Permagardens:
Empowerment through Resilience

A Guide for Facilitators




Training Small Groups in the Step-by-Step Creation Techniques

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December 2015

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Please note: All opinions expressed within this document are my own and do not necessarily reflect the policies nor opinions of the United States Government, USAID or the Peace Corps. The science that is found within this manual, however, is fact and not under dispute.

Introduction

Hunger, malnutrition and early childhood stunting are problems across the developing world. The root causes have been linked to poverty, illness, lack of sanitation, early marriage, low birthweight babies and climate change impacting agricultural productivity. These root causes can be overwhelming. Mitigating the problems at the source, the industrialized world, is of course, one solution, and efforts are currently underway on a global scale. But how can those of us in the developing world respond? Should we just wait for our world leaders to solve the problems? What is the answer? Why are we here? Just asking "the question", like all the questions asked during your training, is the first step towards gaining adoption and 'buy in' from even the most risk averse members of the target community.

Permagardens are small-scale, high-yield, climate-smart, family-classroom, home gardens that engage those most impacted by hunger and climate change to respond successfully. This training of trainers manual, in conjunction with the more detailed Complete Permagarden Manual, is intended for Peace Corps Staff and Volunteers from all development sectors. It outlines the critical creation and management steps to make a complete garden from bare ground to fully protective and productive year round garden using only what materials are already accessible. The steps demonstrate the important adaptation, mitigation and intensification steps that will allow even the most vulnerable family to focus on their nutrition as well as overall food security. Each step will bring resilience to each household, one small, doable action at a time. The vision is that the lessons learned from this 'family classroom' permagarden, will not only be the sought after link between seasonal agriculture crops and the daily need for nutritious family food, but will also lead to adaptation to the farm.

The training design suggests small groups of no more than 15 if possible. This facilitates active participation and deeper skills development and serves as a replicable model for the Volunteer to follow upon return to her site. Vulnerable families will be best able to adopt this evidence-based method if it is seen as doable, via small steps. As soon as it looks 'too hard, complicated or tiring' we lose a great deal of enthusiasm from PCVs as well as local familes.

The Terra Firma Method (this manual) informs us how to create Permagardens as a blend between Permaculture and Bio-Intensive Gardening. Permaculture provides us with protective tools that help us work with nature rather than against her while Bio-Intensive gives us powerful methods to maximize annual productivity. Following the four critical themes of local resource assessment, proactive protection, year round production and ongoing management, it uses only locally accessible materials, tools, seeds and plants to provide the family with a diverse supply of fresh, nutrient-dense vegetables, fruits and legumes on a daily basis. The garden will not always produce the same product. Rather, it is designed and managed in such a way that it will continue to provide diverse products for the family table week after week, without the family needing to be overly worried about the weather.

This Facilitators Guide is meant to be used in the field, as you teach. As you discover gaps or better ways to deliver a message, please feel free to adapt. We want families to adapt and prepare; so you to must feel empowered to do the same. It will allow even our most inexperienced Trainees to feel empowered to take the most critical first steps towards lasting behavior change; their own as well as their targeted families.

Materials and Site Selection

The key to the success of any training is to make it as close to reality as possible. Even if your training facility has really good soil and lots of nice tools, don't use them. If we want our trainees to make a lasting impact by getting local families to adopt these (or any) methods, we must use only those materials, plants, seeds and tools that those families already have easy access to. Literally speaking, if they don't have it; we don't use it!

Prior to any training, it is imperative to gather local tools and materials and choose an appropriate site that fits your target population. The list that follows are suggestions only. Feel free to add or subtract to fit the local situation.

Site Selection: "The Badder the Better"

- Close to a small building or house with a roof
- 4m x 4m is the ideal size to create a garden with 3 beds surrounded by berms
- Ideally the land will be hard with a slight slope leading away from the house
- At least 4 hours of sunlight per day
- Reasonable access to water for garden building purposes only
- Poor quality soil (not solid rock!) to start with: hard is ideal to show real change

Tools: Locally Accessible Only

- The local digging tool, whatever it is. 4
- 20-liter buckets for transporting water or materials 4
- 50-kg grain sacks (fill with dry brown leaves if none are available on site) 4
- Meter long straight sticks (old broom handles) 4 for marking beds, thermometer 4

Materials: Locally Accessible Only

- Manure: 50 kg sacks of cow, sheep, goat (ruminant) is best 4
- Charcoal: 50 kg sacks of the small chips on the ground where charcoal is sold 4
- Wood Ash: 20-liter bucket
- Other local waste materials: dry egg shell, snail/oyster shell, coffee grounds, tea bags

Plants and Seeds: Locally Accessible Only

- Annuals: Leaf (amaranth, kale, maize); Fruit (tomato, pepper – seedlings are ideal); Root (carrot, beet, radish); Legume (bean, pea, cowpea). Enough to demonstrate planting technique.
- Perennials: Locally preferred medicinal, culinary or pest repelling varieties such as: lemongrass, rue, rosemary, mint, papaya, aloe vera.
- Trees: agroforestry species suitable for live fencing if possible: leucaena, glyricidia, sesbania,
- Border Shrubs: Tephrosia, Tithonia, Lantana, Sisal, Vetiver, Neem

The Lesson Plans

Session One:	Introduction to Gardening	(classroom)
Session Two:	Garden Site and Local Resource Assessment	(garden)
Session Three	Resource Capture via Compost Making	(garden)
Session Four:	Garden Water Management	(garden)
Session Five:	Bio-Intensive Bed Preparation	(garden)
Session Six	Bio-Intensive Garden Management	(garden)

Key Aspects of Each Session:

- should be 2 hours long with a 5 minute break (except Intro = 90 minutes)
- should include no more than 20 participants, 10-15 as ideal (intro is whole group)
- should be co-facilitated wherever possible (PTA with experienced PCV)
- should use the See, Do, Teach Action Learning Methodology
- should reflect how we expect PCVs to conduct trainings in their community
- should use ONLY locally accessible materials, tools and plants
- should use a representatively poor piece of ground, near a small building or home
- should end with a Wrap Up of four questions: Was this activity "CLOSE"? what did we learn; how will we use this; and, why was this important.

Overall Training Theme: The Permagarden is a Climate-Smart, Nutrition Focused, Family Classroom. "If we prepare for the climate; we can stop worrying about the weather."

- Climate Smart = Being responsive to the local climate challenges
    1. Adaptation (berms and swales for water control)
    2. Mitigation (carbon-rich soil and perennial borders capture carbon dioxide)
    3. Intensification (bio-intensive spacing for increased plant numbers and health)

Key Session Themes:

- Assessment (of locally accessible materials)
- Protection (from flood, drought, wind, animals)
- Production (high yields of nutrient dense foods for daily feeding)
- Management (seasonal variations, planning and expansion)

Behavior Change and Adoption Themes:

- Every Action is Small and Doable
- Every Action is Learned best via the See, Do, Teach Method
- Every Action follows the Rule of CLOSE
    1. Close (to the area of daily observation and management)
    2. Local (accessible tools, plants, materials)
    3. Organic (natural, non-synthetic, a living thing which changes to fit the area)
    4. Small (in size to start with; provides substantial product)
    5. Easy (to see it, do it and teach it)
- **C** x **L** x **O** x **S** x **E** = **Positive Attitudes leading to Adoption**
    1. If any one of these is missing, then the end result will be 'No I Cant".

Session One: Addressing the Problem, Defining our Target (whole group) 90'

1. Energizer: The Rain Dance **10'**
    a. How to Start a Movement via the Early Adopter/Risk Taker
    b. Behavior Change in Action through Small Doable Actions
    c. Water Management "Six S" Intro: Stop, slow, Sink, Spread, Save, shade

2. Introductions **10'**
    a. Name, Your Degree, Garden Experience (any in the Tropics?)
    b. "It's nice to meet you David"

3. David vs Goliath **15'**
    a. Why did I call you David? Just like biblical David; You are "expected" to fail!
    b. But who actually won? And why? Because he used his particular skills and talents and didn't try to go hand to hand with Goliath. If he had, he would have lost for sure.

Garden	**Description**	**Farm**
Small	**Size**	Large
Narrow/Deep	**Tillage**	Wide/Shallow
Women	**Gender***	Men
Food/Table	**Purpose**	Crops/Market
Daily	**Timing**	Seasonal
Hand	**Tools**	Machine/Plow
Local/Organic	**Fertility**	Imported/synthetic
Natural	**Pest Control**	Synthetic
Bucket/Rain	**Water**	Irrigation/Rain
David		**Goliath**

PC Approach: We work with "David" to act like David…NOT Goliath!

The Rule of CLOSE: Close x Local x Organic x Small = Easy

C = Close (to the home)	vs	Far	(F)
L = Local (materials, tools, etc)	vs	Imported	(I)
O = Organic (life, changeable)	vs	Synthetic	(S)
S = Small (to begin, can expand)	vs	Large	(L)
E = Easy (to see, do, teach)	vs	Difficult	(D)
CLOSE		FISLD	(Fizzled)
Independence, Positive Attitude	vs	Dependency on Ext factor	
Home Gardens		Commercial Agriculture	

4. PC Approach to Development/Gardens **10'**
    a. "Teach Two" Paper Cutting Exercise
        i. By keeping things Small, Doable and C.L.O.S.E. we reach our early Adopters and 'Start a Movement for Positive Change'
    b. Intercultural Blending:
        i. Modern Science & Adaptation (climate smart)
            X Traditional Values and Methods = Resilience and Acceptance

The Missing Link FlipSack (see below): **10'**

Permagardens are the "missing link" between seasonal farm production and the daily food needs of the family. This 'classroom' is a blend of sound agriculture, locally appropriate science and local traditions and values, right outside the back door. The permanent garden provides daily ACCESS for the family. We are moving beyond production for the market (to which mothers have limited transport, time and financial access) towards daily kitchen access and food for the entire family.

5. Permagarden Vision, Goals, Objectives and Tasks Overview **10'**

   a. These will be the 5, 2-hour hands-on, sessions to follow
      How do these fit within our Project Framework?

   Vision: Empowered, Climate-Resilient, Nutrition Secure Families

   Goals: 1. Daily Nutritious Food 2. Seasonal Environmental Control
   3. Weekly Maternal Income 4. Community Level Trainers

   Objectives 1. Home Based High Yield Permagardens 2. Local Experts

   Tasks: "Prepare for the Climate; Stop Worrying about the Weather!"

Resource Assessment	(Soil Quality, Landscape Walk)
Resource Capture	(Compost, Waste Resources)
Water Management	(Berms and Borders)
Bio-Intensive Bed Preparation	(Double Digging)
Bio-Intensive Garden Management	(Plant Spacing, Crop Rotation)

Wrap Up Review Why are we here? What is the answer? The question IS the answer.
What did we learn?
Why was this session Important?
Why do gardens fail? Vs Why do *Garden Projects* Fail?

Flipsacks: why we focus on Permanent Household Gardens – to reach the large percentage of hungry mothers, fathers and children who lack ACCESS to all the food grown and available.

Session Two: Resource Assessment: Garden Site, Soil and Local Resources

Objectives: By the end of this session, participants will know the values of local resources and soil and how to use these assets in a properly sited home garden

1. Garden Site Assessment 15'
2. Land Clearing 45'
3. Landscape Walk 45'
4. Review Questions 15'

Materials/Preparation Needed

- Flipsacks: Landscape Walk, Basic Soil Science
- Several empty sacks to gather found materials
- Hoes to loosen soil for assessment
- Take a walk in the area beforehand to discover key stopping points

Key Messages (Information)

- Much of what we need to improve garden productivity can be found nearby.
- We can improve any soil (ANY) if we remember the Three Basic Needs: Air, Water and Carbon.
- Carbon (Organic Matter) is the most important thing to add to the soil to improve its structure. Texture CAN NOT be changed but the Structure can be.
- Useful Leguminous trees: Sesbania, Leucaena, Tephrosia, Moringa
- Useful perennials (for berms): Rue, Rosemary, Lemongrass, Aloe, Thyme, Papaya
- Useful 'waste': charcoal (carbon), wood ash (minerals), manure (bacteria), Egg shell (calcium), Coffee grounds (Nitrogen), dry and green leaves (materials for compost).
- The landscape provides us with great examples of erosion, local methods and gardens (both good and bad) from which we can learn. This outdoor classroom also attracts a lot of attention.

- Considerations for Placement of a garden:
    - Soil: "The Badder the Better" (can be poor quality to begin with)
    - Sun: At least 4 hours a day (6 is 'ideal')
    - Slope: To move water "where we want it to go"
    - Water: Access to home water supplies, saved waste water, grey water
    - Intrusions: Animals, people, birds, wildlife, etc

- Soil Science 101 (Flipsack)
    - Texture: % sand, silt, clay (can't change) vs Structure: air/water dynamics (can change through additions of carbon/organic matter)
    - Acidity: can block nutrient uptake and plant health; how to adjust
    - Fertility: naturally occurring vs what can be added and held

Part 1: Garden Site Assessment: Sun, Soil, Water and Slope **15'**

- Review basic needs of a garden site: Sun, Soil, Slope, Security
- Review Basic Soil Science: Texture vs Structure

- Soil Structure (air and water) can be changed; Texture (% sand, silt, clay) cannot.
- Organic matter (compost, manure, char) fixes any soil problem
- The most important things to add to soil are: **Air, Water and Carbon**

Practice: Garden Area Clearing (5m x 5m) **30'**

Confirm with the group: Does this area (which was chosen) meet the qualifications of access, sun, soil, security, water and slope?

- With just 5 people at a time, using only hoes and moving from bottom to top in a line, remove the grasses and any obvious rocks from the 5m x 5m area.
- Look closely at the soil. Loosen some soil of selected garden plot.
- Each participant gathers a handful for assessment.
- Using squeeze test, determine whether topsoil is clayey, sandy or loam (a blend of all three…the "ideal".).
- What does this texture tell us about this soil? What can we do to change it? (nothing!). What can we do to improve the quality/structure? Add organic matter!

Practice: The Soil Assessment Process "the squeeze test":

- Everyone takes a handful of top soil.
- Drip small amount of water on the dry soil.
- Roll it around and try to form a ball or a 'worm'.
- If the 'worm' can form a circle = heavy clay (fix with organic matter)
- If the 'worm' breaks in the middle = good mix of clay, silt, sand
- If the soil cannot be rolled at all = sand (fix with organic matter)

- In one small area, dig down to the subsoil (where there is a noticeable color, and/or structural difference). Measure the depth of this 'top' soil? This will be important when we double dig later.

- Remove some of the subsoil. Have group describe what they see, feel and smell. If clay, what does this mean for air, water and minerals (see flipsack). If loose and sandy, what does this mean for air, water and minerals (see flipsack). If rocky, can we still have a garden? (yes, raised beds, containers or keyhole). What is the challenge of containers or keyhole gardens? (We will need to make and import good soil; water will have to be added manually)

- The group agrees that this is either a good or bad site for a Permagarden (sun, soil, slope, security, closeness to a home/kitchen).

- How can the soil, of whatever initial quality, be improved with local materials?

Part 2: The Landscape Walk 45'

Information: Review flipsack with all participants standing in a circle.

Practice: Lead group on a 30-minute tour of the area.

- Highlight values of materials discovered: char, ash, manure, kitchen waste

- When cutting tree branches, discuss ‘apical dominance’ (how a tree will regrow from “the new top”, a principle known as coppicing, which forces regrowth down to the next node.
- The key idea: “the more you cut the more you get.”

- Gather examples of local waste materials if any are seen: wood ash, char, green and brown leaves, manure, kitchen waste, egg shell, coffee grounds, etc. Bring samples back to the garden area.
- Look for examples of water or wind erosion (ie, roof water gathering speed as it comes down a path). Discuss what we learn from this.

Summary Review Questions: 20’

- What have been the visible results of erosion?
- How can we use signs of erosion to our advantage in a home garden?
- What is the problem with a gully (all the water goes to same place)
- What is good about a gully (all the water goes to the same place)
- Are there any local measures currently in place to stop the water?
- Is there an area in the path of the water that is NOT eroded? Why not? (often due to something stopping and slowing the water like rocks or grasses).
- How can we use this idea in the garden we are going to create?
- What examples of gardens did we see? Are they good or bad? How can we learn from both?
- How can we use these waste materials to improve the soil structure/fertility?
- What are the values of each of the items we collected?
- How can what we have learned be applied to a small garden near home?

Session Wrap Up 15’

Was this activity CLOSE?
What will we do with this knowledge and skill?
Why were these activities (landscape walk and garden site assessment) important as the first step in garden creation?

Soil Texture Assessment (improve with OM)

The Landscape Walkabout to ID local resources

Session Three: Local Resource (Carbon) Capture via Composting

Objectives: By the end of this session, participants will know the value of carbon in soil as well as how and why to make compost.

Materials/Preparation Needed

- Flipsack: Compost Making
- One 50+ kg sack of green vegetable waste from local market (gathered day before)
- 4, 50 kg sacks of dry brown material (leaves, straw)
- 2, 20-liter buckets of manure (can be old and dry)
- Access to 80 liters of water
- Clear plastic sheeting (small piece), plus plastic tarp that can cover the whole pile.
- Sharp stick (no bark) to act as a thermometer

Information: The Key Messages:

Community Barriers to Adoption: **(**these can be read aloud to the group.)

- Benefits of compost are not widely known or understood. (most think of it as fertilizer when its most important role is that of conditioner, allowing a soil to hold air, water and minerals.)
- The role of microbes in soil health is not known or understood. "bugs are bad"
- Many gardeners don't know how to prepare it simply (think you need a deep pit)
- Compost making has often been seen as too much hard work (you have to dig a pit!).
- Pervasive feeling that compost is not as effective as synthetic fertilizers.

Information: FlipSack 30'

- Compost is a cheap, effective, and easily made, soil conditioner made from local waste. It is not a fertilizer but DOES increase a soil's fertility via carbonic acid and microbial action. Its key value lies in its ability to help any soil hold onto air, water and plant available minerals!
- Adding compost increases the microbial life of the soil. These microbes add nutrients, vitamins, antibiotics and growth hormones which all work to improve root health and growth which leads to overall healthy and productive plants.
- The addition of compost helps to increase the moisture holding capacity of the soil helping a plant withstand longer periods of dry weather.
- Adding compost season after season improves soil health for the long term.
- Compost must remain moist (like a wet sponge) so keep it out of direct sun and wind.
- The heat generated inside the compost comes from bacterial decomposition. The initially high temperatures (over 130F for 2 days) will kill weed seeds and pathogenic microbes.

Practice: The Action Steps in Compost Pile Making 60'

(Note to facilitator: Have all materials gathered before the session begins. Some time can be spent gathering some brown materials but the bulk of this should already be on hand so as to save time from doing a menial task. Overall, make sure that all get to participate. This is a small space activity so remember to rotate people in and out. This is the first time we will use the See, Do, Teach Model. It will not be the last time! Remind participants that we are asking them to see, do and teach in the same way that we want them to ask their community participants to do during their community based trainings. It is the best way for all of us to continue our learning.**)**

Practice: Making the Compost Pile

- Dig a 1m x 1m square depression, 10cm deep only. (Save the soil as it will be added back into the pile as it is built.)
- Add a 10 cm layer of 'dry' brown vegetative material (carbon).
- Add a 2 cm layer of 'wet' green plant material (nitrogen).
- Sprinkle 2-3 handfuls of animal manure or topsoil. (bacteria source)
- Mix layers together as you sprinkle with water.
- Continue mixing all layers until the pile is close to a full cubic meter.
- Push sharpened stick (no bark) down through the center of the pile from the top. This helps to measure the temperature in a few days.
- Cover with clear plastic sheet plus a tarp (or lots of dry grasses) to keep as much heat and moisture inside as possible.
- Secure with rocks placed around the base to prevent the tarp blowing off.

- Why clear plastic?: *This will 'clearly' show the condensation after just a few days. This important visual proves the value of the tarp in keeping the pile moist and the bacteria alive and thriving*. (See photo.)

Management Reminders:

- We need to mix and add small amount of water to the entire pile every 2 weeks.
- Compost will be ready when material is dark with no warmth to the touch.
- With regular turning and moisture, the compost should be ready in 2-3 months.
- One cubic meter pile gives us +/- 10, 20-liter buckets for garden beds.
- Apply one 20-liter bucket to the surface of each m^2 of double dug garden bed.

Session Wrap Up: **15'**

Was this CLOSE?
What did we learn?
What will we do with this knowledge and skill?
Why was this session important?

Clear plastic shows vital moisture saving.

High temperature kills weed seeds & pathogens.

Session Four: Water Management "Six S"

Objective: By the end of this session, participants will know how to manage surface water runoff by constructing berms, swales and catchment holes around the garden.

(Facilitator Note: It is now time to go back to the garden to create the protective berms and connecting swales and holes. This is an active, multi-step process. Once the garden map is created (an outline of the berms, holes, swales, paths and beds) we then create the Berms, Holes and connecting Swales around the garden. Once the protective berm structure is created, we will be amending the soil of the berms (an early look at double digging). This will prepare us for planting perennials in the berms in Session 6.)

1. Garden Layout for Easy Management
2. Creating Protective Berms and Swales

Materials Needed:

- Hoes
- 2-3 old grain sacks
- Local waste materials seen during walkabout: char, manure, ash

Information: Review Water Management "Six S" Flipsack **(15')**

Key Messages:

- The order of the steps is important: Stop, Slow, Sink, Spread, Save, Shade.
- We are bringing control of water by forcing it to stop, slowly sink, then spread to where it will be saved until the coming dry season when it will return back UP into the root zone.
- How much water is contained in a cubic meter? (Answer: 1000 liters).
- In an area that gets 1000mm of rain. That means for every sq meter of roof, we have a cubic meter of water falling off it in just few months. Ie: a 4mx6m room will have 24,000 liters of water! Where does the water go? Away; unless we learn to do the 6 S's.
- The Primary Slope is the dominant, top to bottom, slope.
- The Secondary Slope is the gentle, side to side, slope.

Practice: Drawing the Map and Amending the Berms

Facilitator Questions to the group:

"Where do we want the water to go?" Exactly where we tell it to go!
"How will water enter the garden area? Roofs, pathways, other?

Crouching down to near soil level, from the bottom of the slope, use your hand to show the water direction. Palm up and down = primary slope; palm side to side = secondary slope

- Determine top and bottom slope of the garden (the primary slope).
- Determine side to side slope of the garden (the secondary slope).
- Point to the place where water first enters (at the top of both slopes).

This is the point where the first 'stopping or catchment hole' is placed.

Remind all that we are simply drawing a map before we do any hard work. We want to make management of soil, water and plants easier and more productive.

Part 1: Draw the Garden Map (Berms, Swales, Holes, Paths and Beds) 45'

- At the initial point of water entry, (the top corner of the garden), dig a "Stopping or CATCHMENT HOLE" 50 cm wide and 50 cm deep. Place removed soil down the slope around the hole to give it further substance and strength.

- Along the top of the garden, draw a line leading from the hole to a point 3 meters along the slight secondary slope. This line will become the SWALE, or ditch, that carries the water SLOWLY along the top of the garden. At the end of this line draw a circle for the second CATCHMENT HOLE.

- Draw a second line, parallel to the first, 50 cm into the garden area. This is marking out the low BERM we will soon be making. You should now have a large hole with two lines leading to another drawing of a hole, 3 meters away. This is the stopping berm, swale and hole system that will be copied below.

- Below the drawn berm, mark another line, parallel to the berm, that is 30 cm away. This is the top line that will define the first GARDEN BED. Reminder: This bed will be running parallel to the protective berm just up the slope.

- Mark another line, parallel to the one just made, one meter away. This is the lower edge of the garden bed. (This will be the garden bed that we dig in the next session).

- You will now have the top BERM, a 30 cm wide PATH, and a one meter wide GARDEN BED, marked out within your cleared area. Walk through this process so all can recall what we have just done. If any mistakes are made, simply rub them out and start again.

- Below each hole, we need to allow the excess runoff to escape once they fill with water. Mark out a simple ditch that curves around the hole and then straight down the primary slope 3 meters away. This ditch (another swale) should lead the water into the catchment hole which will become part of the lower stopping swale and berm system.

- Draw the outline of the hole, the swale and the berm as a mirror image of what the top area looks like. *(Note: while the upper berm stops water from entering, the lower berm works to hold the water in the garden until it can exit slowly.)*

- You should leave enough room to allow the trainees to draw the second 30 cm wide PATH and meter wide GARDEN BED as practice. Remember, we are just scratching lines in the soil so allow mistakes to happen and then correct them as necessary.

Practice Part 2: Amending the Berm Soil (45')

Reminder: The primary function of the berm is to control 'rain event' runoff water, it is not for irrigation, perse. By amending the soil, much in the same way as for the garden beds in the step to follow, the secondary function as a source of useful, nutritious, medicinal, or culturally important perennials (and annuals in the first years) becomes apparent.

Action Steps:

- Within the drawn 'top berm' lines, loosen the topsoil (just the topsoil, leave the subsoil where it is) along its entire length, from hole to hole. The soil will elevate because we are adding air *(reminder: air is the number one basic need of all of us. Without air in the soil, it can't hold water; which is the second basic need.).*

- Smooth the surface of this newly aerated soil.

- From one end of the berm, pull 40 cm of loosened topsoil onto an empty sack, exposing the hard subsoil. Turn to stand on the path you just marked (the one just above the garden bed); deeply aerate the subsoil and blend in 2 handful each of manure and crushed charcoal.

- Straddle the berm and pull the next 40 cm of loosened topsoil over this newly amended subsoil to expose the next area of subsoil. Aerate and amend subsoil as before.

- Continue pulling topsoil, then amending subsoil, all the way to the end of the berm. This is an early look at and practice of double digging.

- When you reach the end, you will have an open area over amended subsoil. Place the removed topsoil from the first step (on the sack). Smooth out the entire surface.

- Amend the topsoil of the 3 meter long berm with one 20-liter bucket of manure and half a bucket of charcoal along with a few handfuls of wood ash. *(Note: as you add each, check for understanding of what each provides: manure = fertility and microbes; char = pure carbon housing for microbes; wood ash = minerals such as calcium carbonate, phosphate, potash.)*

- Using the hoe or fingers, blend the topsoil amendments with the topsoil only. Smooth the berm into a garden bed ready to receive water.

- Gently apply water with a bucket and cup. Allow water to thoroughly soak into the soil. The berm is now ready to receive the perennials which will be planted in one of the next sessions.

Bottom and Side Berms: (if time allows)

- Following the pattern drawn previously, conduct the same soil amending exercise as described above. *(Note: Allow trainees to do this on their own with occasional guidance.)*

Wrap Up: Was this activity CLOSE? Why was this session important?

Session Five: Bio-Intensive Soil Preparation

Objective: By the end of this session, participants will know how to properly double dig and amend a garden bed.

1. Making a Bio-Intensive Garden Bed (Double Digging)

Materials Needed

- Hoes, 2
- Straight stick, marked at 10cm intervals. Used to measure depth before and after digging.
- Empty grain sacks, 2
- Bucket for watering , 2
- Local Amendments found during landscape walk: char, manure, ash. 1 bag of each

Information: The Double Dig Flipsack (15')

- What is the problem in the 'before' picture? Is it that we have too much sun; or that the roots are stressed from compacted soil?
- Which system is easier to create? Which system is easier to manage? Needs less water?
- What do we gain by deep digging? (*Able to add air, water and carbon deeply*)
    - More Water Stopping and Holding from irregular rainfall = **Adaptation**.
    - Organic Matter rich soils sequester vast amounts of atmospheric C02 = **Mitigation**
    - More plants, healthier plants, higher yield from a small space = **Intensification**
    - **This is what is meant by <u>Climate-Smart</u> Agriculture**.

Notes to Facilitator:

- "Bio-Intensive" refers to both the manner of deep digging as well as the manner of offset, "triangular" spacing to be outlined in the session that follows.
- By breaking through the lower compaction found in most cultivated soils, we can improve the overall structure of the soil (improved air, water and fertility holding ability) which allows annual crops to grow to their desired depth and strength. We practiced this when we made the berms but we are going deeper this time.
- This is a good time to point out the tools we will need to double dig: a hoe and a grain sack - <u>ONLY</u>! If we use lots of different tools, or show the method using muscle, we create a huge "barrier to adoption" for local families, youth, and the chronically hungry, sick or disabled.
- One of our hardest jobs, is to make it look easy! The work takes thoughtful energy, not wasted energy! The concepts are simple, our job is to make sure people do NOT say that double digging is HARD!

<u>The key reasons to double dig are</u>:

- It allows the amended soil to hold greater amounts of rain season <u>water</u>.
- It allows the roots to go deep to reach the <u>air</u>, water and nutrients as they need it.
- It allows closer plant spacing so that the leaf canopy closes. This captures CO2, holds moisture thus increasing photosynthesis (while also eliminating weed growth).
- This healthy microclimate below the leaf canopy helps the plant grow to its fullest possible potential while being resistant to pests, diseases and drought.

(Note: Many will ask: *How often do I need to Double Dig?* Answer: Once! If the double digging process reaches 50 cm, in subsequent seasons we need only amend the surface with compost, blend the topsoil, smooth it, add water and plant using good crop rotation practices.

Practice, Part 1: The Cleaning and Single Digs 45'

- Straddling the defined bed (80 cm wide) and moving in one direction, chop into the surface down about 10 cm. Remove any rocks or weeds, including the roots. This is merely a cleaning/organizing process. Smooth the surface with your fingers or the hoe handle.

- Straddling the bed once again, remove the loosened topsoil. Now 'chip' down further to find the truly compacted lower soil. Pull out all loosened soil in this first 40cm wide "trench", placing it temporarily on the sack at the end of the bed. (As we did with the berms.)

- If the subsoil is very dry, add a few cups of water over it. Let it soak in before moving forward. **Ask***: Why do we wait for the water to soak down?*

- Moving forward, again straddling the bed, continue to loosen to the hardpan, pulling the loosened topsoil back into the space you just opened, and watering the subsoil to soften it up for the next dig.

- When you reach the end you will be left with an open trench down to the compacted layer along the width of the bed. This has been what we call the "Single Dig".

Facilitator Note: Take a break to check for understanding and relax. Acknowledge that this can be hard work. But if we take it slow and steady we will be done easily. If done correctly and with precision, down at least 50cm we will NEVER need to double dig this bed again. This is for greater air, water and nutrient storage for our more tender annuals.

After some good stretching and discussion, **Ask:** *Are we ready to do the Double Dig!"*

Practice, Part 2: The Double Dig (45')

- Gather your soil amendments from the berm session (manure, char, wood ash).

- Standing to the side of the open trench, loosen the hard subsoil with careful chops with the hoe. Go as deep as you can but you must make it look easy. This was the double dig. Check for understanding that this is the 3rd pass over the bed but we still call it the "double" dig.

- To the loosened subsoil, blend in 6 large handfuls each of old manure and charcoal. **Ask** *"why are we adding these materials?" "What does each provide?"*

- Add a small amount of water to the loosened and amended subsoil to "wake up the bacteria" and to highlight the 3 main items needed to improve soil quality: air, water and carbon.

- Pull the next 40cm of loosened topsoil over the amended subsoil, exposing the next trench of compacted, pre-moistened, subsoil.

- Loosen the subsoil, amend and repeat as above to the end of the bed. Make sure that one person does all the actions but then steps aside to guide the next person. (See, Do, Teach)

- When you have loosened the final trench of subsoil, simply return the initial soil that was removed and placed on the bag during the single dig. Note that it is close and easy to move.

- Rake the entire bed smooth with the hoe handle and fingers. Sprinkle gently with water.

Practice, Part 3: Topsoil Amending (Nutrition-Focusing)

- Per square meter, add 1/2 bucket dry manure, 1/4 bucket charcoal chips, 1 handful woodash, and, if accessible, a handful of crushed egg shell, tea waste or coffee grounds.
- Have people stand on the paths on either side of the bed, reach their right hands across to shake, and raise their left fist in the 'Yes I Can salute" . This illustrates practicality of the width as well as the sense of empowerment and control people should be feeling.
- Blend all ingredients uniformly over the bed with your hands before incorporating all within the top 20 cm of topsoil using a blending motion with hands. Allow time to enjoy the feeling!
- **ASK:** *"why do we add these extra ingredients so carefully into the topsoil but not as much into the subsoil?"* (Answer: because the new seeds and young seedlings need the best possible nutrition early in their lives so as to avoid becoming stunted…the same that applies to our families and children.")
- Rake the bed smooth with your fingers and the hoe handle to form a flat surface.
- Gently add 20 liters of water per 2 meters of garden bed. This helps to settle the soil and allow good shaping of the bed surface for planting. As you apply the water check for possible erosion points. Fix any sections where the water runs off.
- Apply a layer of straw, dried grasses or dry leaves to the surface as a mulch to prevent moisture loss over night.

Wrap Up:

Was this CLOSE? What will we do with this skill? Why was this session important?

The single dig to remove the topsoil.

The Double Dig into the exposed subsoil.

Amend the subsoil with char & manure.

Add same to topsoil, blend well, add water.

Session Six: Bio-Intensive Plant Spacing and Overall Garden Management

Objective: By the end of this session, participants will know how to properly space garden plants within a yearly successional planting plan.

Part One: Plant and Seed Spacing

Materials Needed

- Seeds (locally available from market or seed store in nearby town)
- Small sticks, 20 cm long, many (for marking planting holes)
- Water and buckets (only use a watering can if commonly accessible)
- Local Perennials: ie, aloe, lemongrass, rosemary, rue, mint, papaya, etc
- Several used plastic water bottles with caps
- Straw or brown leaves (mulch for final step)

Information: The Benefits of Bio-Intensive Spacing (Flipsack) 10'

- Increases Plant Density (deeper roots allow close space, able to grow more/unit area)
- Increases Plant/Root Health (moisture and CO2 capture)
- Decreases Weed Pressure (canopy shading of bare soil)
- Decreases Hand Water Requirement (canopy shading of bare soil)

The deep digging allows us to place plants closer; using precise, triangular spacing. By planting in triangles we maximize plant density, plant health, and overall yield per square meter.

The soon-to-close leaf canopy will maximize sun to the leaf and shade to soil, increasing photosynthesis while decreasing moisture loss from evaporation. As a result, 30% more plants can fit within a given space and each plant has the potential to be 2-3 times as productive. Overall, yield increases by as much as 600% while resource needs decrease.

Information: Crop Rotation Planning and Planting (flipsack) 10'

The three biggest reasons to rotate crop families: "Break, Break, Balance"

- The crop rotation pattern we use *balances* soil and plant fertility between crop families while also *breaking* pest and disease life cycles.
- Crop rotation is one of the most important plant health and pest control practices in home gardens and crop fields alike.
- Each bed, or portions of beds, can hold successive plantings following the Leaf – Fruit – Root – Legume rotation plan. For example, over the course of 18 months depending on the rain/dry season, a bed will be planted with Kale (leaf), then Tomato (fruit), then Carrot (root), and finally Fava Bean (legume).

Practice, Part 1: Marking and Planting the Bed (maize and cowpea intercropping) 25'

(Note: we are only planting maize and bean in this bed as it is close to the rainy season. Other tender vegetables will be planted in the coming dry season, once the maize and bean have been harvested and the dry season has begun. Reminder: the berms and double dug beds work to force excess moisture down deep from whence it will return to the root zone during the dry season. This is the critical period for home gardens: *allowing dry season vegetables for the family kitchen*.)

Practice, Part 2: Intercropping Maize, Bean (and Pumpkin)

- Following the seed and plant spacing chart (attached), and using a meter stick along one end of the bed, mark seed holes for the maize every 30 cm along the end of the bed.
- Place small sticks along with 2 maize seeds, 1 cm deep in each hole. Cover gently with soil.
- 30 cm down the bed but offset 15 cm on either side, create holes, add sticks and add 2 seeds.
- Proceed down the entire bed. Point out the triangle shape and check for understanding about why we plant in triangles vs rows.
- In the space between each stick (with its maize seeds) place a bean seed, also on triangle spacing. Mark with another small stick.
- Allow all to practice as much as possible.
- At 50 cm down the middle of the bed, plant 2 pumpkin seeds 3 cm apart in a small hole. Cover well and mark with a larger stick to remind all that this is different.
- Apply a layer of dry mulch, 2 cm thick, over the surface. Add water gently with cup and bucket.

(Note: We will be addressing seedling nurseries and vegetable planting strategies at IST. The critical learning here is the creation of the garden space using locally accepted plants like maize and bean (and pumpkin). These are ';rain tolerant' crops. At the 3 week point, one of the maize seeds needs to be removed so as not to compete. If neither seed germinates in a planting area, a removed maize plant can be transplanted there.)

Practice, Part 3: Planting the Berms 25'

During the community resource walk, locally available perennials were discovered. These perennials can be divided and replanted. It is important to use only locally available and appropriate perennials but a few examples are aloe, lemongrass, rue, birdseye chillies, rosemary, papaya, and even sweet potato for its Vitamin A and Iron-rich leaves.

With gathered perennials at your side, you are now ready to plant your perennials in "guilds" around the holes and in the berms. A guild is perhaps best described as a team; where each plant plays complementary roles. For example, a medium height Rosemary can be planted next to a bunch grass such as lemongrass which are in turn protected by creeping ground covers below and a tall papaya above. This companion planting concept will lead to further discussion of crop rotation and intercropping during the planting of the production beds.

- **Action:** Plant the berms with local perennials using the guild pattern around the holes (papaya, aloe, lemongrass, ground cover – each growing in its own space, supporting the others.

Part 2: Garden Management : some initial critical steps 35'

"Once planted, the garden will require ongoing care and management." **ASK WHY?** (The number one reason gardens fail = poor management.)

- to minimize the negative impacts of weeds, insects and diseases;
- to apply additional water carefully and only when needed;
- to repair minor damage from wind or rain when it happens;
- to harvest vegetables at peak growth so as to maximize yield per square meter.

1. **Mulch**

- This is one of the more important steps in resilient vegetable production. Whether planting seeds or seedlings, roots will need to have continuously adequate soil moisture to foster rapid seed germination, a reduction in transplant shock, and continuous growth and harvest.
- Any dry material can be used that has no viable seed heads: straw, bark chips, grass without seeds and dry brown leaves.

    - **Action:** Apply a 2cm layer of gathered dry material over the beds and around the planted perennials (as may have been done already on the garden beds).

2. **Drip Bottles**

- Watering seeds and seedlings is critical. For freshly planted, mulched beds, once a day is sufficient.
- As seedlings grow into mature plants they will have greater water and nutrient needs even when the leaf canopy closes, blocking sunlight from hitting the soil.
- A simple technique using locally available water bottles allows the gardener to apply water exactly where it is needed, to the roots.
- Most vegetables can be harmed by overhead watering which wets the leaves making them prone to fungal and insect attack unnecessarily.
- Tender vegetables want wet roots but dry leaves making them difficult to grow during the rainy season. The 'drip bottle' is the answer.

    - **Action:** Make a demonstration "Drip Bottle"; let all practice:

        - Poke two small holes into the bottom of a 1 liter used water bottle.
        - Fill with water. Place the cap on firmly.
        - Twist the cap open just enough to let the water come out. Open further to let more water out; close it to slow it down. (Liquid will only come out of the bottom as the cap is opened, giving you control over how much comes out.)
        - Bury the bottle so that the cap is still above ground and the bottom is at the lower root zone, 5 cm away from the main stem. Open the cap slightly, allowing water to slowly drip and spread through the lower soil.
        - Keep bottles in the ground, refill each morning as necessary.
        - Place up to 8 bottles per square meter of garden bed.

3. **Pest Control.** (Note: More specific pest control will be covered later at IST. We are only discussing the "4-Step Framework".)

- Prevention is the first order of business. All of the work that went into the creation of controlled water and deep healthy soil will produce vigorous plants that are resilient to pest and disease attack. But there could still be a need for work beyond these cultural techniques. As described earlier, there are four levels of pest control, each with varying tasks:

Discussion: The Four Step Framework Using Flipsack as guide. **10'**

- Cultural: Soil and Water Health. Actions such as Berms, Swales, Double Digging, Amendments, Plant Spacing of Healthy Seedlings
- Physical: Pruning away the dead, diseased and damaged limbs; traps and netting
- Biological: Companion Planting, perennial borders housing beneficial insects,
- Chemical: Bio-Rational leaf extracts from neem, lantana, tithonia, garlic, pepper, etc. Synthetic insecticides, fungicides and herbicides are dangerous, costly and beyond what we need in most gardens. We are not 'certified' to give advise on how to use these!

(Note: Remind all that more about pest control will come during IST but most insects will be controlled by the cultural practices that went into garden creation, soil health and water management.)

Wrap Up:

What did we learn? Was it CLOSE? What will we do with this knowledge and skill? Why was this session important?

Offset triangles create a closed canopy.

Drip bottles deliver water to root zone.

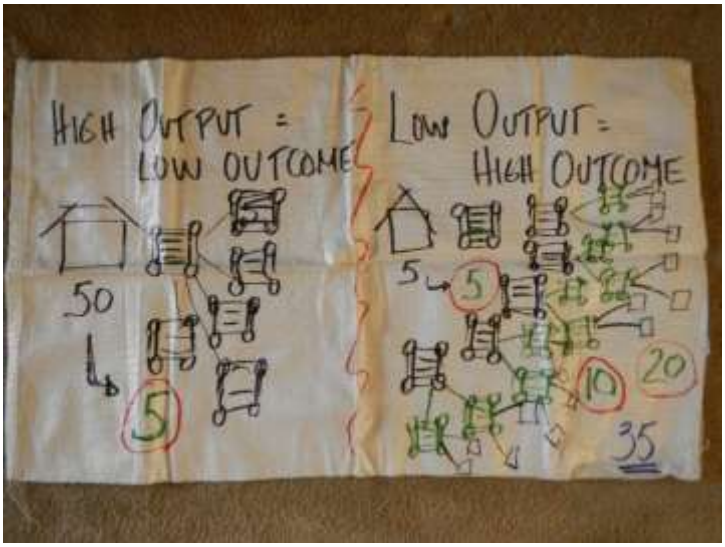
Intercropping beans with maize.

'Watering in' the local perennials on the berms.

Overall Wrapup: **15'**

Your Future Training Design: Which gives us the greatest IMPACT?

High Output/Low Outcome vs Low Output/High Outcome



Some possible group discussion/closure questions:

- What are the key lessons we learned? (Use Local; Stop Water; Dig Deep; Plant Close; Harvest Often)
- Who is our target audience? Why?
- How do we reach the "Highly Vulnerable and Most Risk Averse".
- Why is the Rule of CLOSE essential with this group?
- What are the top 3 reasons families don't have a garden? (No water. Not enough land. No tools. No money.) How can we help people overcome these obstacles?
- How much water is contained in a cubic meter? (1000 liters). Why is this important?
- In an area that gets 1000 mm of rain, how much water comes off a 4m x 6m roof onto the ground? (24,000 liters).
- Where does water go? (From high to low, in terms of slope as well as concentration.) Before the garden (away). After the garden (exactly where I tell it to go!)
- Why do we make compost? (carbon capture, soil structure, balance fertility, microbes)
- What role does a Permagarden play within your sector?

Post Test: Give all 20-30 minutes to take the Post Test individually.

END

Permagarden Pre and Post Test Date _____

Name _____ Sector _____

77 Total Points. (Points are given for partial answers.)

What are the 3 aspects of Climate Smart Agriculture? Give an action example for each as they relate to a Permagarden. (6) Why is the order critical? (2)

List 3 local 'waste materials' that can be used to improve garden soil AND what each provides. (6)

List the 3 'most important things' we can add to improve the quality of any garden soil. (3)

List the 4 'textural' components of soil AND what each provides. (8)

List 3 issues to consider when deciding where to place a garden. (3)

List, in order, the 6 Steps of Surface Water Management. (6)

How many liters of water falls from a 4m x 6m hard roof in an area that gets 1000mm of annual rainfall? (4)

What are the 4 Main Ingredients that make up a compost pile? What does each provide? (8)

What causes a compost pile to become hot? (2) Why is this important? (2)

Compost is ‘best’ considered as a Fertilizer, or as a Conditioner? (2) Describe why. (2)

List 3 reasons to double dig a garden bed (3)

List 3 reasons to plant seeds using ‘bio-intensive’ triangular spacing. (3)

List the 4 Family Crop Rotation Cycle. (4)

List the 3 key reasons why we practice this crop rotation cycle (3)

What is meant by The Rule of CLOSE? Why is this important (10)

Please circle

This test was: too hard too easy just right

Permagarden Pre and Post Test (Answer Key) 77 Possible Points

What are the 3 aspects of Climate Smart Agriculture? Give an action example for each as they relate to a Permagarden. Why is the order critical? (8)

Adapt (berms and swales); Mitigate (adding carbon to soil/compost); Intensify (bio-Intensive triangular spacing). You CANT intensify if you have not yet prepared for the climate in your area via proper adaptation and mitigation. Adapt, Mitigate…then Intensify!

List 3 local waste materials that can be used to improve garden soil? Include what each provides. (6)

Charcoal = carbon; egg shell = calcium; wood ash = minerals (calcium carbonate, potash, phosphate); Manure = bacteria, NPK; Coffee Grounds = Nitrogen; Vegetable waste = water, micronutrients

List the 3 'most important things' we must add to improve any garden soil? (3)

1. *Air 2. Water 3. Carbon (refer to Question 10, "Why Double Dig")*

List the 4 textural components of soil and what each provides. (8)

Sand = aeration, no water holding ability
Silt = Some fertility, some water holding
Clay = a LOT of fertility, too much water holding
Organic Matter (OM) = the balance between all the above, essential to improving STRUCTURE no matter what the textural classification of the soil.

List 3 issues to consider when deciding where to put a garden. (3)

Sun (at least 4 hours/day); Slope (moderate to control runoff); Soil (can be poor initial quality but not just rock); Water Access nearby; Close to the house or point of management for security/management; Wind, Animals or other dangers

List, in order, the 6 Steps of Water Management. (6)

The Order is Important! Stop, Slow, Sink, Spread, Save, Shade ("Six S")

How many liters of water comes off a 4m x 6m hard roof in an area that gets 1000mm of annual rainfall? (4)

4m x 6m = 24m^2 x 1 meter of rain = 24m^3. 1 m^3 = 1000 liters. Therefore: 24,000 liters!

List the 4 Main Ingredients that make up a compost pile? What does each provide? (8)

Brown = Carbon
Green = Nitrogen
Manure = Bacteria
Water = keeps bacteria active, allows continuing decomposition

What causes a compost pile to become hot? (2) Why is this important? (2)

Bacterial decomposition creates tremendous initial heat. This is important as it sterilizes the compost ingredients, killing any possible pathogens (E.coli, typhoid, cholera) and weed seeds that may have been in the water, manure or materials added during construction of the pile. It is also an indicator of successful initial pile construction.

Compost is <u>best considered</u> as a Fertilizer, or as a Conditioner? (2) Why? (2)

<u>Conditioner</u>, as it helps in the holding of air, water and fertility. It does help a soil release and hold its already available fertility, but the compost itself should not be considered a 'Fertilizer'. It does increase soil fertility through the carbonic acid cycle induced by microbial life where loosened soil minerals convert to plant available form.

List 3 reasons to double dig a garden bed (3)

By breaking the hardpan, compaction layer, we are adding AIR. WATER can now be held deeply within the soil profile, which allows for more INTENSIFIED PLANTING. In the amending process we are also able to add CARBON materials deeply within the soil profile which helps the soil sequester carbon dioxide while holding excess air and water for plant health.

Air, Water, Carbon, + Plant Intensification, Climate Adaptation and Mitigation

List 3 reasons to plant seeds using triangle spacing (3)

To achieve a closed canopy. This allows:

1. Greater CO_2 and H_2O capture; 2. Increased leaf area for greater Photosynthesis; 3. Less weed competition; 4. Greater Plant Density 5. Increased Plant Health; 6. Increased Yield/m^2

List the 4-step Crop Rotation Cycle. (4)

Leaf (Needs N)
Fruit (Needs less N, More P,K)
Root (Needs no N, wants more P,K)
Legume (Gives N back to the soil)

List the 3 key reasons why we rotate crops (3)

Break Insect Life Cycles
Break Disease Life Cycles
Balance fertility needs of the family, the soil and the next crop

What is meant by The Rule of CLOSE? Why is this important (10)

EVERYTHING we do must be Close, Local, Organic, Small and Easy. This builds Positive <u>Attitudes</u> towards change (Yes, I can DO AND teach my neighbors because the actions were close, local, organic, small <u>and</u> easy). This can lead to our overall vision of lasting Behavior Change reaching even into the most risk averse populations.

Appendix 1: Permagarden Training Objectives

Terminal Learning Objectives:

1. By the end of the training, participants will be able to create and manage a climate smart, nutrition focused Permagarden to increase family access and utilization of nutrient dense foods year round.

2. By the end of the training, participants will be able to teach others how to create and manage a climate-smart, nutrition-focused Permagarden.

Session Objectives:

Session 1: Permagarden Overview: Filling the Gap; Defining our Targets

Able to articulate the Dimensions of Food *In*Security
Able to define the evidence based aspects of "Climate-Smart" and "Nutrition Focus"
Able to describe the Permagarden Planning/Vulnerability Index
Understanding the 7 Essential Nutrition Actions (and the 4 that relate to the garden)
Able to articulate the vision of The Q of Sustainability

Session 2: Landscape Resource Assessment

Able to perform a local "Landscape Walk"
Able to identify at least 3 local Waste Materials and how to use them in the garden
Able to identify at least 3 local Vegetation Assets and how to use them
Able to describe the 5 essentials of Garden Placement
Able to demonstrate ability to Prepare the Garden Area

Session 3: Resource Capture

Able to identify at least 2 local Carbon and 2 Nitrogen Waste Materials
Able to demonstrate How and Why to Make Compost

Session 4: Water Management

Able to Determine annual Rainfall Volumes from slopes, roof and within garden plot
Able to list, in order, The Six S's of Water Management
Able to Determine Primary and Secondary Slopes
Able to Draw the Garden Structural Map according to local conditions
Able to Create Berms, Swales and Saturation Holes for Year Round Protection
Able to Properly Amend Berms as Planting Bed (the 'simple double dig')

Session 5: Soil Health

Able to list the key parameters of Soil: Texture, Structure, Fertility, Acidity
Able to effectively Double Dig a Garden Bed using only 1 tool.
Able to articulate the three principal reasons for deep soil preparation.
Able to demonstrate effective Utilization of local Waste Amendments to improve soil Structure and Fertility.

Session 6: Plant Management

Able to articulate the 3 principal reasons behind Bio-Intensive 'Triangle Spacing'
Able to plan for proper Weed and Water Management thru the growing season
Able to articulate the 4-Step Crop Rotation cycle and the 3 reasons for doing so.
Able to articulate The 4-Step Pest Control Framework and demonstrate at least one action of each step of the framework

Session 7: Extension Planning

Can describe the Training and Reconnect Model of Extension
Can demonstrate ability using the Walk and Talk Extension Technique
Can create an extension outreach plan highlighting "The Importance of 5":
Can describe the differences between Output, Outcome and Impact
Can demonstrate understanding of the multi-step Permagarden Observation Checklist: Measuring Progress Towards Perfection".

A Suggested Training Design

Adults learn better in small groups where they each have the chance to go through the progression of learning: seeing, doing and teaching. If the training group is larger than 15, information and skill retention will drop markedly. To avoid this, and to give a good model for the Volunteer to follow upon return to their community, the following is a suggested.

30 Total Trainees. Divide them into two groups, A and B, along sector, language or regional lines whichever makes most sense to your program. While Group A is doing a Permagarden Session, Group B is doing language or other tech. Groups switch in the later session. Using this model, each trainee will get 12 hours of total content slowly throughout the week.

Session One: Overview	Group Discussion	Friday	3-5 pm
Session Two: Assessment	Group A	Monday	8-10 am
	Group B		3-5 pm
Session Three: Capture	Group A	Tuesday	8-10 am
	Group B		3-5 pm
Session Four: Protection	Group A	Wednesday	8-10 am
	Group B		3-5 pm
Session Five: Production	Group A	Thursday	8-10 am
	Group B		3-5 pm
Session Six: Management	Group A	Friday	8-10 am
	Group B		3-5 pm

Appendix 2: Quick Reference to Permagarden Training: The Six Step Method

Key Themes:

- Climate Smart allows Nutrition Focus.
- Availability, without Access, is Irrelevant.
- The "Window of Opportunity" (baby) must focus on the Wall (mother) AND the foundation (father/community).
- Adapt to the Climate so you can stop worrying about the weather.
- The Only Tool we Use is the Tool you already have.
- If your actions aren't CLOSE; you have a drawing board to get back to.
- Small Doable Actions with Immediate Measurable Visible Results = Attitude Change.

Terminal Learning Objectives:

1. Able to Create a Climate-Smart, Nutrition-Focused Permanent Garden in the Tropics
2. Able to Teach Others how to Create a Climate-Smart Nutrition-Focused Permanent Garden in the Tropics
3. (For Staff TOT): Able to Provide Timely Supportive Supervision to PCVs
4. (For Staff TOT): Able to Develop a Post-Level Monitoring & Evaluation Strategy

The Six Sessions:

1. Overview: Filling the Gap; Defining Our Targets
2. Local Resource Assessment and Garden Clearing
3. Carbon Capture: Making and Using Compost and Biochar
4. Water Management "Six S": Making Protective Berms and Swales
5. Soil Health: Double Digging as Mitigation Strategy
6. Garden Management: Bio-Intensive Planting and Continuity

<u>Before</u>: a hard 'impossible' soil

<u>After</u>: visible and resilient change

Permagarden Session Notes

Session One: <u>Permagarden Overview</u> Whole Group 90 Minutes

Rain Dance 'Movement for Change'

- Discuss the feelings of the group during the exercise: from negative confusion to happy participation in a matter of minutes.
- Who were the 'risk takers, early adopters, late adopters and laggards'?
- How is this similar to your community experience already?
- How do we get even the laggards and late adopters to be willing to change?
- The RULE of CLOSE : ALL actions must be Close, Local, Organic, Small and Easy so that even the marginalized/vulnerable can say "Yes, I can".
- The opposite of CLOSE is "FISLD"… (how the conventional ag model does NOT elevate the laggards, late or even early adopters due to these barriers to adoption.)

Pre-Test (measuring 'Progress towards Perfection'); importance of reading all the questions; not knowing all the answers! Peace Corps: we are bold enough to ask the questions without knowing the answers!

- Terminal Learning Objective "Arrows" Discussion of TLOs: 1. Able to create a climate smart permagarden; 2. Able to teach others how to create
- Previous Experience "Arrows" (academic and practical experience of the group)

The Dimensions of Food *InSecurity*: Filling the gap betw Availability and Utilization (Access)

- Seasonal Agri Production = Markets full of food (great work farmers!)
- Health/Nutrition Education builds awareness of nutritional health (kudos Health!)
- The missing link is lack of daily access to nutrient dense foods (high stunting rates)
- The Answer: a Permanent (aka Climate Smart) nutrition-focused, home garden

The Latest DHS Child Nutrition Chart – the Importance of the 'First 1000 Days'

- The"Window of Opportunity" = 6-24 months of complementary foods. At 6 months, stunting rates climb dramatically. That is the problem AND the answer!
- If the baby is the 'window' then who is the wall that holds it up? The mother. And who is the foundation that holds up the wall? The family/community.
- Therefore, maternal AND child health/nutritional needs must be the focus

The Framework of the next Five Action Sessions

(Review the Essential Nutrition Actions as they relate to the Permagarden)

- Assessment: the landscape walk. Resource ID and Use, good/bad examples
- Capture: converting Carbon into a resource rather than CO2/smoke (compost)
- Protection: Surface water management using the "Six S" framework
- Production: Soil Health via double digging and carbon additions
- Continuity: Plant Spacing, Timing and Rotation
- Monitoring Progress towards Perfection: M&E Tools and Outreach Planning

Session Two: <u>Resource Assessment and Garden Clearing</u> Two Hours

The Landscape Walk: Assessing locally <u>Accessible</u> Resources 60

- Tithonia, Lantana, Amaranth, Neem and other "Monsters": use and management. These are monsters…but they're OUR monsters!
- Erosion in gullies: what does a gully tell us? Where all the water goes. What is bad about a gully? That is where all the water goes. What is good about a gully? That is where all the water goes.
- Observe local gardening strategies. What is missing from the gardens? Diversity. Why aren't there any gardens? Mama says, 'because I don't have any water'.
- Observe surface water movement from paths, roofs, roads, slopes. How could this be managed? How much water comes off a 4m x 6m roof in an area that gets 1000mm of annual rainfall? See if anyone knows – we will come to this later but it is 24,000 liters!! More than enough for several years of gardening!
- Key Takeaway: Most/All of what mama needs to grow a great year round garden; she already has!!

Garden Placement, Clearing and Soil Assessment 45

What are the most important things that determine a good garden site?

- Sun: at least 4 hours; partial shade in afternoon if possible
- Soil: can be of poor structure/texture in beginning
- Slope: whether steep or none plays a role in water management
- Security: People, animals, wind, etc
- Access: should be close to the home for daily harvesting/troubleshooting

Mark out a 4m x 4m area that meets the above characteristics
Clear grasses and debris to just below the root zone; remove all

Soil Assessment

- Texture squeeze test – is this clayey, sandy or a mix?
- Structure assessment – how well can this soil hold air and water?

Classroom Review: <u>Basic</u> Soil Science 15 minutes

- The 4 Textural Components: Sand, Silt, Clay, Organic Matter
- Texture (can't be changed). Most important for field crop Ag: tells farmer type of crop, tillage, irrigation, fertilizer she will need
- Structure (can be changed). Improving structure (via carbon) can allow a gardener to grow whatever she wants, whenever she wants on whatever soil she may start with that is next to her kitchen (often hardpacked B horizon 'construction' soil)
- What Three THINGS improve the quality of ANY soil in the world? Air, Water and Carbon. (An ongoing/critical point to make throughout the next few sessions.)

Session Three: <u>Carbon Gathering and Compost (Capture)</u> Two Hours

Classroom Session: Why does Climate Smart allow Nutrition Focus? 30 Minutes

- Target is complementary feeding of 6-24 month olds as well as pregnant woman
- Daily access is required. A full market is IRRELEVANT if mama does not have access!
- Climate Smart Steps (the order is critical)
  1. Adapt – learn about the climate patterns and adapt system to match it
  2. Mitigate – add carbon to the soil to hold water; don't waste it by 'giving it to the polar bears' (global warming tertiary benefit that mamas doesn't care about)
  3. Intensify – grow more from a small space that requires less land clearing/labor yet results in 4-800% more food per square meter!
- Nutrition Focus
  1. Go Foods (Carbs)
  2. Grow Foods (Proteins)
  3. Glow Foods (Vitamins and Minerals)
     - This is <u>our principal target</u>: green, orange, yellow, red
     - Iron, Zinc, Vitamins A, C, D
     - Chard, Amaranth, OFSP, carrots, tomatoes, cowpea, etc

Gathering Brown and Green 'Waste' 30 minutes

- Carbon and Nitrogen rich plant materials may already be gathered in advance to save time but give participants a chance to gather their own from the area.

Making a Compost Pile **45 minutes**

- The Four Main Ingredients: Brown, Green, Manure, Water
- Choose a shady location and blend all in the correct proportions
- Cover with clear plastic plus grain sack; place stick in middle, record temperature
- Discussion: why make compost? Conditioner; NOT fertilizer. Source of microbes that build soil health and release native soil fertility. How do we manage the pile? Mix, aerate and moisturize every two weeks for 3 months.

Review: **15 minutes**

- Describe how our actions were CLOSE (if they weren't, how can they be?)
- Why is the order of the climate smart steps important?
- What do we mean by 'nutrition focusing'?
- What is the state of 2 year old malnutrition here? Must add the % stunted, underweight and wasted together. Why is a permanent garden a good answer to this problem?
- Is the garden ONLY for mother and child? Is it only to be made by the mother? Who else can we engage to create/build these gardens? (men, youth, students, etc)

Session Four: **<u>Water Management (Protection)</u>** **Two Hours**

"Understand and adapt to the Climate so you don't have to worry about the Weather".
"A garden without berms is like a bus without brakes".

Water Management "Six S" (discussion) **20 minutes**

- Water off a Roof Formula: mm annual rainfall x m^2 of roof surface = liters per year
- Determine total water entering garden from slopes, roof, and rain on the garden.
- Why is this important? Families don't lack water; they lack control of water.
- Rain Dance with steps articulated: stop, slow, sink, spread, save, shade

Drawing the Garden Map (berms, swales, paths, beds and holes) **30 minutes**

- Determine Primary and Secondary Slopes
- Highest point and Lowest Points
- Draw berms, swales, holes, beds and paths

Create and amend the berms, swales and holes **60 minutes**

- Double dig all berms
- Add gathered carbon waste to amended subsoil and topsoil
- Water in the top of the berms
- Create 50 x 50 x 50 cm holes at each corner

Review: Was this action CLOSE? Why was it important? **10 minutes**

Session Five: <u>Soil Health and Depth (Production)</u> **Two Hours**

Mark out the Garden Beds and Paths. **10 minutes**

Review the Before and After 'flipsack' of the paradigm shift

- Why Double Dig?: to break up compaction and allow air, carbon and water to go deep, this allows closer plant spacing to follow.

Review waste resource values (as seen during the Landscape Walk): 10

- Manure Bacteria, organic carbon, trace minerals
- Charcoal Pure Carbon – holds air, water and microbes forever
- Rice Husk carbon silicates – slow to decompose, aids soil structure
- Coffee waste Carbon, trace minerals, organic matter
- Wood ash Minerals ($CaCo_3$, MgO, K_2O, $HPO_{4)}$), Acidity balancing
- Egg Shell Ca – needed by the flower and for Mg-Ca bonding
- Coffee 2% Organic Nitrogen

Double Dig two, 1m x 2m Garden Beds: **100 minutes**

- Cleaning, Single and Double Digs followed by topsoil amendment.
- Review: Why do we add more to the top? Nutrition security for the developing seedlings. The same as for the developing fetus and under 2 child.

Session Six: <u>Bio-Intensive Management and Continuity</u> **Two Hours**

The 4-Step Crop Rotation Cycle **30 Minutes**

- Leaf, Fruit, Root, Legume (describe nutrition role of each)
- Seasonality: the timing of garden actions (The "Q" of Sustainability)
- Reasons to rotate:
  - Balance (nutrition of soil, plant, people)
  - Break (disease life cycles)
  - Break (Insect Life Cycles)
  - Dietary (complementary foods) diversity

Why Plant in Triangles? **30 Minutes**

To create a closed canopy. Can ONLY be done if first steps of adaptation and mitigation have been completed. Less water, less weeds, less work, more food.

- Captures CO_2 and H_2O for increased PHOTOSYNTHESIS which = thriving plants as well as increased Carbonic Acid to increased plant mineral access.

- $CO_2 + H_2O$ ===> $C_6H_{12}O_6 + O_2$ (role microbes play in converting C to CO_2)
- $CO_2 + H_2O$===> CH_2O_3 (Carbonic Acid) allows K to convert to K_2O

Practice Plant Spacing, Mulch and Watering **60 Minutes**

- Intercropping maize with cowpea; tomato with carrot
- Perennial guilds near saturation basins (rosemary, lemongrass, local)
- Annuals within the berms to fill the gap (green beans, OFSP)
- Atmospheric Pressure 'drip irrigation' bottle
- Mulch application to shield soil from sun and rain

Closing Session **Capnote** **Whole Group** **90 Minutes**

Moving From Permagarden to 'Terra Firma": **20 Minutes**
The paradigm shift to Agroecology

- Climate Smart Allows Nutrition Focus
- Adapt x Mitigate allows Intensification of Nutrient Dense Foods
- Garden as Classroom to move towards protective/productive landscapes

Outreach, Monitoring and Evaluation: Teach Five **40 Minutes**

- Permagarden Observation Checklist
- Permagarden 'Stories of Change'

"Paper Plane Development" : Without good step-by-step training and follow up, even the best idea will end in very poor levels of adoption.

Post Test! **30 Minutes**

END

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