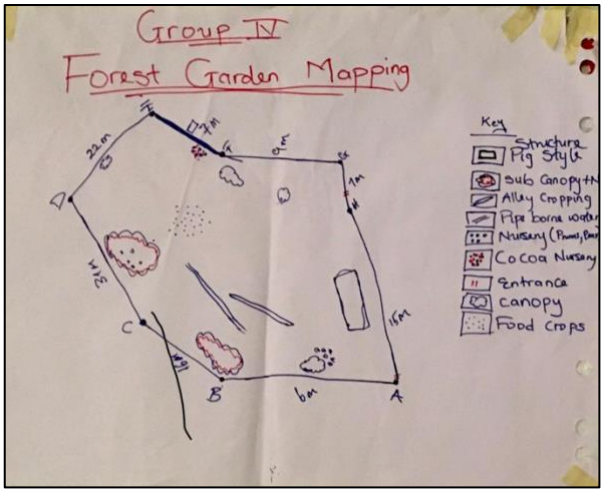
In Forest Garden Design you will take the trees and vegetables you identified in Planning, and learn how to arrange them in your Forest Garden design, preparing your design for your outplanting when your trees are ready.

Take home Activity Checklist: Forest Garden Design Review

- ❑ Go home and share this newly created design with your family members. See if they have any other thoughts or ideas or things to change. Update the design together so that it reflects what you all will do on the field as a household.
- ❑ You will bring back your design to each workshop.
- ❑ Thinking about what you want to grow, and what TREES will give you as part of the program, think about where you will source the rest of the seed. Where can you find it? Will you buy it or collect it?

Notes

Examples of Forest Garden Designs

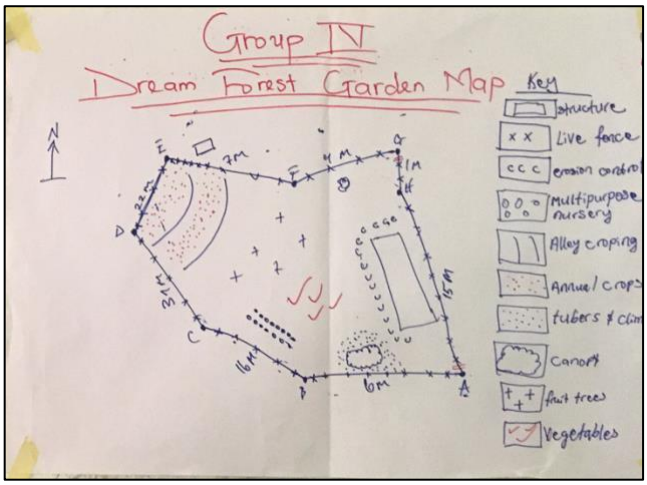


Top View Base Maps (left)

Base maps show you what is already on your field. They include things like: 1) Perimeter of the field and lengths, 2) Orientation (where is North and South?), 3) water access, entrance, or collection points, 4) any large existing trees or structures, 5) existence of slopes, and 6) other important elements in bordering properties.

Forest Garden Designs (right)

Forest Garden Designs are what you envision your field will become. Your designs can be drawn on top of your top view base maps or separately. Your designs include the locations of where different elements of the Forest Garden will be after planting. They are an exciting thing to dream about and work towards.



Species that will be used in the Design

Species that will be used in Green Wall

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

Species that will be used in Alleys and/or Contours

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

Fruit Trees that will be planted

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

Any other trees that will be planted (timber, indigenous, medicinal)

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

List of Species that TREES will provide

Fill in the chart below with the list of seeds, seedlings, and other planting material that TREES will provide. This list will be given to you by TREES technicians.

Vegetables	Trees
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5. _____	5. _____
6. _____	6. _____
Other	
1. _____	1. _____
2. _____	2. _____

List of Species that You will provide

The planning chart below will help you think about what seeds you will purchase, save, or trade for this year. Refer to the lists you have created in the Planning section and Forest Garden Design section of this workbook, as well as the list of species TREES will provide. List the species you will need to obtain on your own, as well as how much you will need, where you will get them from, and when they are needed.

Seed Collection and Purchasing Plan Chart

Vegetable Seed Type	Amount Needed	Buy or Collect (from where?)	Season/Month Needed
Tree Seed Type	Amount Needed	Buy or Collect	Season/Month Needed
Other Type	Amount Needed	Buy or Collect	Season/Month Needed

Steps of Forest Garden Design

Follow this guidarnce to help you create your Forest Garden design:

1. Design the Green Wall
   - On the border of your field
   - 2-3 lines of trees
     - Line 1: Species_____ Spacing_____
     - Line 2: Species_____ Spacing_____
     - Line 3: Species_____ Spacing_____

2. Design Alleys and Contours
   - Is your land sloping? (If not, you can use alleys; if so you will need contours)
   - How many alleys or contours will you use?
   - Where will they be located? (If alleys, be sure to orient them east to west)

3. Design Fruit Trees
   - Where will your fruit trees be in your Forest Garden?
   - How big is their canopy? Draw a dot in the center for where it will be planted, and a circle around it estimating the size of the mature tree, in relation to the scale of the map
   - How many fruit trees will you plant of each species?

4. Design Timber and other trees
   - Where will the timber trees be in your Forest Garden?
   - How many timber trees will you plant?

5. Design a Permagarden area
   - How big will your permagarden area be?
   - It should be where you can access it easily and frequently
   - It should be near a water point or water access where possible

6. Add water point area(s)
   - Where is your existing water point(s), if applicable
   - Will you have a water point in the future? If so, where?

7. Add tree nursery area
   - It should be where you can access it easily and frequently
   - It should be near a water point or water access where possible

8. Add compost areas (at least 2 piles)
   - It should be in a shady area
   - It should be where you can access it from all areas of the Forest Garden

9. Staple crops
   - Where will you plant staple crops, if needed?
   - How much space will you need?

Workshop 3: Tree Nurseries

Introduction

Tree nurseries are an important part of every Forest Garden farmer's work. You will learn to establish and maintain a tree nursery that will supply most of the trees you will plant in your Forest Garden.

Take Home Activity Checklist: Start a Tree Nursery

- ❑ First visit—when the nursery is set up
  - ❑ Set up the nursery in a good location in relation to water access, maintenance, sun
  - ❑ Protect the nursery (shade, animals, children)
  - ❑ Use a good soil mixture
  - ❑ Properly fill and set up tree sacks
  - ❑ Properly dig bare root beds
  - ❑ Review Seed pretreatment and all upcoming tasks
- ❑ Second visit—3 to 4 weeks after seeding nurseries
  - ❑ Pretreated seed
  - ❑ Seeded the right amount per sack/space
  - ❑ Properly thinned seedlings
  - ❑ Seedlings are being adequately cared for (watered, shifted for air pruning)

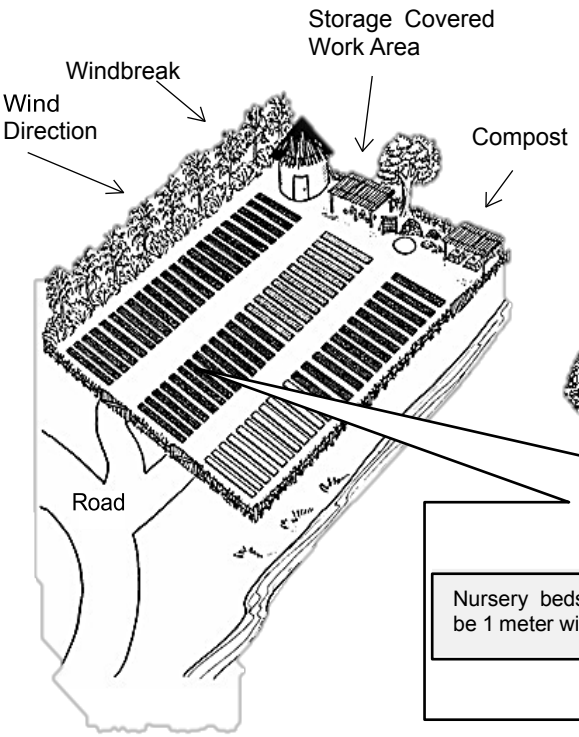
Notes

Nursery Location

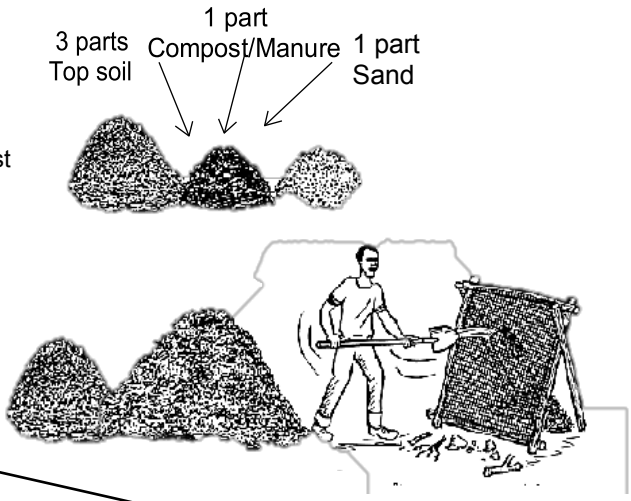
When setting up a nursery, be sure to identify a site with these characteristics:

1. Sufficient area
2. Suitable microclimate and soils
3. Water of adequate quantity and quality
4. Security from theft, vandalism, animals, children
5. Appropriate drainage—slight slope if needed
6. Wind protection

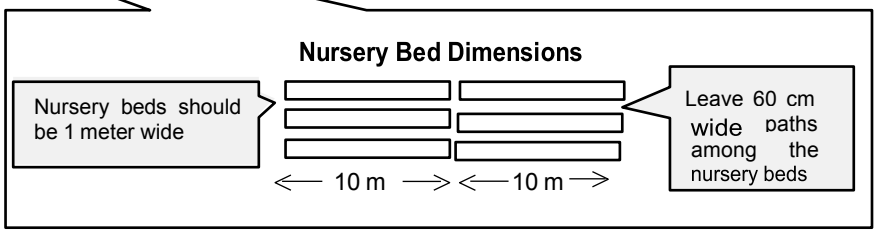
Layout of a Tree Nursery



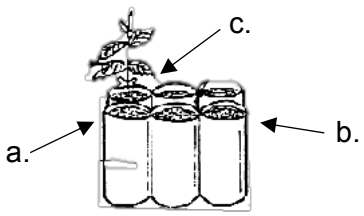
A Good Soil Mix for Seedlings



Nursery Bed Dimensions

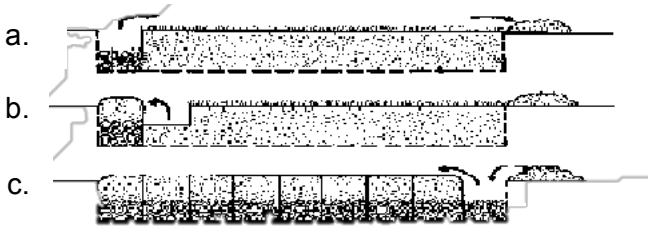


For Tree Sacks



a. Fill sacks 1 cm from the top
b. Place sacks in straight rows leaving space for drainage
c. Sow seeds in the center of the sacks

Double Dig Bareroot Beds



a. Dig and remove topsoil from nursery bed at depth of 30 cm, placing soil at far end. Then loosen subsoil
b. Repeat the first step further down the bed BUT transfer soil to previous Area, mixing in compost and manure as you go
c. Continue down bed (repeating step b). At the end, transfer soil from first section to last

Setting up a Nursery

Steps for Setting up a Tree Sack Nursery bed:

1. Identify a good location
2. Prepare bed surfaces
3. Set up shading
4. Prepare soil mix (3 topsoil: 1 sand: 1 compost)
5. Screen the soil
6. Fill the sacks
7. Sow the seeds

Steps for Setting up a Bareroot Nursery* bed:

1. Identify a good location
2. Double dig beds
3. Set up shading
4. Amend topsoil with compost
5. Pretreat the seeds
6. Sow the seeds

** Good for trees with a deep taproot; not good for a shallow, fibrous root system.*

Tips for Managing the Nursery

- ❑ Use shade to protect seedlings from sun
- ❑ Keep the area fenced to protect from animals/intruders
- ❑ Water the seedlings daily
- ❑ Carefully thin seedlings to one seedling per sack (tree sacks)
- ❑ Thin seedlings to ~10cm apart when ~5cm high (bareroot)
- ❑ Weed the sacks/beds frequently
- ❑ Prune the terminal buds of trees that will be planted in a living fence/green wall at two months
- ❑ Begin hardening off your seedlings one month before outplanting

Workshop 4: Outplanting

Introduction

Outplanting is the time of planting your tree seedlings into your Forest Garden. It is a very important time, as how well you do outplanting will help determine how much trees will survive and how successful your Forest Garden will be.

Take Home Activity Checklist: Outplant Your Forest Garden Trees

- ❑ Constructed a Dead Fence to protect Green Wall.
- ❑ Successfully planted the Green Wall and Alleys/Contours.
- ❑ Successfully planted and protected some fruit trees.
- ❑ Weeded, mulched (fruit tree only), and watered the outplanted seedlings.
- ❑ Replaced dead seedlings.

Notes

Preparing Seedlings for Outplanting

Hardening Off

One month before outplanting, prepare your seedlings for more sun and less water:

- Slowly reduce the amount of shading each week. After one month, the seedlings should be in full sun all day.
- Slowly reduce the amout of water. Water every other day, then every third day. By the time you are outplanting, the seedlings should be able to survive a week without water.

When to Plant

- Plant your seedlings at the beginning of the rainy season, after about two weeks of three or more significant rains.

Spacing

Agroforestry Tree Spacing

Green Wall and Alley trees are generally planted close together. You may fill in the General spacing guidelines according to your Trainer's instructions.

	Tree species	Spacing between trees in a line	Spacing between rows of trees
Green Wall			
Alley			
Contour			

Don't forget a dead fence around your Forest Garden to protect your newly planted living fences, green walls, alleys and contours from livestock!

Fruit Tree Spacing

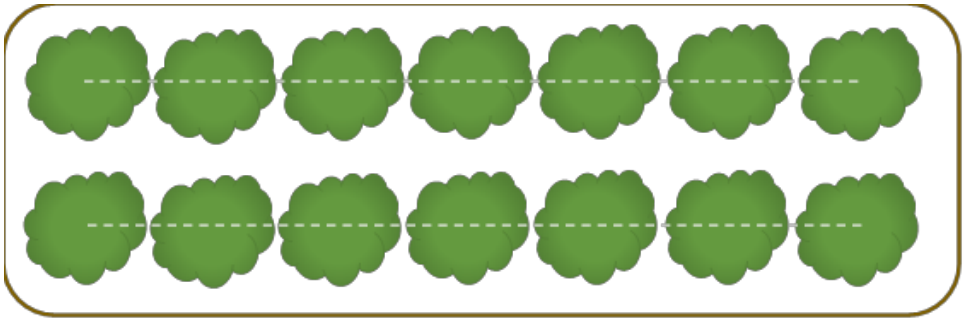
Fruit trees often require farther spacing. You can use these guidelines to help with spacing for the following trees.

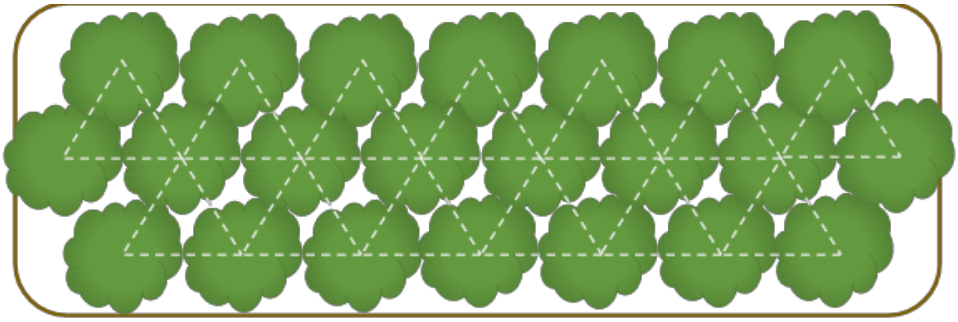
Small trees/plants 2-3 m (6-10')	Small trees/shrubs 3-5 m (10-15')	Large trees 6-9 m (25-30')
Pomegranate  Tree tomato  Papaya 	Apple  Guava  Banana  Soursop  Lime, Orange  Sweetsop 	Mango  Macadamia  Cashew  Avocado 

Triangular Spacing

Using Triangular Spacing can help use space better and fit more trees in an area.

Trees planted using traditional row spacing, as seen on the right, hold fewer trees. This area can fit 14 trees.

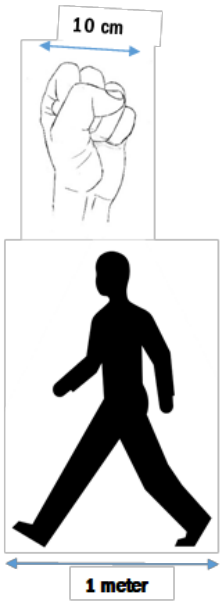


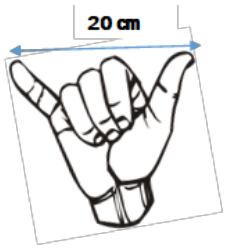


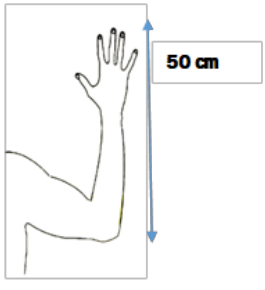
Trees planted using triangular spacing, as seen on the left, hold more trees. We can fit 22 trees in the same area.

Use your Body to Help with Spacing

You may not always have a measuring tool available when measuring spacing for planting. If not, it may be helpful to use these parts of the body as measurements.







Outplanting

Tree Sack Outplanting

1. Prepare planting holes ahead of time, correctly spaced for the species/use, slightly larger than the size of the planting sacks.
2. Water seedlings thoroughly before transplanting.
3. Carefully remove and transport trees in sacks to planting location. Only remove what you will plant that day.
4. Remove sack from around the seedling and gently loosen the soil around the roots
5. Place the seedling in the hole. Fill in or remove more soil as needed to ensure the soil level is the same height as the root collar (the soil level around the seedling).
6. If taproots are too long to stick straight down in prepared planting hole, dig deeper or prune the roots with a clean, sharp knife.
7. For high value trees, mix top soil from hole with fully decomposed compost or manure.
8. Then fill in and firmly compact the soil around the seedling (don't compact too tightly!)

Bare Root Outplanting

1. Prepare wide, deep planting holes ahead of time, correctly spaced for the species/use.
2. Remove seedlings very carefully after deeply watering the bed the night before
3. Wrap seedling roots in banana leaves or rice sacks after coating them with mud slurry; be sure to keep them moist until planting
4. Only remove those you can plant the same day
5. If taproots are too long to stick straight down in prepared planting hole, dig deeper or prune the roots with a clean, sharp knife.
6. Place the seedling in the hole, ensuring the taproots point straight down. Firmly pack the topsoil around the root system, up to the root collar (don't compact too tightly!)
7. Cleanly prune the leaves and branchlets on the stem, leaving only a few at the top of the seedling. This will encourage root establishment before more stem and leaf growth.

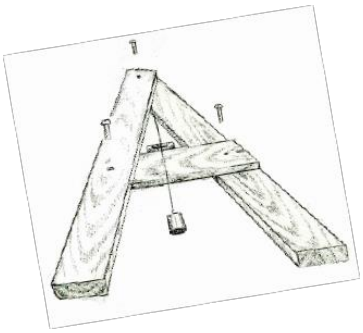
Outplanting Bare Root Seedlings

Using an A-Frame

Building an A-Frame

Materials Needed to Construct an A-frame:

- Two 1.5 to 2 meter sticks or poles about 3 to 5 cm in diameter (can be wood, bamboo, plastic, or any other light-weight, sturdy material)
- One 1 to 1.5 meter stick of the same material
- Three nails, or 2 meters of twine/string for binding the wood together
- One 1.5 meter piece of twine/string for the level
- One round rock or weight, about 5 cm in diameter

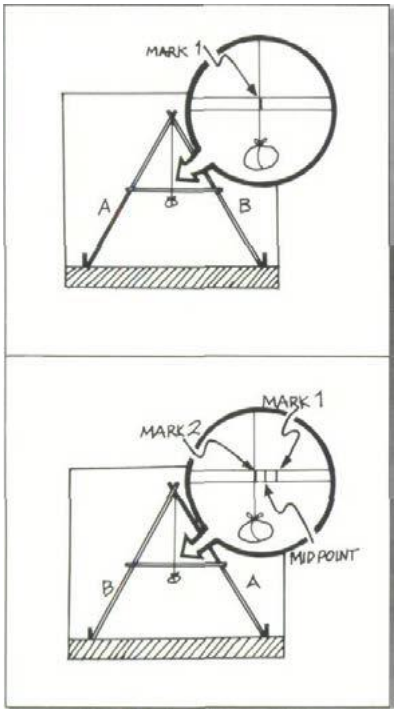


Making the A-frame

1. Join the three poles securely to form an 'A'.
2. Tie a string from the top of the A-frame.
3. Tie a rock to the bottom of the string, allowing it to hang ~25cm or more below the horizontal pole.

Find the 'Level' Line

1. Place the A-frame on nearly level ground
2. Mark the spots where the legs (A and B) touch the ground.
3. Mark the crossbar where the weighted string passes it ("mark 1").
4. Turn the A-frame so that leg A is exactly where leg B was, and leg B is exactly where leg A was
5. Mark the crossbar where the string falls now ("mark 2").
6. If the two marks are the same, they are the midpoint.
7. If they are in different places, the midpoint is exactly halfway between the two.



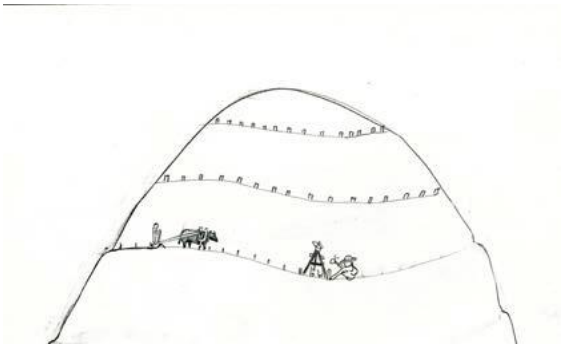
Check the 'Level' Line

1. Check that your level line is accurate by holding one leg on the ground and moving the other leg until the string hangs at the midpoint
2. Mark the positions of legs A and B with stakes in the ground.
3. Reverse legs A and B

4. If the string hangs at the midpoint again, the A-frame is level and the midpoint is accurate. Mark the midpoint clearly on the A-frame.

Using the A-Frame

Find and Mark the Contours:



1. Start at the top of a hill in your land
2. Placing leg A of the A-frame on the ground where you want to establish the first row. Mark the leg with a marking stake (a piece of wood).
3. Adjust the other leg until the string hangs across the center 'level' line, showing that it is level. Place a stake at leg B.
4. Next, pivot leg A around, keeping leg firmly in place at that second mark. Readjust leg until the string shows it is level and mark the third point.
5. Continue this same process across the hillside or slope.
6. Follow the same steps to delineate the next line down, which should be parallel to the one you just completed. The vertical drop between contour rows (not the distance between rows) should be about 2 meters. The steeper the slope, the closer the contours will be.
7. Continue this process down to the bottom of the hill.

Prepare the Contour Trenches (berms and swales):

1. Using your markers as a guide, dig a ditch about 50cm wide and 50 cm deep along the contour to create a swale.
2. Place the soil from the ditch on the uphill slope to form a berm
3. Pack the soil firmly.

Stabilize the Berms:

1. Sow pretreated seeds or plant trees and grasses along the berms. Their roots will stabilize the berms and slow and trap runoff.
2. Be sure to keep animals from grazing the berms and eating the trees/grasses.
3. Before the next rainy season, remove the soil that washed into your swales the previous year. Place it back on the berm above.
4. Fill in gaps in your vegetation with more trees and grasses.

Caring for Outplanted Seedlings

Be sure to:

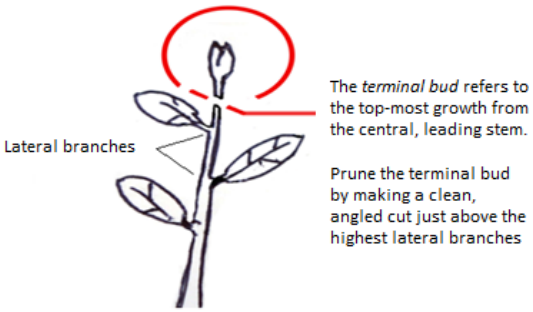
1. Protect your seedlings
2. Water your seedlings
3. Weed your seedlings
4. Prune terminal buds of living fence trees
5. Replace dead seedlings

Protect Important Trees:

Though you have a Dead Fence to protect your Forest Garden, you should still to protect individual high value trees, like grafted fruit or timber trees. Here are some ways you may protect trees.

Water High-Value Seedlings:

High-value seedlings like fruit and timber trees should be watered if possible, unless there is adequate rain. It is better to water a lot at one time rather than a little bit over many days. Digging a cuvette and mulching around the seedlings will help conserve water.



Prune Living Fence Trees:

The Terminal Bud of thorny living fence trees should be regularly pruned, every few months, starting when trees are in the nursery. This will help the tree form more lateral (side) branches and making a more secure fence.

Workshop 5: Permagardening

Introduction

The Permagarden is where you will grow a lot of your market and home vegetables. It is a way of gardening that takes care of and designs for soil fertility, water management and pest management. You will learn how to establish and manage your Permagarden to get good harvests of lots of nutritious vegetables.

Take Home Activity Checklist: Establish your Permagarden

- ❑ Within 2 weeks
  - ❑ Establish a vegetable nursery bed
  - ❑ Correctly sow seeds.
  - ❑ Establish 3 permagarden beds (double dug, sunken or raised depending on region).
  - ❑ Establish basic garden earthworks (swales and berms) around their permagarden.

- ❑ Within 8 weeks
  - ❑ Created and applied one natural solution according to what is identified in the field
  - ❑ Successfully transplanted their anchor crops from the nursery
  - ❑ Direct seeded anchor crops
  - ❑ Sown or transplanted plants for the purpose of feeding the soil
  - ❑ Established companion plant groupings for IPM and secondary/tertiary production in each bed, for example:
    - ❑ Using one or more techniques to attract beneficial insects (flowers for pollinators; planting crops that tower high--sunflower, papaya--for praying mantis, birds and lizards; others?)
    - ❑ Planting one or more companion plants to repel insects (onions, desmodium, garlic, lemongrass, marigolds, other pungent herbs)
    - ❑ Planting one or more companion crops for secondary or tertiary production
  - ❑ Planted borders around their permagarden area

Notes

Making a Meal

Draw a non-nutritious meal in the box below:

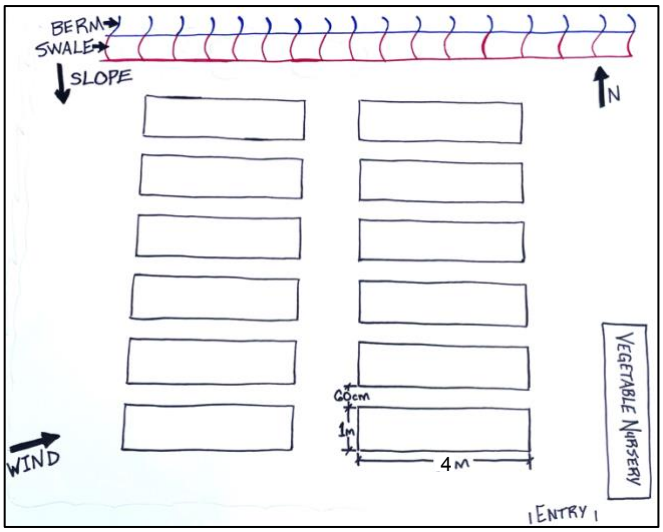
Draw a nutritious meal in the box below:

Eating a variety of colorful fruits and vegetables (especially dark green, orange/dark yellow, red) along with protein (legumes or animal-source foods) provide the important nutrients your family needs to be healthy.

Designing your Permagarden

Step 1: Location and Layout

- Permagarden site should be easy to access, near a water point where possible, and receive at least 4 hours of direct sun each day.
- Use berms/swales to redirect rain water under ground or around/under raised beds (or into sunken beds in dry areas)
- A good size permagarden is 10 meters x 10 meters. A good bed size is 4m x 4m. Leave at least 60cm of space between beds for access.

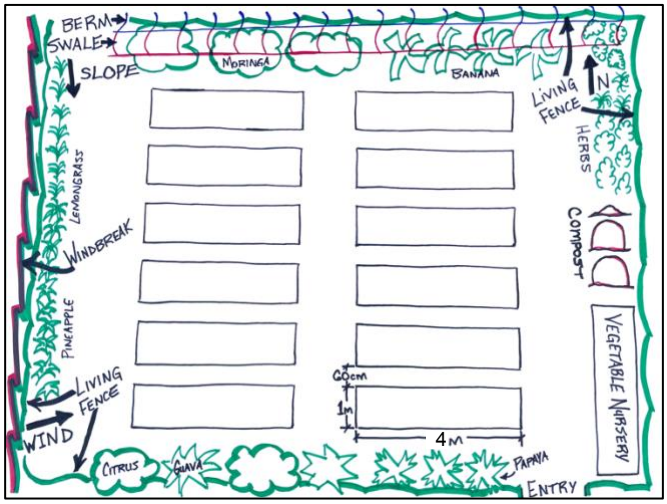


Step 1: Draw bed layout and earthworks

- Situate beds east to west or along contours if sloped
- Leave room for a vegetable nursery bed, compost piles and general work space.

Step 2: Borders and Alleys

- Plant living fences and windbreaks to protect your permagarden and to segment and protect your market gardens, tree crops, field crops and any other areas of your Forest Garden.
- Plant grasses, bushes, shrubs and trees along borders and alleys to maximize production, fertilize your crops, reduce erosion, and manage pests



Step 2: Draw Borders and Alleys (where relevant)

Step 3: Food for the Family

- For each section (bed, alley, contour, or segment), identify an anchor crop that you will grow for your family (for nutrition or for market).
- Recall the vegetables you selected after the planning workshop. Anchor crops should be nutritious (dark in color, or a legume) or have good market/profit potential.

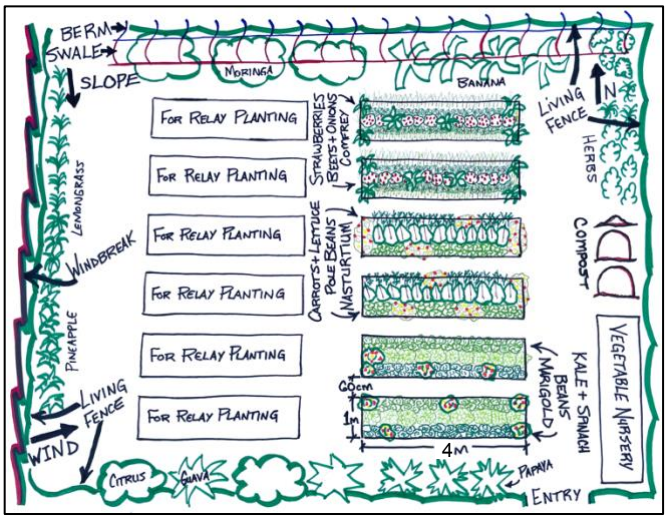
Step 4: Food for the Soil

- Select nitrogen fixing plants or plants with a very long taproot (diggers and miners) to fertilize and improve soil structure. Use cover crops when you're not planting sections to prevent soil exposure.

Step 5: Finding Companions

Diversify your beds and sections with companion plants that compliment and protect your anchor crops. Avoid planting antagonist plants together (see the Vegetable Planting Chart in the Planting the Permagarden section. Try to add several plants for the following purposes:

- They grow well as secondary products to your anchors, to provide nutritious or marketable products
- Their roots or crowns occupy different layers of space below or above ground, or they require different types of nutrients. These companions reduce competition for nutrients, sunlight, and water.
- Short plants that like shade and grow well under taller plants; tall plants for vines and climbers to climb up.
- Strong-smelling plants that deter pests
- Plants with pollen or nectars that attract insects or birds that eat pests
- 'Trap' plants that pests prefer to your anchor or secondary crops



Steps 3-5: Design and draw beds with anchors, food for soil, and companions (this can be done separately where preferred)

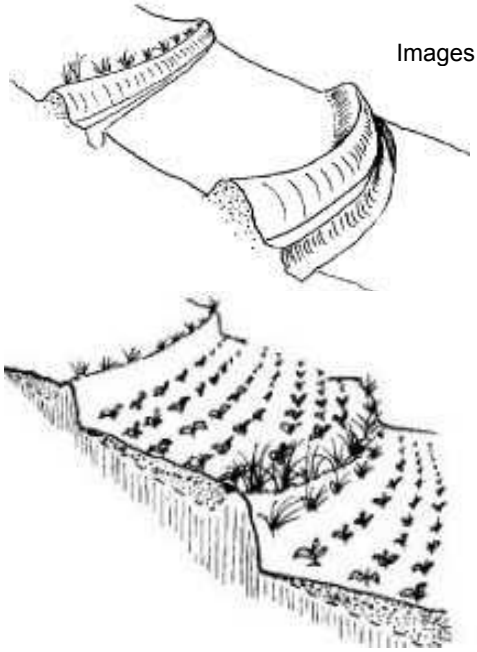
Establishing the permagarden

Permagarden Bed and Alley Design

Use the boxes below to design your beds, alleys, contours or sections of your Forest Garden, following Steps 2 (where needed), 3, 4, and 5 of the Permagarden design process.

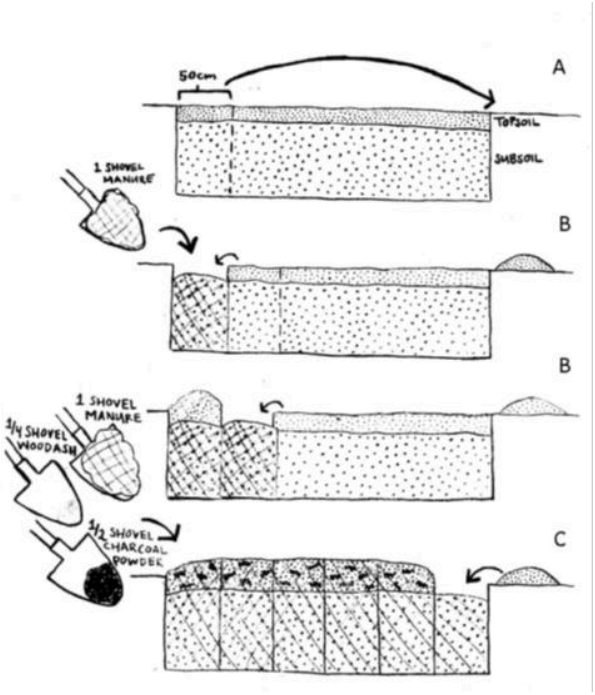
Establishing the Permagarden

Images from IIRR



Use berms and swales on sloped land

1. Plant the berms with trees and grasses
2. Plant contours with diverse crops
3. Over time the contours will form terraces



Double Digging

Double Dig and amend your permagarden beds

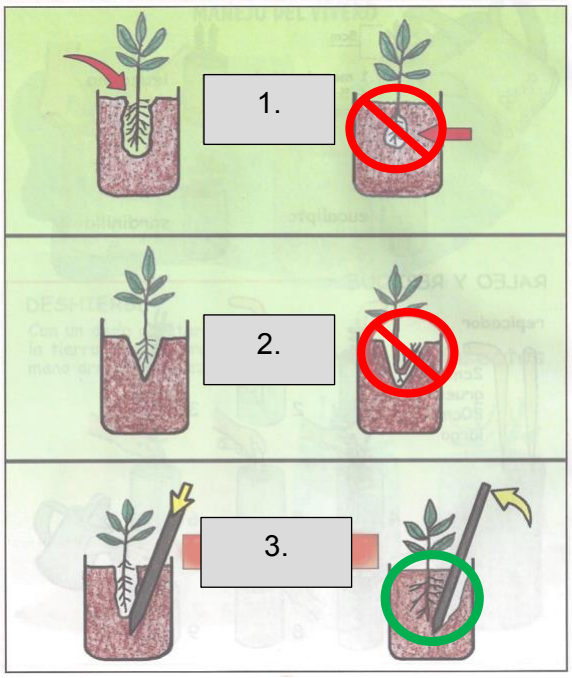
Vegetable Nursery

Vegetable nurseries beds do not need to be double dug, but they should be deeply tilled, amended with compost, and protected from direct sun

Planting the Permagarden

Transplanting

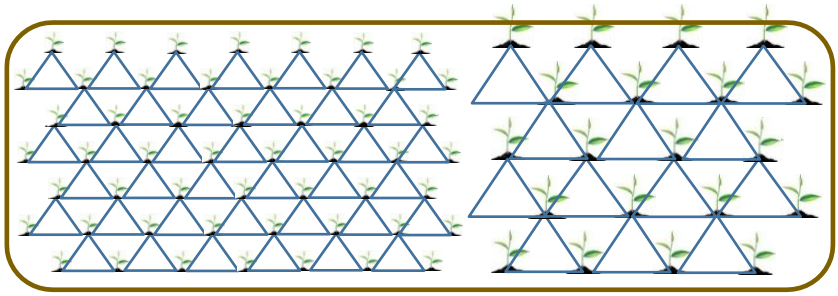
When transplanting plants from your vegetable nursery into beds, alleys, etc., dig holes slightly larger than the root system of the plant.



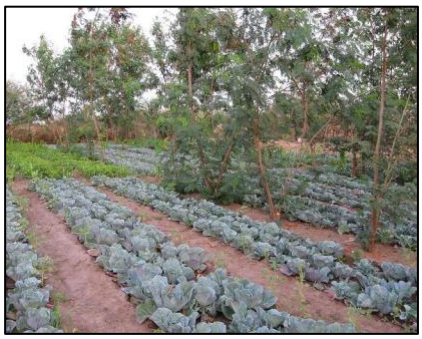
1. Place the plant in the hole. The soil level should be slightly above the upper-most roots. Press soil firmly around the roots. Not too tight, but do not leave big air pockets around the roots either.
2. Be sure the roots face straight down. The taproots should not curve back up, forming a 'J' root.
3. Use a stick to gently push soil around the roots, then use your hands to firmly press the soil down.

Triangular Spacing

Use triangular spacing when not using the broadcast method. This helps you grow more food in less space.



Use the same permagarden design and planting principles whether you are planting in beds, alleys, contours, or segments.



Vegetable Planting Chart

Vegetable	Direct Seed or Nursery	Germination Time	Spacing when Planting	Time to Maturity	Companions	Antagonists
Amaranth	Nursery	4-10 days	30cm	1 month	eggplant, cucumber, corn, potatos, peas, beans	celery, tomato
Bell pepper (sweet)	Nursery	7-21 days	45cm	60-90 days	basil, onions, tomato, spinach	beans, cabbage, kale
Bitter Tomato	Nursery	8-10 days	45cm	12 weeks	carrot, beans, marigold	cabbage, broccoli, kale (brassicas)
Broccoli	Direct Seed or Nursery	7-10 days	45-60cm	80-90 days	basil, bush beans, cucumber, garlic, marigold, mint, onion, potato, radish, rosemary, dill sage, thyme	mustard, oregano, strawberry, tomato
Butternut Squash	Direct Seed	10 days	4 per hill / 2-3m apart	3 months	Flowering plants (pollination)	sweet potato
Cabbage	Nursery	7-10 days	60cm by 60cm	1.5 -4 months	Beets, bush beans, celery, mint, onion, potato, orgegano, rosemary, sage, dill	pole and runner beans, peppers, strawberry, tomoto
Carrot	Nursery	14-21 days	30cm between rows; 5cm in rows	3-4 months	Pea, lettuce, onion, tomato, beans, rosemary, broccoli, cauliflower	potatos, dill
Cauliflower	Direct Seed or Nursery	7-10days	60cm by 60cm	50-100 days	basil, bush beans, cucumber, garlic, marigold, mint, onion, potato, radish, rosemary, dill sage, thyme	mustard, oregano, strawberry, tomato

Chilli Pepper (hot)	Nursery	7-10 days	45-90cm	90-150 days	basil, onions, tomato, spinach	Beans, cabbage, kale
Collard	Nursery	4-7 days	30cm by 45cm	55 to 75 days	Beets, carrots, marigold, radish, turnip	
Corriander	Nursery	14-21 days	broadcasted or drills	40-45 days	Leafy vegetables, legumes, tomato	
Courgette (Zucchini)	Direct Seed	7-10 days	90cm by 90cm	2-2.5 months	Flowering plants (pollination)	Sweet potato
Cow peas	Direct Seed	7-10 days	5cm by 8cm(for Seed}	80-90 days	Maize, sorghum, melons	
Eggplant (Aubergine)	Nursery	7-12 days	45cm	70-80 days	Bean, peppers, tomato	fennel
Giant night shade	Nursery	7-14 days	20cm	30 days	tomato	
Green Beans	Direct Seed	3-4 days	60 by 30cm	3 months	beets, cabbage, cauliflower, kale, cucumber, celery, swiss chard, spinash, maize, eggplant, peas, tomato	onion, leeks, garlic, peppers
Green Peas	Direct Seed	3-5 days	10 by 60cm	8-12 weeks	beans, cabbage, celery, corn, cucumber, lettuce, potato sage	onion, leeks, garlic
Kale	Nursery	7-10days	60 by 40cm	30-45 days	Beets, carrots, marigold, radish, turnip	
Leeks	Nursery	10 -14 days	15cm by 3cm	120-150 days	Beets, cabbage, carrots, lettuce, rosemary, strawberry, tomato, onion, garlic	beans, peas

Leaf Lettuce	Nursery	7-10days	30cm by 25cm	45 - 90 days	mint, beans, beets, carrots, maize, marigold, onion, peas, radish, strawberries	parsley
Okra	Direct Seed	2-12 days	15 by 45cm	50-65days	brassicas like kale, brocolli, cauliflower, chard	vine crops like sweet potato or squash
Bulb Onion	Nursery	7-10 days	30-38cm	14 weeks	Beet, strawberry, tomatoe, lettuce, leek, cabbage, eggplant	Pea, bean
Onions	Nursery	drills 2.5cm deep and 30cm apart	15cm by 10cm	3-4 months	beets, cabbage, carrots, lettuce, rosemary, strawberry, tomato, leek, garlic	Beans, peas
Potato	Direct Seed	15-21 days	75cm-rows 30cm between tubers	3 months	beans, cabbag, corn, eggplant	celery, cucumber, pumpkin, rosemary, strawberries, tomato
Pumpkin/Squash	Direct Seed	10 days	2.4m-3m-rows and1.2-1.8 for plants	90-120 days	beans, maize, radish	potato
Spider Plant	Direct Seed	6-8 days	broadcasted	21-30 days		
Spinach	Nursery	5- 7days	30 by 10cm	45 days	Beans, lettuce, peas, strawberries	Potato
Sweet Potato	Direct Seed	7 days	30-45 cm	8-10 months	beets, okra, dill, thyme	squash, zucchini, watermelon
Tomato	Nursery	6-8 days	100 by 60cm	60 -100 days	Beans, basil, carrots, spinach, broccoli, cauliflower, celery, marigold,	Kohlrabi, fennel, potato, cabbage

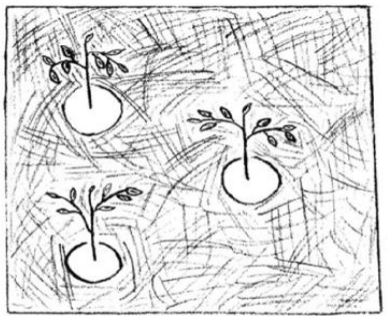
					peppers, watermelon	
Watermelon	Direct Seed	4- 12 days	2m by 2m	70 -85 days	Flowering plants (pollination)	sweet potato

Permagarden Maintenance and Care

Maintain and Care for your Permagarden by:

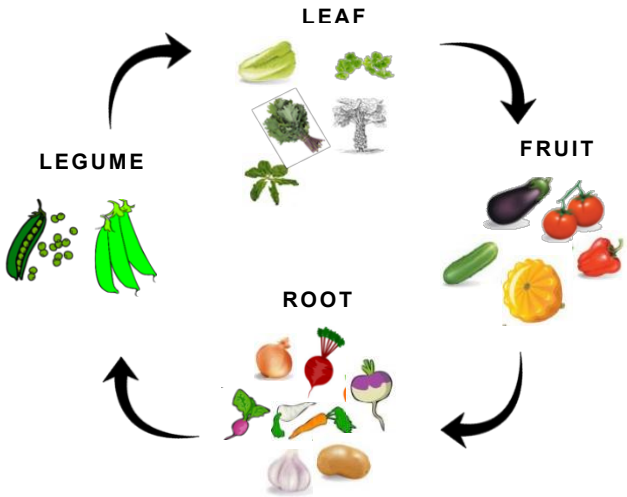
- Spreading 3cm of mulch on the exposed soil, leaving 3cm or space around the seedlings.
- Watering and weeding your permagardens as needed.
- Rotating your crops as possible, from Leaf > Fruit > Root > Legume
- Practicing Relay Planting of crops that mature at different times, to stagger and extend production as much as possible.

Mulch – Top View

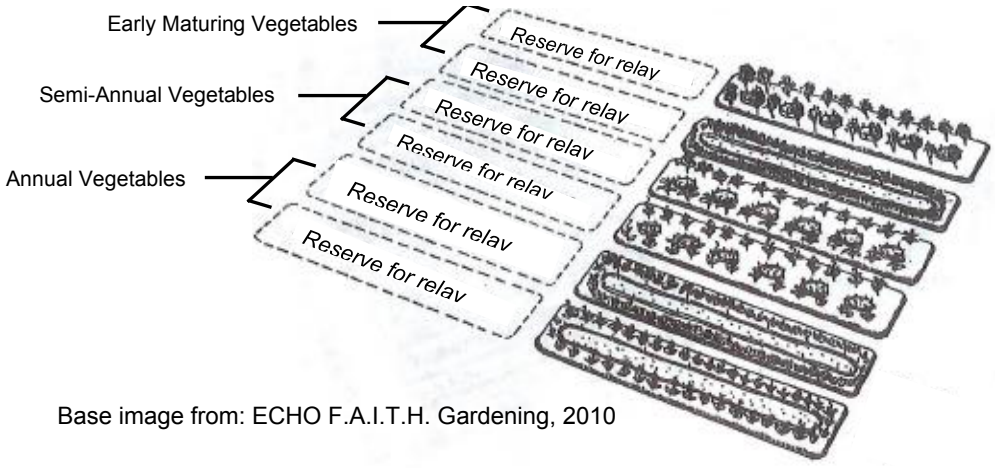


Mulch your beds to a depth of 3cm, leaving 3cm of space around the seedlings' stems

Crop Rotation



Relay Planting



Base image from: ECHO F.A.I.T.H. Gardening, 2010

Integrated Pest Management

Write down natural pesticide recipes that you learn here:

Recipe Name:	Pest Name:
Ingredients	
Directions	
Application Instructions	

Recipe Name:	Pest Name:
Ingredients	
Directions	
Application Instructions	

Workshop 6: Compost

Introduction

Compost is an important natural fertilizer in the Forest Garden. It can be made by you and all Forest Garden farmers are encouraged to have multiple compost piles or pits throughout their Forest Garden to provide compost to permagarden beds and high value trees. You will learn how to make, maintain and use compost.

Take Home Activity Checklist: Establish Compost

- ❑ Located in a good location (Shaded, access to water, near a potential prime application area (permagarden, orchard, etc))
- ❑ Correct dimensions (2m square for pit; 1m-1.5m high for pile)
- ❑ Made up of the correct materials
- ❑ Correctly layered in good proportions/ratios (4 part brown, 1 part green, additional white/grey as available (no more than 1 part))
- ❑ Actively managed (Watered, aerated/turned, heat maintained while decomposing, materials being added to it)

Notes

Identifying Soil Types

There are three main simple types of soil: sand, silt/loam, and clay. It can be helpful to know your soil type. Here is a simple way to test the soil texture of your Forest Garden.

Simple Soil Test:

a. Grab a handful of soil, make a fist with it, and stick it in a bucket of water until it is thoroughly wet, holding it tight. Remove it from the water
b. Try to form a ball with the wet soil in your hand
c. If there is little resistance and the soil does not stick together at all, it is mostly sand. Nutrients and water are prone to leaching quickly through sand. Add organic matter, compost, or dried manure.
d. If it forms a ball in your hand, try rolling the ball between your hands to form a snake. If it starts to fall apart as it gets longer, it is some form of loam (short snake = sandy loam; long snake = clayey loam)
e. If you can touch the ends of the snake together without it falling apart, you have clayey soil. They may be prone to waterlogging, and plant roots may have difficulty accessing nutrients, air, and water. Add organic matter, compost, or dried manure. The good news is that applying compost will improve any type of soil.

Compost Piles and Pits

Adding plenty of compost will improve any type of soil.

A **compost pit** is good for **dry areas**, to conserve moisture

A **compost pile** is good for more **humid areas** to allow for drainage

Compost Materials and Layering

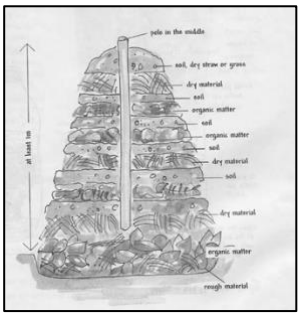
The key to compost is having the right materials in the right proportions. It is good to gather a large amount of each of these and have them ready for when you will layer your compost. Both Compost Piles and Pits use the same materials and layering technique.

Materials Needed for Each Layer of Compost

Material	Example	Ratio	Example
Brown	Dry leaves, straw, branches. Large Pieces may need to be chopped up.	2 large sacks	
Green	Green leaves; green grass. Large Pieces may need to be chopped up.	1 large sack	
Grey	charcoal, ash, eggshells	1 shovel	
Activator	Manure, Finished Compost, Forest Soil. This will help microbes enter the compost to help decompose.	1 shovel	
Water		1 large bucket	

Layering

Once you have gathered the materials, you will layer these materials one at a time, either in a pile or pit. You will repeat the layers until the pit is full or the pile is the right height.



Steps in Layering Compost

1. Add 2 parts **brown** material

2. Add 1 part **green** material

3. Spread 1 shovel **grey** material & 1 shovel activator

4. Add 1 large bucket of **water**

THEN REPEAT

5. When pile is ~1 meter high/deep, stick a stick in it and cover it in banana leaves or plastic

6. Dig a trench to divert water around your pile if needed

Maintaining Compost

Check the compost weekly to be sure it is working. If layered correctly with the right materials, compost will decompose naturally without much labor. Remove the stick in the compost and feel it to see if it is decomposing. IF the:

- Stick is HOT--it is decomposing and working correctly.
- Stick is COLD--it is not working correctly. It may need mixing or turning to reactivate, and more attention paid to the material ratio.
- Stick is DRY—add water.

Turn compost piles every two weeks to give them air and water, then cover them again.

Once compost is fully decomposed, it will no longer be hot. It should dark, soft, and moist, and smell like fresh soil without any bad odor.

TREES FOR THE FUTURE

Forest Garden Training Center

training.trees.org

inches

centimeters